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Pacific Northwest
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Database and Interim Glass Property Models for Hanford HLW and LAW Glasses

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September 2002

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RL01830

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Abstract

This report discusses a methodology for increasing the efficiency and decreasing the cost of vitrifying nuclear waste by optimizing waste-glass formulation. This methodology involves collecting and generating a property-composition database for glass properties that determine waste-glass processability and acceptability and relating these properties to glass composition via property-composition models. The report explains how the property-composition models are developed, fitted to data and evaluated, validated with additional data, used for glass-formulation optimization, and continuously updated in response to changes in waste-composition estimates and processing technologies. Further, the report describes a waste-glass property-composition database compiled from literature sources and presents the results from a critical evaluation and screening of the data for applicability to Hanford waste glasses. Finally, the report provides interim property-composition models for melt viscosity, liquidus temperature (with spinel and zircon primary crystalline phases), and Product Consistency Test normalized releases of B, Na, and Li. Models were fitted to a subset of the database deemed most relevant for the anticipated Hanford waste-glass composition region.

Summary

Efforts are being made to increase the efficiency and decrease the cost of vitrifying radioactive waste stored in tanks at U.S. Department of Energy waste sites. The compositions of acceptable and processable high-level waste and low-activity waste glasses need to be optimized to minimize the waste-form volume and, hence, to save cost. A database of properties and associated compositions for simulated waste glasses was collected at Pacific Northwest National Laboratory for developing property-composition models. The database includes waste-glass compositions and properties, such as Product Consistency Test (PCT) response, viscosity (η), Toxicity Characteristic Leach Procedure response, density (ρ), and liquidus temperature (T_L), that are important for processability and product performance. Data from Pacific Northwest National Laboratory, West Valley Demonstration Project, Savannah River Technology Center, Vitreous State Laboratory at Catholic University of America, Idaho National Engineering and Environmental Laboratory, and several other institutions were reviewed and compiled into a single, easy-to-use database. This database, although not comprehensive, represents a large fraction of data on waste-glass compositions and properties that were available at the time of this report. Because of the size of the database, two versions of this report were printed, one version with the database attached as Appendix A and one version without the database attached.

Glass property-composition models were fit to subsets of the database for several key glass properties. Models were generated for normalized boron, sodium, and lithium release in the PCT, r_B, r_{Na}, and r_{Li}, respectively; T_L in the spinel ($[Fe,Ni,Mn][Fe,Cr]_2O_4$) and zircon ($ZrSiO_4$) primary phase fields; η at 1150°C (η_{1150}); Arrhenius η coefficients (A and B); and molar volume (V). Tables S1 through S4 summarize these models and the composition regions over which they are valid.

These models were developed from available data in a limited period of time to meet a client deadline. Selected statistical model development, evaluation, and validation methodologies were applied, but there was insufficient time for a complete evaluation and validation. Ordinary "good practices" quality assurance (QA) practices were followed, but the QA was not compliant with RW-0333P (DOE-RW 2002) or Nuclear Quality Assurance Requirements and Descriptions requirements (PNNL 2000). Future updates of models could be developed to tighter QA requirements when required.

These models should be considered for interim use in calculating properties of Hanford waste glasses. The models presented here represent updates of the models developed by Hrma et al. (2001) and appear to perform as well or better than those models; they cover broader composition regions with comparable or higher R^2 values, especially for validation datasets. However, as we discuss below, the models should be updated when the database is updated.

Table S1. Partial Molar Coefficients for Normalized B, Li, and Na Releases in the PCT

Component	$b_{B,i}$	$b_{Li,i}$	$b_{Na,i}$
Al_2O_3	-28.483	-28.866	-27.370
B_2O_3	13.749	11.087	8.981
CaO	-11.537	-7.367	-4.040
F	15.957	24.631	11.990
Fe_2O_3	-9.692	-10.013	-11.597
K_2O	8.055	2.931	11.807
Li_2O	9.061	8.996	7.175
MgO	7.031	5.323	9.058
MnO	-17.752	-17.695	-11.371
Na_2O	11.508	12.616	15.189
NiO	34.479	28.840	39.979
P_2O_5	-24.522	-8.028	-19.351
SiO_2	-4.352	-3.938	-4.669
SO_3	75.518	---	49.951
SrO	-9.824	-20.210	17.360
ThO_2	-17.107	---	---
TiO_2	-27.156	-20.204	-30.906
ZnO	-3.511	14.493	-21.494
ZrO_2	-19.611	-18.661	-17.045
Others	1.909	0.640	-1.987
R^2	0.749	0.769	0.772
R^2_{adj}	0.739	0.757	0.762
R^2_{pred}	0.724	0.739	0.747
s	0.547	0.485	0.446
min response ($\ln[r_i]$)	-2.72	-1.635	-2.749
mean response($\ln[r_i]$)	-0.658	-0.457	-0.71
max response($\ln[r_i]$)	3.22	2.09	2.64
# observations	516	371	445

Note: Normalized B, Li, and Na releases in the PCT are calculated with the formula:

$$r_j = \exp\left(\sum_{i=1}^{N} r_{ji} x_i\right) \tag{S.1}$$

where:

j = B, Li, Na is the element released

i = oxide component

N = number of components

x_i = i-th component mole fraction where $\sum_{i=1}^{N} x_i = 1$

r_{ji} = coefficient listed in Table S1.

Note: Melt viscosity at 1150°C is calculated with the formula:

$$\eta_{1150} = \exp \sum_{i=1}^{N} h_i x_i \tag{S.2}$$

Melt viscosity at a given temperature T is calculated with the formula:

$$\eta = \exp \sum_{i=1}^{N} \left[\left(A_i + B_i / T \right) x_i \right] \tag{S.3}$$

where:

i = oxide component

N = number of components

x_i = i-th component mole fraction where $\sum_{i=1}^{N} x_i = 1$

h_i, A_i and B_i = coefficients listed in Table S2

Table S2. Partial Molar Coefficients for Viscosity

Component	h_i	A_i	B_i
Al_2O_3	19.791	2.554	23392.8
B_2O_3	-9.52	-23.120	19322.4
CaO	-5.286	-11.840	9158.0
Fe_2O_3	-3.433	-14.951	15620.9
K_2O	-8.678	-8.380	1270.8
Li_2O	-16.25	-7.886	-11261.2
MgO	-1.393	-18.479	24230.9
Na_2O	-10.53	-11.008	837.1
P_2O_5	14.747	-18.382	43075.7
SiO_2	9.028	-8.839	25425.3
ZrO_2	13.246	-53.976	94861.2
LN_2O_3	-11.53	-51.517	52422.2
BaO	-8.507	27.367	-50506.4
F	-7.921	-13.866	9173.6
MnO	-7.578	-2.611	-6619.8
SrO	-4.64	-3.084	-176.8
ThO_2	13.443	---	---
TiO_2	-6.516	-5.508	1826.5
V_2O_5	-9.038	-45.533	50114.4
ZnO	---	-49.368	71022.4
Others	0.502	-22.152	33384.5
R^2	0.9707		0.9787
R^2_{adj}	0.9691		0.9784
s	0.175		0.170

Note: T_L is calculated with the formula:

$$T_L = \sum_{Ni,Cr,Mn} T_i x_i + \sum_{Alk,AlkE} (t_{ion} + \Theta_{ion} P_i) x_i + \sum_{remaining} (t_{\mathrm{cov}} + \Theta_{\mathrm{cov}} P_i) x_i \qquad \text{(S.4)}$$

where:

i = electropositive-element component

x_i = i-th element mole fraction where $\sum_i x_i = 1$

P_i = Z_i/r_i, where Z_i is the valance of the ion and r_i is the crystal radius of the ion given by Shannon (1976)

T_i, t_{ion}, Θ_{ion}, t_{cov}, and Θ_{cov} = coefficients listed in Table S3.

In Equation S.4, components are broken into three groups represented by the three terms in Equation S.4. The first group includes the major spinel components minus Fe, the second group includes the alkali and alkaline-earth components, and the last group includes all components not in the first two groups.

Table S3. Partial Molar Coefficients for Liquidus Temperature with Spinel Primary Phase

Item	Value
t_{ion}	-1,942
Θ_{ion}	1,996
t_{cov}	6,038
Θ_{cov}	-500
T_{Cr}	33,271
T_{Mn}	1,316
T_{Ni}	13,675
# Observations	320
Min T_L (°C)	859
Max T_L (°C)	1,310
Mean T_L (°C)	1,063
R^2	0.897
R^2_{adj}	0.895
s (°C)	32.77
Max residual (°C)	78

Note: T_L is calculated with the formula:

$$T_L = T_{Zr}x_{Zr} + \sum_{Alk,AlkE}(t_{ion} + \Theta_{ion}P_i)x_i + \sum_{remaining}(t_{\mathrm{cov}} + \Theta_{\mathrm{cov}}P_i)x_i \quad \text{(S.5)}$$

where:

i = electropositive-element component

x_i = i-th element mole fraction where $\sum_i x_i = 1$

P_i = Z_i/r_i, where Z_i is the valance of the ion and r_i is the crystal radius of the ion given by Shannon (1976)

T_{Zr}, t_{ion}, Θ_{ion}, t_{cov}, and Θ_{cov} = coefficients listed in Table S4.

In this equation, components are broken into three groups represented by the three terms in Equation S.5. The first group includes only Zr, the second group includes the alkali and alkaline-earth components, and the last group includes all components not in the first two groups.

Table S4. Partial Molar Coefficients for Liquidus Temperature with Zircon Primary Phase

Parameter	Value
t_{ion}	-3,979
Θ_{ion}	3,524
t_{cov}	2,505
Θ_{cov}	-146
T_{Zr}	12,254
R^2	0.868
R^2_{adj}	0.859
s (°C)	29.9
# Observations	64

Note: Molar volume (V) is calculated with the formula:

$$V = \sum_{i=1}^{N} V_i x_i \quad \text{(S.6)}$$

where:

i = the component

N = number of components

x_i = i-th component mole fraction where $\sum_i x_i = 1$

V_i = the partial molar volume of i-th component listed in Table S5.

The density (ρ) is calculated as follows:

$$\rho = \frac{\sum_{i=1}^{N} M_i x_i}{V} \tag{S.7}$$

where M_i is the molecular weight of i-th component.

Table S5. Partial Molar Volume for Density

Component	18-Comp. V_i	56-Comp. V_i	Component	18-Comp. V_i	56-Comp. V_i
Al_2O_3	46.149	46.149	Ag_2O		20.000
B_2O_3	30.048	30.048	As_2O_5		59.810
BaO	18.866	18.866	Ce_2O_3		45.341
CaO	15.214	15.214	Cr_2O_3		38.262
F	7.526	7.526	CuO		13.960
Fe_2O_3	39.158	39.158	Eu_2O_3		46.855
K_2O	37.741	37.741	Gd_2O_3		46.491
Li_2O	9.943	9.943	MoO_3		36.731
MgO	13.028	13.028	Nd_2O_3		48.117
MnO_x	13.175	13.175	P_2O_5		59.307
Na_2O	19.834	19.834	PdO		15.069
NiO	12.668	12.668	Pr_2O_3		48.640
SiO_2	25.316	25.316	Rh_2O_3		38.855
SrO	17.611	17.611	RuO_2		25.070
TiO_2	17.964	17.964	SeO_3		35.709
ZrO_2	27.081	27.081	Sm_2O_3		47.227
ZnO	15.069	15.069	SO_3		35.526
BeO		7.800	TeO_2		25.307
Bi_2O_3		45.000	UO_3		37.606
CdO		17.600	V_2O_5		61.155
CoO		14.500	WO_3		36.784
Cs_2O		47.000	Others	42.812	33.479
Ga_2O_3		42.500	Number of Glasses	365	365
HfO_2		27.500	R^2, molar volume base	0.949	0.946
La_2O_3		40.000	R^2 (Adjusted), molar volume base	0.946	0.937
Nb_2O_5		56.000	R^2, density base	0.921	0.917
PbO		22.250	R^2 (Adjusted), density base	0.918	0.902
Rb_2O		43.000			
Sb_2O_5		47.000			
Sc_2O_3		28.000			
SnO_2		28.800			
Ta_2O_3		52.000			
ThO_2		31.700			
Y_2O_3		35.000			

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Abbreviations

ASTM	American Society for Testing and Materials
BNFL	British Nuclear Fuels, Limited
BNI	Bechtel National, Inc.
CCC	canister centerline cooled
CUA	Catholic University of America
CVS	composition variation study
DOE	U.S. Department of Energy
DWPF	Defense Waste Processing Facility
EA	environmental assessment
EDS	energy dispersive spectroscopy
HAW	high-activity waste
HLW	high-level waste
HWVP	Hanford Waste Vitrification Plant
HT	heat treated
HTWOS	Hanford Tank Waste Optimization Simulator
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IP	ion potential
ISV	*in situ* vitrification
LAW	low-activity waste
LM	light microscopy
LN_2O_3	mixed lanthanide oxide (LN_2O_3=Ce_2O_3+Eu_2O_3+Gd_2O_3+La_2O_3+Nd_2O_3+Pr_2O_3+Sm_2O_3+Y_2O_3)
MCC	Materials Characterization Center
MS	melter study
NCAW	neutralized current acid waste
NQARD	Nuclear Quality Assurance Requirements and Descriptions
OM	optical microscopy
ORP	Office of River Protection
PCT	product consistency test
PNNL	Pacific Northwest National Laboratory
PVTD	PNNL Vitrification Technology Development

Q	quenched (glasses)
QA	quality assurance
RPP	River Protection Project
RFETS	Rocky Flats Environmental Technology Site
RPP-WTP	River Protection Project-Waste Treatment Plant
RMSE	root mean squared error
SBW	sodium-bearing waste
SEM	scanning electron microscopy
SG	Savannah River Glass
SP	spinel (study)
SRS	Savannah River Site
SRTC	Savannah River Technology Center
TCLP	toxicity characteristic leaching procedure
TEM	transmission electron microscopy
THERMO	thermodynamic hydration energy reaction model
TRU	Transuranic
TWRS	Tank Waste Remediation System
VHT	vapor hydration test
VSL	Vitreous State Laboratory
VFT	Vogel -Fulcher-Tamman
WAPS	Waste Acceptance Product Specifications
WQR	Waste Form Qualification Report
WTP	Waste Treatment Plant
WVDP	West Valley Demonstration Project
WVNS	West Valley Nuclear Services
WVST	West Valley Support Task
XRD	X-ray diffraction

List of Symbols

Symbol	Definition	Equation
a	constant in molar volume equation	(6.3)
a'	constant in molar volume equation = $ar_0^3/2$	(6.4)
A, A_{VFT}	composition-dependent coefficients	(1.9), (1.10)
A_i	i-th component coefficient in Arrhenius viscosity equation	(1.12), (3.2)
$A_{VFT,i}$	i-th component coefficient in VFT viscosity equation	(1.11)
b	constant in molar volume equation	(6.3), (6.4)
B, B_{VFT}	composition-dependent coefficients	(1.9), (1.10)
B_i	i-th component coefficient in viscosity equation	(1.12), (3.2)
$B_{VFT,i}$	i-th component coefficient in viscosity equation	(1.11)
$b_{\alpha,i}$	i-th component coefficient for α-th property	(1.3), (1.4)
c_α	α-th property constraint constant	(8.1)
f_α	α-th property-composition function	(1.1), (1.3)
$\mathbf{F}_W$	composition vector function	
g_α	α-th property-composition function (inverse)	(1.4)
h_i	i-th component coefficient for $\ln[\eta_{1150}]$	(3.1)
K	number of constraints	
L_i	i-th component atomic/thermodynamic characteristic	(1.6), (1.7)
m_α	α-th property empirical coefficient	(1.6), (1.7)
M_i	i-th element molecular weight	(6.1)
n_α	α-th property empirical coefficient	(1.6), (1.7)
N	number of components in glass	(1.2), etc.
$\mathbf{p}$	property vector	
p_α	α-th property	(1.1), (1.3)
p'_α	α-th property of the corrected glass	(8.4)
P_i	i-th ion potential = Z_i/r_i	(4.1), etc.
Q_0, Q_i	i-th component constraint constants	(8.2)
r_i	i-th component ionic radius	(6.3), (6.4)
r_j	j-th element normalized PCT release from quenched glass	(5.1)
$r_{j,i}$	i-th component coefficient for j-th element (PCT release)	(5.1)
t_{cov}	intercept of the line relating the effect of other components on T_L with their ion potential	(4.1), etc.
t_{ion}	intercept of the line relating the effect of ionic components on T_L with their ion potential	(4.1), etc.
T	temperature (on absolute scale unless otherwise specified)	(1.8), etc.
T_0	composition-dependent coefficient	(1.9)
$T_{0,i}$	i-th component coefficient in viscosity equation	(1.11)

T_i	liquidus temperature i-th component coefficient	(4.1), etc.
T_L	liquidus temperature	(4.1), (4.4)
G	glass composition region with acceptable properties	(8.3)
v_i	i-th component apparent partial molar volume	(6.3), (6.4)
V	molar volume	(6.1), (6.2)
V_i	i-th component partial molar volume	(6.2)
W	waste loading	(8.3)
x	composition vector	(1.1), (1.8)
x_i	i-th component mole fraction	(1.2), etc.
x'_i	i-th component mole fraction in corrected glass	(8.4)
$\mathbf{x_0}$	optimized glass composition vector	
Z_i	i-th component charge (valence)	(6.3), (6.4)
ε	melt electrical conductivity	
η	melt viscosity	(1.9), etc.
ρ	glass density	(6.1), (6.2)
ρ_i	i-th component coefficient for glass viscosity	(6.2)
θ_{cov}	slope of the line relating the effect of other components on T_L with their ion potential	(4.1), etc.
θ_{ion}	slope of the line relating the effect of ionic components on T_L with their ion potential	(4.1), etc.

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Quality Assurance

Ordinary "good practices" quality assurance (QA) was performed in developing the database and models. Formal QA documentation, such as would be required for Nuclear Quality Assurance Requirements and Descriptions, was not performed because of the interim nature of the work.

Contents

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Tables

1.0 Introduction

This report discusses interim property-composition models developed for Hanford high-level waste (HLW) and low-activity waste (LAW) glasses. This effort is aimed at improving the understanding of composition effects on glass properties over the broad composition space of expected Hanford waste glasses. With this increased understanding, the ability to more accurately estimate glass volumes, cleanup cost and schedule, and the impacts of changing property constraints and flowsheet options will be possible.

The interim models were developed from a glass property-composition database compiled for this purpose. Because the compiled database covers a large fraction of the regions of HLW and LAW glass compositions considered potentially of interest for Hanford, the resulting interim property-composition models are considered *global models* (Piepel, Hrma, and Vienna 1998). Global models are useful when it is necessary to make property predictions over a wide HLW glass-composition region. Global models are likely to yield less-accurate property predictions (compared to local models near specific waste glass compositions), but still can be useful. Eventually, when target compositions and composition-variation regions around target compositions for specific waste types[(a)] are better defined, it may be advisable to develop *local models* to predict HLW glass properties over the composition-variation region corresponding to a target composition for a given waste type. *Local models*, because they cover smaller composition regions centered near the glass composition of interest, are typically more accurate.

The glass property-composition models presented in this report are referred to as *interim models* for several reasons. The most obvious reason is that property-composition models will continue to be developed as more property-composition data become available, and better information about HLW compositions[(b)] and corresponding waste-glass compositions become available. However, the models should also be considered interim due to limitations in the data used to develop them. Ideally, to provide good support for developing property-composition models (per Piepel, Hrma, and Vienna 1998), a waste-glass-composition region of interest should be defined and covered with property-composition data derived with the use of statistical experimental design methods.

The interim models presented in this report were developed from a compilation of existing data. The data were screened so that only relevant data (i.e., data in the appropriate composition region) were used. However, the coverage of the waste glass-composition region(s) of interest was not as extensive as desired. Hence, the quality of the property-composition models discussed in this report may be affected by the limitations in the available data upon which they were based. Further, the time to develop, evaluate, and validate the interim-property models was limited. The available time did not permit the use of many statistical regression diagnostic methods (Draper and Smith 1998; Montgomery and Peck 1992) to identify outlying or influential data points and to identify the subset of waste-glass components that should be included in the interim model for a given property. Statistical model-validation methods (Montgomery and Peck 1992, Chapter 10) were not applied. However, informal model-validation

(a) A *waste type* is defined in the Waste Acceptance Product Specifications (WAPS) (DOE 1996) as "the waste material fed to each vitrification plant, the composition and properties of which will remain relatively constant over an extended period of time during waste-form production."

(b) It is expected that waste feed compositions will be updated as tank characterization, retrieval/blending scenarios, and definition of chemical impacts from separations and pretreatment processes are improved.

methods were applied to identify validation points for which model predictions are not close to measured values. In summary, although the interim property-composition models presented in this report have certain limitations, they should be useful for the intended purpose. These models are expected to give improved predictions of glass properties over those previously developed for Hanford HLW waste glasses.

The following subsections in this introduction address the role of property-composition models, property constraints implemented through models, the need for property-composition data to develop models, the forms of property-composition models, model fitting and reduction, and previous work to develop property models for Hanford HLW glasses. Section 2.0 presents a property-composition database compiled from previous studies to provide a basis for developing HLW property-composition models. Sections 3.0 through 7.0 discusses the interim property-composition models developed for Hanford HLW glasses, the data used to develop the models, and the glass-composition regions over which the models are valid for predicting glass properties. Section 8.0 discusses the use of property-composition models and mathematically constrained optimization methods to develop glass formulations and estimate waste-glass volumes. Section 9.0 summarizes a number of suggestions for future studies to complete the objectives of this research.

1.1 The Role of Property-Composition Models

The processability and acceptability of a waste glass is specified in terms of its properties. To make waste glass, the waste must be mixed with glass-forming additives in proportions to obtain a target glass composition that must have properties within prescribed limits. High-level waste and LAW glass compositions vary as a result of the changing composition of waste. The economic aspect of vitrification requires that waste-glass composition should minimize the expense.

It is practically impossible to develop an optimized waste glass for each waste composition on a purely experimental basis. Mathematical, statistical, and optimization methods are extremely useful in developing optimal glass compositions. Therefore, the task of developing optimum glass compositions must be addressed within a mathematical framework. An indispensable element of such a framework is a set of property-composition models. These models should be developed for waste glasses covering both the glass composition region of interest and a sufficiently broad range of values for glass properties of interest.

Property-composition models applicable to Hanford waste glasses have been developed at Pacific Northwest National Laboratory (PNNL) for over a decade. Initially, only one HLW waste stream was considered that would be processed in a certain type of melter without any attempt for optimization (Hrma et al. 1994). However, the need for property-composition models broadened over time because the waste-composition estimates changed, new waste streams were taken into consideration, new types of melters were tested, and economic considerations became more important. Thus, it became clear that the composition region of waste glass for the development of property-composition models was too narrow, and the ranges of existing property-composition models were not broad enough for practical applications.

The composition region of waste glass is determined by compositions and concentrations of waste and additives. Which are, in turn, determined by the range of glass properties that define acceptability for waste form storage, transport, and disposal; the processing technology related constraints; and the

applicable economic considerations. These factors are not fixed; all are frequently changing, and some are interdependent. Estimated waste compositions change with new samples and chemical analyses, pretreatment methods, retrieval strategies, and blending options. The acceptability conditions for HLW glass have been relatively stable for the last decade.[c] However, opinions vary as to how much crystallinity should be allowed in the glass and whether the glass can include immiscible amorphous phase-separation. New LAW glass-acceptability constraints have been recently developed (BNI 2001). It is conceivable that additional acceptability conditions may be imposed in the future as additional concerns regarding safety are raised. Finally, different melter types have been considered in the past or are considered for the future, e.g., Joule-heated melter, stirred melter, high-temperature melter, and cold-walled induction-heated melter. Different melters require different sets of glass-property values for processability. Economic considerations are often assessed in terms of waste loading in glass. Maximizing waste loading generally minimizes the costs of producing and disposing of the waste glass if produced at a fixed rate.

With each change, whether in

- the estimated composition of waste in the tanks currently considered for vitrification
- the group of tanks being considered for processing
- the key glass components resulting from pretreatment or
- the melter type being considered for vitrification,

the set of property-composition models needs to be updated. Extrapolation beyond the composition region on which the models are established can lead to misleading results. There is another reason for periodic updating of property-composition models. As more glasses are being tested to support various programs, more and more glass-property data accumulate. These data can be used to validate the existing property-composition models and ultimately to update these models. The development of property-composition models must respond to continuous changes. Consequently, developing property-composition models for waste glass is a continuous process.

1.2 Property Constraints

Three kinds of constraints on waste-glass properties exist: acceptability constraints, processing constraints, and economic constraints. Each of these kinds of constraints is discussed below.

1.2.1 Acceptability Constraints

Acceptability constraints are concerned with the acceptability of the final product. Roughly, waste glass should have sufficiently high chemical durability[d] and should retain this durability over thousands of years. Although the engineered barriers in the repository and the geology of the repository itself are designed to prevent the spreading of radioactive elements into the environment, the glass itself should

(c) The acceptability of HLW glass is described in the Waste Acceptance Product Specifications (WAPS) (DOE 1996).

(d) Chemical durability is typically defined as resistance to degredation caused by chemical attack. In the case of waste glasses, chemical durability can be considered the ability of the glass to withstand attack from an aqueous medium without the release of hazardous or radioactive components.

have good resistance against corrosion by water. The benchmark test for U. S. HLW glass is the Product Consistency Test (PCT) (ASTM 1998). A rough statement of an applicable PCT constraint is that no acceptable HLW glass should have a higher release of boron, sodium, or lithium than the environmental assessment (EA) glass after normalization for their fractions in glass (DOE 1996). As our knowledge of glass behavior increases, glasses are routinely formulated that surpass the EA constraint by nearly an order of magnitude. However, to implement this constraint, various uncertainties must be accounted for in PCT measurement, release predictions from models that are functions of glass composition, and glass compositions used in predicting PCT release.

Under the current River Protection Project-Waste Treatment Plant (RPP-WTP) contract (BNI 2001), the LAW glass at Hanford must also be tested with the PCT and yield normalized boron and sodium releases of less than 2 $g \cdot m^{-2}$ after 7 days. In addition, the rate of alteration as measured by a vapor hydration test (VHT) at 200°C should be less than 50 $g \cdot m^{-2} \cdot d^{-1}$.

High-level waste glass properties may strongly depend on the temperature history of the glass. Slowly cooled glass is prone to amorphous phase separation and crystallization. Crystals are usually durable, which means that they remove components from the glass phase that endow glass with durability. Thus, the crystallization of certain minerals, such as nepheline, may produce non-durable glass. Therefore, PCT performance should be studied and modeled for glass that is quickly cooled, such as quenched glass, and glass with the slowest rate of cooling, such as canister-centerline-cooled; see Marra and Jantzen (1993) and Riley, Rosario, and Hrma (2001). Although the primary consideration in waste form acceptance is its performance, the formation of additional phases impacts the ability to predict the performance, such as PCT release. This imposes a further restriction on glass composition by increasing the error margin in PCT release for which an account must be given.

1.2.2 Processing Constraints

The second type of constraint is added to assure the processability of glass in the melter. The acceptable ranges for processability-related glass properties differ for different melter types. Generally, glass is processable when its viscosity (η) is lower than 10 or 15 Pa·s—the lower the viscosity, the higher the rate of processing. However, when η is below 1 or 2 Pa·s, glass becomes more corrosive to those materials that are in contact with the melt (e.g., refractories, electrodes, and bubblers) and steam excursions[(e)] become more likely. Therefore, between 1 and 2 Pa·s is generally considered the lower limit for melt viscosity, although lower viscosities may be acceptable.

An important property of HLW glass is its liquidus temperature (T_L), the highest temperature at which a solid phase can exist in the melt at equilibrium.[(f)] With increasing waste loading, the T_L increases until it reaches and exceeds the melter operating temperature. When this happens, solids can precipitate in the

(e) Steam excursions may occur when water from the melter feed is intimately mixed with a hot glass or salt melt. The heat from the melt is quickly transferred to the water which abruptly transforms the liquid into a steam. This is only likely if the water and hot melt are allowed to quickly mix as might be the case with an exceedingly low viscosity melt.

(f) Frequently the presence of melt insolubles from the waste, such as noble metals and their oxides, are ignored. This is consistent with the definition of T_L since these components are not considered part of the melt (or thermodynamic system) and therefore are more like the crucible the melt is held in. However, for practical purposes, the presence of melt insolubles is an important consideration in glass processing.

melter. If these solids are not removed from the melter as the glass is poured, they accumulate and can eventually obstruct melter operation. To prevent a premature shutdown of these melters, the T_L is required to be lower than a certain temperature appropriate for the melter. Typically, a 100°C or more safety margin is used so that $T_L \leq T_M$ - 100°C, where T_M is the nominal melter operating temperature.

Processability constraints may be modified in the future. In particular, the T_L constraint currently limits waste loading in most of Hanford and Savannah River HLW glasses and, thus, has a huge economic impact. Hence, the T_L constraint is likely to be scrutinized and made less restrictive without putting solid-phase-sensitive melters at risk. For example, it may be acceptable to allow some small-volume fraction of certain crystals in the melter as long as they do not segregate to the melter bottom, cause other processing problems, or affect the acceptability of the HLW glass. Other constraints may be added to the existing list. For example, constraints could be developed that would prevent the segregation of molten salts in the melter or prevent an unacceptably low melting rate or high corrosion rate.

Another property that has been required to be within certain limits is electrical conductivity (ε) of the melt. Because glass is heated by an electric current passing through it, the glass conductivity must be substantially higher than that of the melter walls and sufficiently low to prevent electrode damage or thermal instability. The permitted range of ε of molten glass is wide, usually 10 to 100 S/m. With this wide range, ε is unlikely to affect the formulation of HLW glasses that meet viscosity and PCT constraints. Once the power system for the melter has been built, the acceptable range for ε may be narrowed to meet the specific power output of the system. Because of the broad range of acceptable ε, this property rarely limits the waste loading of HLW glasses and therefore was not modeled in this study.

1.2.3 Economic Constraints

The cost of producing HLW glass depends on the total volume of glass to be produced and the required processing time. By increasing the waste loading of HLW glass, i.e., the fraction of HLW incorporated in the glass, the volume of HLW glass will be reduced. Thus, the cost will be reduced by decreasing the time required to process the waste at the same rate and by decreasing the space and handling required for the canistered waste. Hence, constraints may be placed on the waste loading of HLW glass to control the cost of producing the glass. For example, it is often desirable to optimize glass composition to have the maximum waste loading while meeting other product quality and processability constraints. To some extent, the cost of LAW glass production is also determined by loading of waste in the glass along with production rate.

Acceptability constraints and processing constraints are typically placed on waste glass properties, whereas waste loading (economic) constraints are placed directly on the waste glass composition itself. For glass development and qualification work, property-composition models provide a way to implement property constraints as functions of glass composition.

1.3 Property-Composition Models

Property-composition models or constitutive equations are functions of the form

$$p_\alpha = \mathrm{f}_\alpha(\mathbf{x}) \tag{1.1}$$

where p_α is the α-th property, **x** is the composition vector, and f_α denotes the functional form of the model. The composition is defined as $\mathbf{x} = (x_1, x_2, \ldots, x_{N-1})$, where x_i is the i-th component mass or mole fraction, and N is the number of components. Only N-1 components are independent because the mass and mole fractions must sum to 1:

$$\sum_{i=1}^{N} x_i = 1 \tag{1.2}$$

Typically, the functional form f_α involves parameters or coefficients that are independent of state variables, such as **x**. Values of these coefficients must be determined by measurement. Models in which all coefficients are estimated from data are called *empirical models*. Models in which some coefficients are derived from fundamental principles of physics and chemistry, while other coefficients are estimated from data, are called *semi-empirical models*. Models that are developed from the fundamental laws of physics, e.g., quantum and statistical mechanics, without the use of any experimental data are called *first-principle models*. First-principle models[(g)] are not applicable to the prediction of multi-component waste-glass properties but may be useful in understanding fundamental relationships that guide model development.

The following two subsections discuss property models linear in composition, and property models linear in composition and nonlinear in temperature. The final subsection briefly discusses the concept of first principles.

1.3.1 Property Models Linear in Composition

A simple but very useful property-composition model form is given by

$$p_\alpha = f_\alpha \left(\sum_{i=1}^{N} b_{\alpha i} x_i \right) \tag{1.3}$$

or, more conveniently,

$$g_\alpha (p_\alpha) = \sum_{i=1}^{N} b_{\alpha i} x_i \tag{1.4}$$

where $b_{\alpha i}$ is the i-th component coefficient for α-th property and g_α is the inverse of f_α. Note that the mathematical transformation, g_α, could be the identity transformation, i.e., no transformation. Also note that the sum runs from 1 to N, and thus not all x_i are independent. This form enabled us to write Equation 1.4 without a constant, i.e., an intercept term, because, by Equation 1.2,

(g) A good working definition of first-prinicple's was given by Cohen (1994) "In a first principles approach, one uses fundamental quantum physics to obtain energetics and the static and dynamic properties of a system, without fitting *any* experimental data."

$$x_N = 1 - \sum_{i=1}^{N} x_i \ . \qquad (1.5)$$

Because $g_\alpha(p_\alpha)$ in Equation 1.4 is also a property, we can identify the $b_{\alpha i}$ coefficients as partial-specific or partial-molar properties. Models of the form (1.4) are often referred to as *first-order, i.e., linear, mixture experiment models* (Cornell 2002) because the functional form is a first-order, i.e., linear, polynomial. Note that in classical thermodynamics, Equation 1.4 is used for non-ideal mixtures. In these mixtures, partial specific or molar properties are functions of composition. Glass is generally a non-ideal mixture. If individual components in waste glasses are confined to sufficiently narrow ranges of concentrations, non-linear functions of composition may be approximated as linear with acceptable error. As components vary over wider ranges, linear functions of composition may not adequately approximate the underlying nonlinear relationship. In such cases, nonlinear approximating functions may be required.

Glass composition (the **x** vector) can be expressed in three basic ways.

1) Glass composition is traditionally expressed as a mixture of single metal oxides such as SiO_2, Fe_2O_3, SO_3, Na_2O, etc. and halogens, e.g., F. Multivalent oxides are all represented with the most prevalent oxidation state. Though the oxygen content in the glass is not counted accurately, the composition is uniquely defined and is probably the most suitable for technological and engineering applications, especially when mass fractions are used. Accounting for the true oxidation-reduction states of all components is not practicable because this state depends on glass-making conditions such as selection of raw materials, temperature, and atmosphere during glass making. However, models have been previously developed that account for variations in oxygen fugacity by including separate terms for FeO and Fe_2O_3.

2) Glass can be viewed as a mixture of electronegative elements, such as O and F, and electropositive elements, such as Si, B, Fe, Na, etc. The problem with the redox state, e.g., Fe(II) and Fe(III), and the fraction of oxygen does not arise if only electropositive constituents are considered. This may be advantageous for semi-empirical models that include fundamental properties of ionic species, such as the size or charge of the ions.

3) Glass composition can be resolved into simple silicates and borates (e.g., see Jantzen 1992). This representation is not unique and can be accomplished in different ways for different properties, dependent on which structural units are associated with different transport properties, hydration reactions, or crystallization behavior. This may be advantageous for modeling the effects of elements that fill multiple structural roles in glass, depending on composition. This method has not been applied to models in this report. However, this method may be useful in developing future models.

Approach 1 has been used in developing η and PCT release models in this study. Approach 2 has been used in the T_L and V models in this report. Approach 3 has been applied in the hydration energy model (Jantzen et al. 1995).

The disadvantage of an empirical model, such as Equation 1.4, is that a large number of coefficients must be estimated from data. Waste glass can have up to 80 elements, and some of these elements can be in multiple oxidation states. It would be difficult to cover a large composition region with enough

compositions to estimate 80 or more coefficients. However, in practice, most glass properties are only significantly affected by "major" glass components, e.g., those appearing at mass or mole fractions greater than 0.005. Hence, the number of components for which $b_{\alpha i}$ coefficients in Equation 1.4 must be estimated is usually much smaller than the total number of glass components.

The problem of empirically estimating a large number of component coefficients in Equation 1.4 can be resolved if the coefficients are related to some basic atomic or thermodynamic characteristic of the components. If such relationships are simple, the number of empirical coefficients can drastically decrease. Suppose that

$$b_{\alpha i} = n_\alpha + m_\alpha L_i \tag{1.6}$$

where L_i is the atomic or thermodynamic characteristic of the i-th component, and n_α and m_α are empirical coefficients for α-th property. Combining Equations 1.4 and 1.6, we obtain a semi-empirical relationship

$$\mathrm{g}_\alpha(p_\alpha) = n_\alpha + m_\alpha \sum_{i=1}^{N} L_i x_i \tag{1.7}$$

Because Equation 1.7 has only two empirical coefficients, it will generally yield less accurate property predictions than the fully empirical Equation 1.4. However, Equation 1.7 may yield better results if $b_{\alpha i}$ coefficients are not known for some influential components. A semi-empirical relationship such as Equation 1.7 is easier to develop and use, and N can be larger than for an empirical relationship represented by Equation 1.4. Comparing empirical and semi-empirical $b_{\alpha i}$ values can identify shortcomings in the assumptions inherent in Equation 1.7; see, for example, Piepel, Redgate, and Masuga (1996) and Piepel, Redgate, and Masuga (1997).

1.3.2 Property Models Linear in Composition and Nonlinear in Temperature

Some glass properties, such as η and ε, are functions of temperature (T) as well as composition. For such properties, models are of the form

$$p_\alpha = \mathrm{f}_\alpha(\mathbf{x}, T) \tag{1.8}$$

For a given waste glass, the temperature dependence of a property, such as viscosity, is often approximated by the Vogel-Fulcher-Tammann equation[(h)]

$$\eta = \exp\left(A_{VFT} + \frac{B_{VFT}}{T - T_0}\right) \tag{1.9}$$

or, in a narrow temperature interval, by the Arrhenius equation

(h) See H. Vogel, *Phys. Z.* **22,** 645-646 (1921), G. S. Fulcher, *J. Am. Ceram. Soc*. **8**, 339-366 (1925), G. S. Fulcher, *J. Am. Ceram. Soc*. **8**, 789-794 (1925), and G. Tammann and W. Hesse, *Z. Anorg. Allg. Chem*., **156**, 245-257 (1926).

$$\eta = \exp(A + \frac{B}{T}) \tag{1.10}$$

where A_{VFT}, B_{VFT}, T_0, A, and B are temperature-independent coefficients.

In any of these equations, the parameters A_{VFT}, B_{VFT}, T_0, A, and B can be expressed as functions of composition to also capture the dependence of the property on composition. Expanding the parameters in Equations 1.9 and 1.10 as linear functions of composition. i.e., linear mixture models, yields

$$\ln(\eta) = \sum_{i=1}^{N} A_{VFT,i} x_i + \frac{\sum_{i=1}^{N} B_{VFT,i} x_i}{T - \sum_{i=1}^{N} T_{0,i} x_i} \tag{1.11}$$

and

$$\ln(\eta) = \sum_{i=1}^{N} A_i x_i + \frac{\sum_{i=1}^{N} B_i x_i}{T} \tag{1.12}$$

Coefficients A_{VFT}, B_{VFT}, T_0, A, and B can be treated as composition-dependent properties, and thus they may be reparameterized as in Equation 1.7.

1.3.3 A Comment about First Principles

In classical field theory, material parameters or properties are mathematically established as constitutive equations that relate these parameters to state variables, such as temperature, pressure, and composition. These relationships are distinct from the first-principles that postulate the basic laws of physics, such as the balance of energy. The constitutive equations themselves are not first-principles. They just define material objects whose behavior is subject to the basic laws, i.e., the first-principles.

Can constitutive equations themselves be based on first-principles? Yes, if these equations were based on quantum mechanics, as in the *ab initio* calculations (see Cohen 1994). In such models, no empirical coefficients would be needed. They would be based solely on the first-principles or basic laws. Such an approach is not realistic at present. For example, properties of even a single-component glass (SiO_2) are much easier to measure than to accurately calculate from first-principles. The term "first-principle" is occasionally erroneously used to describe semi-empirical models.

1.3.4 Comment on Significant Figures

Throughout this document a number of models coefficients and other values are reported a with higher number of figures than are significant. Past experience has suggested that prediction of property models is slightly better with more figures than significant. However, a detailed evaluation of the

appropriate number of figures to report and use was not performed. We therefore suggest use of all reported figures for consistency.

1.4 Need for Property-Composition Data

Partial properties in Equation 1.4 or empirical coefficients in Equation 1.7 can only be measured or estimated from data. The temperature dependence of a property, such as η, can be determined by: 1) measuring the property at a series of constant temperatures, or 2) continuously measuring the property while the temperature is gradually increasing or decreasing. To establish a η-*T* relationship in analytical terms, an empirical model is fitted to measured data. Such a relationship or model[(i)] is ready for use in applications, for example, in the Navier-Stokes equation for fluid flow (see Fung 1994 for example) with a variable temperature. It can also be used for computing viscosity at a given temperature if such a number is needed for understanding a more complex behavior, such as the settling of solid particles. With empirical models, it is important to be aware of uncertainties, such as the uncertainty of measured data, the uncertainty of the empirical model form, i.e., how closely it represents or approximates the true behavior, and the uncertainty of model input values, e.g., the composition of the glass or the degree of uniformity of the melter feed.

To determine the empirical coefficients in property-composition models, a set of property-composition data that adequately covers the composition region of interest is needed. Historical data sets can be compiled for this purpose, or a test matrix of compositions can be designed and the properties measured. Unlike temperature, which is expressed by one number, composition is expressed as a vector with *N*-1 dimensions. The goal in compiling property-composition data to develop property-composition models is to adequately cover the (*N*-1)-dimensional glass-composition region with a manageable number of compositions.

Several approaches can be used to select a test matrix to explore an (*N*-1)-dimensional composition region. Three common approaches are to 1) vary each component one-at-a-time, i.e., adding or removing a single component to or from a baseline composition with the remaining components adjusting for the change while maintaining constant proportions, or replacing one component with another, and 2) changing the fractions of several (up to *N*-1) components at a time. Table 1-1 summarizes some advantages and disadvantages of these three approaches.

(i) The terms "model" and "relationship" are interchangeable in this report, though their connotations are different in materials science and statistics.

Table 1-1. Advantages and Disadvantages of Two Approaches for Exploring a Glass Composition Region of Interest

Approach	Advantages	Disadvantages
One-at-a-time variations from baseline composition or replacing one component with another.	1. Component effects can be graphically visualized. 2. The linearity or nonlinearity of component effects is immediately apparent. 3. Does not require sophisticated software for design or evaluation. 4. Component replacement is useful if one component makes up the majority of the glass.	1. Results may depend on the baseline composition. 2. Does not provide information about non-linear blending, i.e., "interaction," effects of the components. 3. Inefficient way to cover composition space and generate data for property-composition models.
Many-at-a-time variations within a defined glass composition region.	1. Provides information about nonlinear blending, i.e., "interaction," effects of the components. 2. Provides information about linear effects of components over the region. 3. Provides for best coverage of the composition region.	1. Requires statistical optimal experimental design methods and software to implement. 2. Requires models to assess whether components have linear or non-linear, i.e., curvilinear or interaction, blending effects.

The large number of components in Hanford HLW glass means that there are seldom enough data to develop highly accurate constitutive equations over the entire glass-composition region in question. Moreover, the dependence of waste-glass properties on glass composition is fundamentally nonlinear, and thus the linear representation in Equations 1.4 or 1.7 has limited validity. Fortunately, the "true," but unknown, property-composition relationships are generally expected to be smooth or piecewise smooth as functions of composition, such as T_L. For smooth functions of composition, linear functions provide satisfactory approximations over sufficiently small portions of the composition space. Luckily, in many-component HLW glasses, the range of interest for each component is likely to be sufficiently narrow so that a linear function provides a reasonable approximation to the "true" property-composition relationship.

Linear mixture models such as (1.4) can be expanded to include nonlinear blending terms in cases where a linear approximation is not adequate, and there are sufficient data to estimate the coefficients of linear and nonlinear blending terms (Cornell 2002; Piepel, Szychowski, and Loeppky 2002). If glass components are likely to have significant nonlinear blending effects for a given waste-glass composition region, more property-composition data points covering the composition space will be needed to support fitting models with nonlinear blending terms.

1.5 Data Reduction: Partial Specific/Molar Coefficients

Databases alone are insufficient for developing an adequate HLW glass formulation because too many constraints need to be satisfied, and the waste-glass volume should be as small as possible, i.e., the waste loading in the glass should be as high as possible (assuming constant processing rate). Therefore,

data reduction is necessary. As discussed in Section 1.1, the goal of data reduction for formulation purposes is to develop property-composition models that adequately approximate the "true," unknown property-composition relationships. Such models can then be used to predict waste-glass property values as functions of waste-glass composition and temperature, where applicable, anywhere within the composition region of validity for the models.

In this report, we focus attention on models with linear-composition dependence, such as in Equations 1.4, 1.11, and 1.12. Such models can be fit to an appropriate property-composition data set, thereby reducing the data to partial-specific or molar properties. Composition in the models can be expressed in one of the three possible divisions of the mixture to constituents discussed in Section 1.3. Partial properties have been well established in thermodynamics, including their physical meaning and methods of evaluation from data. They can themselves be functions of composition. Hence, Equation 1.4 is useful, even when the composition relationship is nonlinear, that is, $b_{\alpha i} = f_{\alpha i}(\mathbf{x})$. Attempts have been made to use this approach to develop higher-order models, but, for some properties, these attempts were discontinued for the lack of sufficient data or because of the limited time available to develop models for inclusion in this report.

After fitting property-composition data to a linear mixture model—Equation 1.4—and thus estimating partial specific or molar properties for the components in the model, the next step is to assess the adequacy of the model. As noted previously, a model linear in composition may or may not adequately approximate the "true," unknown property-composition relationship over the composition region covered by the available data. Provided the data set includes sufficient replicate data points, or adequate estimates of experimental and property-measurement uncertainties exist, statistical methods for assessing model lack-of-fit (Draper and Smith 1998; Montgomery and Peck 1992) can be applied. If a model does not have a statistically significant lack-of-fit, then it should be validated with data not used to develop it or cross-validated with the data used to develop it (Montgomery and Peck 1992, Chapter 10). However, empirical models with statistically significant lack-of-fits or less than ideal validation or cross-validation performance can still be useful in earlier stages of glass development and formulation studies, provided the models provide reasonable fits and predictive ability. Global models linear in composition may fall into this category, but would still be useful in supporting early waste-retrieval, waste-blending, and glass-development activities. As waste composition and variation information improve, local models can be developed to more accurately predict glass properties over smaller glass-composition regions corresponding to specific waste types. The uncertainty of these local models can be significantly lower than the uncertainties of the global models, approaching the uncertainties in property measurements and compositions in the data used in their development.

If a model linear in composition—Equations 1.4, 1.7, and 1.12—for a given property provides an adequate fit to the data, the next step in the data reduction is to focus more attention on the estimated partial-specific or molar properties obtained from the model fit. For example, the partial properties can be further analyzed to find correlations between them or relationships with more fundamental characteristics of the constituents, such as the electric charge and radius of ions or the free enthalpy of simple silicates and borates (Jantzen 1992; Vienna et al. 2001a). Such a semi-empirical approach to developing property-composition models reduces property-composition data to the maximum practicable degree.

1.6 Existing Property Composition Models for Hanford HLW Glass

Historically, simple relations between properties and composition have been developed for commercial glasses for nearly a century. The book by Scholtze (1990) provides a good review of property-composition relationships for simple glasses. A similar approach became a necessity for HLW glass to deal with the large composition region of Hanford HLWs. Before the Hanford experience, a semi-empirical equation, originally developed by Paul for assessing glass durability (Paul 1977), was applied to HLW at Savannah River (Jantzen 1992, p.153-217).

The Hanford HLW composition region is not fully known, but reasonable estimates of its boundaries have been made based on HLW sample analyses and process inventories. For this estimated HLW composition region, a glass-composition region for neutralized current acid waste (NCAW) was assessed and represented by more than 100 compositions, for which several properties were measured (Hrma et al. 1994; Piepel, Redgate, and Hrma 1995). Property-composition models were then developed from these data (Hrma et al. 1994, 1995a, 1995b).

The basic processing properties measured and modeled (Hrma et al. 1995b, Vienna et al. 1996b) were η, ε, and T_L. Other properties were also characterized and modeled: glass-transition temperature, thermal-expansion coefficients of solid and molten glass, and density (Hrma et al. 1994). Considerable attention focused on PCT response (Hrma 1995a; Vienna et al. 1996a; Kot and Pegg 2001), and other studies for Hanford HLW glass have focused some attention on Toxicity Characteristic Leach Procedure (TCLP) (EPA) to a lesser extent (Vienna et al. 1998, Kot and Pegg 2001, Jantzen et al. 2000). These outcomes of specific tests are, strictly speaking, not properties, but can be treated as such because they are reproducible results of well-defined experimental procedures. For Idaho HLW glass-composition regions, preliminary property-composition models were developed for η and PCT (Edwards et al. 2000; Piepel et al. 2002).

The form of the function g_α in Equations 1.4 and 1.7 is the natural logarithmic function for η, ε, and normalized PCT elemental releases. For other properties, g_α is the identity function. The transport properties, η and ε, are also functions of temperature, as discussed in Section 1.3. For η, Hrma et al. (1995a) developed property-composition-temperature models of the form (1.11) and (1.12) as presented in Section 1.3. For ε, they developed models of the form (1.12). Models for η and ε at a constant temperature were also developed. Hrma et al. (1995b) also used a model of the form (1.7) for PCT normalized elemental releases. A semi-empirical model based on the hydration energies of silicate, borate, and oxide components of glass (Jantzen et al. 1995) did not work well for Hanford HLW glass (Piepel, Redgate, and Masuga 1996 and 1997). Feng, Saad, and Pegg (1990) and Feng and Metzger (1996) developed a semi-empirical model for viscosity and PCT release based on the heat of formation of oxide components in glass. Jantzen (1991) developed a model for T_L based on the free energies of formation of three mineral phases. Jantzen (1991) also developed a model for viscosity based on a calculation of the number of non-bridging oxygen atoms.

Hrma et al. (2001) developed a database of glass compositions and properties from literature. This database was used to fit interim glass-property models for use in predicting the properties of projected Hanford HLW glasses. However, several shortcomings of the database used to develop the models were identified: 1) the data developed in support of the Office of River Protection's (ORP's) Waste Treatment

Plant (WTP) project were not included in the database due to the timing of data release, 2) there was insufficient coverage of the expected composition regions for many properties, primarily T_L, 3) several datasets were inputted to the database, but were not verified and tested for consistency with other data and therefore could not be used in model development, and 4) compositions of interest to Hanford LAW glasses were not considered during model development. In the study reported here, we take the next logical step in the series of required studies to develop and refine the models for Hanford waste glass properties.

2.0 Property-Composition Database

This section describes the waste-glass property-composition database that was compiled to support developing property-composition models. Section 2.1 briefly describes the structure and contents of the database. Section 2.2 lists the major sources of data incorporated in the database and used for model development in Sections 3.0 to 7.0.

The database certainly does not contain all property values of HLW glasses ever measured. Some available data sets were not included because of incomplete documentation to confirm the accuracy of the data. More data will be added as necessary after checking for accuracy or when new reports become available after this report is issued to validate and improve property-composition models.

2.1 Description of Database

The current database was compiled in an Excel spreadsheet with IDs of glasses in rows and compositions and properties in columns as described below.

- *Study, Data Source, and Glass ID*: Each set of data is distinguished by a study name, i.e., the names for a group or groups of data, and the source of the data, i.e., a reference. The same Glass IDs are used as given in the original Data Source.

- *Glass Composition (mass fraction):* Target (-t) and analyzed (-a) compositions are entered in separate columns in alphabetical order for 61 components. The Others component is used only when there is no information available to separate Others into individual component concentrations, and the sum of oxide components in the target composition did not equal one.

- *Melting Temperature (T_M in °C):* The melting temperatures are the actual temperatures used to fabricate the glass. When a glass was melted two or three times, only the final melting temperature was entered.

- *Liquidus Temperature (T_L in °C):* The T_Ls measured by a gradient-furnace method and by a uniform-temperature method are given in separate columns. The primary phase was also recorded in a column.

- *Crystallinity and Homogeneity:* The information on the crystalline and amorphous phase separation was given for quenched, canister centerline cooled (CCC), and heat-treated glasses. The results from visual/light microscopic (LM) observation, electron microscopic, i.e., scanning electron microscopy/electron-dispersive spectroscopy (SEM/EDS) or transmission electron microscopy (TEM), and X-ray diffraction (XRD) were recorded in separate columns.

- *Density (ρ in g/cm^3):* Density data are available for a limited number of glasses.

- *Viscosity (η in Pa·s):* The coefficients for Vogel-Fulcher-Tamann and Arrhenius equations; the calculated viscosity at 1150°C; and temperatures at 2, 5, and 10 Pa·s, based on these coefficients, are

entered as provided in the references. The T_n and V_n (n ≡ data point number = 1 to 14) columns are for the viscosity-at-temperature data.

- *PCT Normalized Releases (r_j in g/m^2):* Normalized elemental releases of j = B, Li, Na, and Si and final pH values from standard 7-day PCT at 90°C and target surface area-to-volume ratio (S/V) of 2000 m^{-1} are given for quenched (Q) and CCC glasses. The releases are all normalized to S/V in addition to the element concentration in glass, giving r_j values in g/m^2. Some studies measured PCT at 20°C; these results are in separate columns.

- *TCLP Response (in ppm):* The TCLP data are available for a limited number of glasses.

The database compiled in this report contains glasses designed for the vitrification of HLW and LAW that were used for the model development.

2.2 Discussion of Data Sets Used in Model Development

This subsection provides a list of studies represented in the database with brief explanations of each study. Table 2-1 summarizes these studies in terms of the number of glasses tested, their compositions, and properties provided. The figures in parentheses in the "property" column indicate the number of glasses for which the property data are provided.

2.2.1 Idaho National Engineering and Environmental Laboratory Composition Variation Studies

This series of studies includes the composition variation study (CVS) to develop glass compositions for immobilizing the HLW calcine and the sodium-bearing waste (SBW) stored at the Idaho Nuclear Technology and Engineering Center (INTEC) conducted at the Idaho National Engineering and Environmental Laboratory (INEEL).

INEEL CVS Phase 1 (Staples et al. 1999)

The first phase of the CVS addressed waste compositions based on the high-activity waste (HAW) fraction from the initial separations flowsheet. This study investigated how glass properties depend on composition within a region compatible with the expected range of INEEL INTEC HAW. Given the range of the HAW compositions, statistical design techniques were applied to derive a formulation matrix for the first phase of the CVS (Piepel, Vienna, and Hrma 1999). Formulations selected from this matrix were characterized with respect to the crystallinity of both quenched and CCC glasses, PCT releases of quenched glasses, η, and T_L. The T_M data are provided for all 44 glasses. Because of batching errors that were discovered after the report was issued, the original report contained some incorrect target compositions and PCT releases that were calculated based on the target compositions. The correct compositions and PCT releases were recalculated later from the original batch sheets and entered in the database. The corrected compositions are documented in a paper by Piepel, Szychowski, and Loeppky (2002). Analyzed compositions were not given in the original report; the analyzed compositions entered in this database were those obtained after the Staples et al. (1999) report was issued.

INEEL CVS Phase 2a (Edwards et al. 2000)

This set of glasses, which was designated as Phase 2a, was tested as a preliminary study before designing the test matrix of 37 CVS Phase 2 glasses, referred to as Phase 2b to distinguish them from the preliminary test glasses (Staples et al. 2000). This report presented the glass-composition experimental region and the methodology used to develop a statistically designed Phase 2b test matrix. Viscosity at 1150°C and the PCT of quenched glasses were entered in the database.

INEEL CVS Phase 2 (Staples et al. 2000)

A test matrix of 37 glasses was developed (Edwards et al. 2000) and tested in Phase 2 to investigate property-composition relationships within the alkali borosilicate glass-composition region compatible with estimates of INTEC calcined compositions with a direct vitrification flowsheet and of HAW fractions proposed to be separated from dissolved calcine. A secondary objective of the Phase 2b test matrix was to investigate the composition boundaries of P_2O_5, F, CaO, and Al_2O_3. These glasses were characterized with respect to the crystallinity of quenched and CCC glasses, PCT releases of quenched glasses, η, T_L, and density. T_M data are provided.

INEEL CVS Phase 3 (Scholes, Peeler, and Vienna 2000)

Phase 3 of the INEEL CVS focused on glass compositions that may be appropriate for either the INEEL separations/pretreatment scenario or the direct vitrification of calcined HLW. Through application of statistical techniques, a test matrix was defined to augment Phase 1 and 2 data with additional data points (Piepel et al. 2002). These glasses were characterized for crystallinity of quenched and CCC glasses, PCT releases of quenched glasses, η, T_L, and density. T_M data are provided for all 30 glasses.

SBW CVS Phase 1 (Scholes et al. 2002)

This report presented the results of the first phase of a composition variation study conducted for the development of glass compositions for the vitrification of SBW located at the INEEL. The purpose of this study was to investigate and model the effects of glass composition on key properties within the expected region of immobilizing the liquid SBW stored in tanks at the INEEL. The T_M, T_L, crystallinity of quenched and CCC treated glasses, ρ, η at T, and PCT of quenched glasses were entered in the database.

Table 2-1. Summary of Number of Glasses Tested and Properties Measured in Each Data Set

Study	Reference	Number of Glasses	Comp[(a)]	Property (Number of glasses)
INEEL CVS Phase 1	Staples et al. (1999)	44	t, a	T_M (44); GT_L (23); UT_L (28); Q (44); CCC (8); ηVFT (36), η(1150°C) (36), η(*T*) (36); Q PCT (44)
INEEL CVS Phase 2a	Edwards et al. (2000)	18	t	η(1150°C) (6); Q PCT (18);
INEEL CVS Phase 2	Staples et al. (2000)	37	t, a	T_M (37); UT_L (26); Q (37); CCC (15); ρ (37); ηVFT (36), η(1150°C) (36), η(*T*) (36); Q PCT (37)
INEEL CVS Phase 3	Scholes, Peeler, and Vienna (2000)	30	t, a	T_M (30); UT_L (24); Q (30); CCC (28); ρ (30); ηA (30), η(1150°C) (30), η(*T*) (30); Q PCT(30)
SBW CVS Phase 1	Scholes et al. (2002)	64	t, a	T_M (64); UT_L (62); Q (64), CCC (64); ρ (63), η(*T*) (62); Q PCT (63)
INEEL DZr Process Demonstration	Musick et al. (2000)	37	t for 28 glasses, a for 9 glasses	UT_L (9); Q (34), CCC (25); Q PCT (18)
INEEL DZr-CV Glasses	Riley, Rosario, and Hrma (2001)	24	t	Q (24), CCC (24); Q PCT (24), CCC PCT (24)
DP Glasses for INEEL HLW	Pittman et al. (2001)	27	t, a	Q (27), CCC (27); Q PCT (27), CCC PCT (27)
SBW Melter Glass Formulation	Vienna et al. (2002) (in preparation)	27	t, a (t only in 4 glasses)	η(*T*) (14); Q PCT (25), CCC PCT (25)
Hanford CVS 1 and 2	Hrma et al. (1994)	146	t, a (t only for roughly ½ of the glasses)	For 122 glasses of CVS1-1 ~ CVS2-101 except CVS2-53, 54: GT_L; CCC; ηVFT@A; η(1150°C); η(*T*); Q PCT; CCC PCT For 22 glasses of CVS2-102 ~ CVS2-123: Q PCT; CCC PCT
Hanford CVS 3	Vienna et al. (1996c)	40	t	UT_L (31); Q (16); CCC (38); ηVFT (32), ηA (39), η(*T*) (39); Q PCT (40); CCC PCT (40)
TWRS HLW Glass Formulation	Fu and Pegg (1998)	42	t, a (t only for 5 glasses)	T_M (42); UT_L (<, >, or ~ 950 or 1050°C) (42); Q (42); HT (42); η A (31), η(1150°C) (31), η(*T*) (32); Q PCT (34); TCLP (8)
RPP-WTP HLW Formulation	Kot and Pegg (2001)	179	t, a (t only in 30 glasses)	T_M (118); UT_L (142); Q (118), HT (115); ρ (20), η(*T*) (23); Q PCT (26); TCLP (140)
Kinetics of Spinel Crystallization	Reynolds and Hrma (1997)	1	t	T_M (1); UT_L (1);
TRU[(b)] Study	Crum et al. (1997)	44	t	UT_L (42)
SP[(c)]	Mika et al. (1997)	41	t	UT_L (41)

Table 2.1 (Contd)

Study	Reference	Number of Glasses	Comp[a]	Property (Number of glasses)
Zr Study	Vienna et al. (1999)	29	t	T_M (29); UT_L (29); Q PCT (28)
MS	Hrma (1999) and Wilson et al. (2001)	28	t	UT_L (28)
SG	Hrma et al. (1999)	63	t	T_M (63); UT_L (63)
SP3, SP×4, Misc.	Vienna et al. (2001a)	50	t	UT_L (50)
Comp. Vs Properties Study	Chick et al. (1981)	102	a	T_M (102); Q (77); CCC (44); η @ 1250°C (102)
SRL 165 Glasses	Pye (1985)	3	t	ρ (3); η(1150°C) (3)
ISV Glass	Carter, Koegler, and Bates (1988)	4	a	T(10 Pa·s) (4)
WV HLW Formulation Study	Chick et al. (1984)	103	t, a	Q (103); CCC (103); HT (103); T @ 10 Pa·s (88); T @ 3 Pa·s (96)
HWVP 85	Bates (1985)	1	t	η(T); ρ
WV Glasses by VSL and PNL	Johnston, Piepel, and Pulsipher (1990)[j]	128		Q PCT (128) – 98 glasses r_B only, 30 glasses r_B, r_{Li}, r_{Na} , r_{Si} and pH
WVDP[d] Support	Olson (1993) and (1994)	20	t, a	η(1150°C) (20), η(T) (20); Q PCT (20)
West Valley CVS Glasses PCT	Olson et al. (1994)	16	a	Q PCT (16)
Glass Dissolution Chemistry	Ramsey (1995)	30	t, a	Q PCT (30)
West Valley WQR[e]	WVNS (1995)	48	t	η(1150°C) (10), η(T) (10); Q PCT (48)
DWPF[f] PCT Model	Jantzen et al. (1995)	177	t, a	Q PCT (177)
Plutonium Vitrification	Bulkley and Vienna (1997)	45	t	T_M (41); ηA (40), η(1150°C) (36), η(T) (40); Q PCT (39)
SRS M-Area Mixed Waste Glass	Fu et al. (1997)	6	t, a	T_M (6); TCLP (6)
TWRS Envelope D HLW Glass	Crawford et al. (1998)	1	t, a	Q PCT (1)
Hanford LLW Glass Formulation	Feng et al. (1996)	79	t, a (t only in 49 glasses)	η(T) (51); Q PCT (78)

(j) J. W. Johnston, G. F. Piepel, and B. A. Pulsipher. 1990. "Evaluation of Empirical Models for Glass Durability," Letter Report Prepared for West Valley Nuclear Services, Pacific Northwest National Laboratory.

Table 2.1 (Contd)

Study	Reference	Number of Glasses	Comp[(a)]	Property (Number of glasses)
TWRS LAW Formulation[(g)]	Muller and Pegg (1998)	51	t, a	UT_L (46); ρ (4); η(T) (46); Q PCT @ 20°C (51); TCLP (4)
TWRS LAW Formulation 2[(g)]	Ferrara et al. (1998)	3	t, a	Q PCT @ 20°C (3); TCLP (3)
RPP-WTP LAW Formulation[(g)]	Muller, Buechele, and Pegg (2001)	107	t, a (t only in 42 glasses)	HT (72);); ρ (18), η(T) (62); Q PCT (66); TCLP (4)
HLP glasses[(g)]	Vienna et al. (2001b)	78	t, a	ρ (63); Q PCT (75)

(a) Compositions given in the database; t = target and a = analyzed.
(b) TRU = transuranic
(c) SP = spinel study
(d) WVDP = West Valley Demonstration Project
(e) WQR = Waste Form Qualification Report
(f) DWPF = Defense Waste Processing Facility
(g) LAW glasses
Other abbreviations: A and VFT = Arrhenius and Vogel-Fulcher-Tammann viscosity coefficients, respectively, CCC and Q = crystallinity of CCC and quenched glasses, respectively, CCC PCT and Q PCT = r_i (i = B, Na, Li) from CCC and glasses, respectively, GT_L and UT_L = T_L measured with gradient temperature and uniform temperature furnace methods, respectively, HT = heat-treated.

2.2.2 Glass Formulations for INEEL HLW Calcine and SBW

INEEL DZr Process Demonstration (Musick et al. 2000)

This report summarized the results of glass formulations that meet the applicable waste acceptance and processing requirements and pilot-scale melter tests to demonstrate vitrification feasibility for INEEL HLW calcines. The major focus of the glass-development efforts was to achieve a high solubility of calcium fluoride to maximize the waste loading. The T_L, crystallinity on quenched and CCC treated glasses, and PCT releases of quenched glasses were entered in the database.

INEEL DZr-CV Glasses (Riley, Rosario, and Hrma 2001)

This report collected and discussed existing data on the PCT releases of boron and sodium from glasses that precipitated crystalline phases upon CCC or isothermal heat treatment. The results of the glass-formulation study for INEEL Run 78 calcine, i.e., glasses designated as DZr-CV, were included in this report when the data became available to assess the effect of crystallization on PCT releases. An initial evaluation of the results was treated in a separate report (Crum et al. 2002), which did not include the detailed data on glass composition and crystallinity. The crystallinity and PCT of quenched and CCC treated glasses were entered in the database.

DP Glasses for INEEL HLW (Pittman et al. 2001)

The objective of this study was to investigate the specific property-composition relationships of glasses over a compositional envelope compatible with INEEL calcine compositions. An important element of this objective was to determine the influence of CCC on the promotion of crystallization and its ultimate impact on durability. This report presents the development of the glass-composition experimental region and the experimental results of specific glass properties as a function of composition. The crystallinity and PCT of quenched and CCC treated glasses were entered in the database.

SBW Melter Glass Formulation (Vienna et al. 2002)

This report summarizes the results of glass formulation and testing to develop glasses that can incorporate the maximum concentration of sulfate for the vitrification of sodium-bearing waste at INEEL. The η at T and PCT releases of quenched and CCC treated glasses were entered in the database.

2.2.3 Hanford CVS Investigations

This series includes the three stages of CVS performed within the Hanford Waste Vitrification Plant (HWVP) and PNNL Vitrification Technology Development (PVTD) programs in support of a future HLW vitrification plant at the Hanford site.

Hanford CVS 1 and 2 (Hrma et al. 1994)

The report presents two CVS data sets, CVS-1 and -2. These studies were performed at PNNL for the Hanford HLW program. Property-composition relationships were obtained for 146 glasses in five statistically designed experimental phases. The properties measured include η, ε, glass-transition temperature (T_g), thermal-expansion coefficients of solid glass and molten glass, crystallinity (quenched and CCC glasses), T_L, and durability based on normalized elemental releases from the Materials Characterization Center-1 28-day dissolution test (MCC-1) (quenched glasses) and the standard PCT (quenched and CCC glasses). Amorphous phase separation was also evaluated with TEM for selected

glasses. The statistical experimental design strategy used in the CVS involved defining a glass-composition region expected to contain glasses that might be made from NCAW and expected to be processed by the previously planned HWVP—scoping tests considering some additional waste types were also included—and then selecting specific compositions for study so as to appropriately cover this region. Ten glass components, SiO_2, B_2O_3, Na_2O, Li_2O, CaO, MgO, Fe_2O_3, Al_2O_3, ZrO_2, and Others, i.e., the remaining waste constituents, were systematically varied in the study. The individual component concentrations contained in the Others component were separated and entered in the database. The compositions in the database are the target mass-fraction values with analyzed compositions for roughly half of the glasses.

Hanford CVS 3 (Vienna et al. 1996c)

This data set, CVS-3, covers a different glass composition region than CVS-1 and -2 to allow for higher-temperature-melting glasses with higher waste loadings to be produced. The properties measured include the viscosity-temperature relationship, T_g, ε, T_L, CCC crystallinity, and PCT from quenched and CCC glasses. This study varied glass components one-at-a-time from a boron-free alkali-aluminosilicate baseline glass while maintaining constant ratios of all other components. The components varied were SiO_2, B_2O_3, Na_2O, Li_2O, Fe_2O_3, Al_2O_3, ZrO_2, Bi_2O_3, UO_2, P_2O_5, and Others. The compositions in the database are the target mass-fraction values.

2.2.4 HLW Glass Formulation for Hanford Wastes at the Vitreous State Laboratory

This series includes two studies on the glass-formulation development for Hanford HLW conducted at the Vitreous State Laboratory (VSL) of the Catholic University of America.

TWRS HLW Glass Formulation (Fu and Pegg 1998)

This report presented the results of glass-formulation development with Tank Waste Remediation System (TWRS) HLW simulants during TWRS Phase I, Part A. Glasses were formulated based on the HLW Envelope D composition specifications provided by the TWRS contract. After specific glass-formulation design parameters were identified, glasses were formulated on the basis of previous experience with the objective of meeting the constraints imposed on those parameters and characterized with respect to T_L, η, and PCT and TCLP releases. The T_M, T_L, η at T, PCT releases of quenched glasses and TCLP results were entered in the database. The T_L data were given as "greater or less than a reference temperature" without information on the primary phase.

RPP-WTP HLW Formulation (Kot and Pegg 2001)

This report presented the results from HLW glass formulation work that was conducted at the VSL during Part B1 of the RPP-WTP Project, formally known as TWRS-P, in support of the privatization contractor, British Nuclear Fuels, Inc. (BNFL, Inc.). This work was built on the results obtained during TWRS Part A (Fu and Pegg 1998), which was directed towards an assessment of the viability of the contractually specified waste envelope and product requirements and identification of the risks associated with complying with those specifications. Two approaches were adopted for glass formulation. In the first approach, glasses were formulated on the basis of existing knowledge and information, and in the second approach, a matrix of glass compositions was designed with a statistical method. Samples of these glasses were melted using simulants and characterized with respect to the properties of interest. The resulting set of glass compositions and properties data were the primary subject of this report. The T_M, T_L

(without primary phases), crystallinity of quenched and heat treated samples, η at *T*, PCT of quenched glasses, and TCLP results were entered in the database.

2.2.5 Liquidus Temperature Studies

These studies are specifically concentrated on the effect of glass compositions on the T_L of important crystalline phases, such as spinel and zirconium silicate, that can occur in the HLW glass melter during operation. The T_L models described in Section 3.4 are primarily based on the data from these studies.

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

This study investigated the kinetics of spinel crystallization under isothermal conditions from a molten high-iron simulated HLW glass designed to maximize the waste loading for a blend of Hanford site wastes. The T_M and T_L for this glass were recorded in the database.

Transuranic (TRU) Study (Crum et al. 1997)

This study of glasses was based on a simulated TRU waste with high concentrations of ZrO_2 and Bi_2O_3 to determine the composition dependence of primary crystalline phase and T_L. Starting from a baseline composition, glasses were formulated by changing one-at-a-time the mass fractions of Al_2O_3, B_2O_3, Bi_2O_3, CeO_2, Li_2O, Na_2O, P_2O_5, SiO_2, and ZrO_2, while keeping the remaining components in the same relative proportions as in the baseline glass. The T_L values are given along with the corresponding primary crystalline phases, which were mostly zircon ($ZrSiO_4$) with some baddeleyite (ZrO_2) and cerium oxide.

SP (Mika et al. 1997)

This study was performed to measure the T_L of melts in the spinel primary phase field as a function of glass composition. The test glasses were based on high-iron Hanford tank wastes. A test matrix was designed containing 33 glasses with 10 components: Al_2O_3, Cr_2O_3, Fe_2O_3, MgO, MnO, Na_2O, NiO, SiO_2, B_2O_3, and Li_2O and Others. The test matrix was derived from the baseline glass containing 47 mass% water-washed Hanford nominal waste blend. The baseline composition was altered, one-component-at-a-time, while maintaining the same relative proportions of the remaining components. All glasses tested had spinel as the primary phase.

Zr Study (Vienna et al. 1999)

The objective of this study was to develop preliminary glass formulations for the HAW fraction of INEEL zirconia calcine and then to recommend a waste loading and frit composition for use in an INEEL scaled melter test. This study focused on the development of glass compositions with a high concentration of ZrO_2 because the estimated waste composition contained 92.58 wt% ZrO_2. In 29 glass compositions tested, the concentrations of ZrO_2, Al_2O_3, B_2O_3, and Li_2O were varied independently, and then the concentrations of SiO_2 and Na_2O were adjusted to maintain a calculated viscosity of 6 Pa·s at 1150°C. The PCT releases and T_L values with the corresponding primary crystalline phases are given. The primary phases identified in this study were mostly zircon ($ZrSiO_4$), baddeleyite (ZrO_2), and parakeldyshite ($Na_2ZrSi_2O_7$).

Melter Settling (MS) (Hrma 1999; Wilson et al. 2001)

The goal of the study by Hrma (1999) was to develop a basic understanding of the dynamics of spinel formation and motion in velocity, temperature, and redox fields that are characteristic for the glass-

melting process. Nine glasses with different compositions, MS-1 to MS-9, were formulated and measured for T_L. In a subsequent study (Wilson et al. 2001), the glasses were formulated by increasing or decreasing concentrations of Al_2O_3, Cr_2O_3, Fe_2O_3, Li_2O, MgO, Na_2O, or NiO, one-at-a-time, from a baseline composition (MS-7). The T_L data from this study were also included in this data set.

Savannah River Glass (SG) (Hrma et al. 1999)

A T_L versus composition study was performed for the DWPF. The main objective of the study was to decrease the uncertainty in T_L model predictions of glasses produced at SRS by developing a database for glass-composition effects on T_L. A series of 53 glass compositions was statistically designed to cover the DWPF composition region by means of a layered design approach (Edwards 1997). The test matrix contained glass compositions within and just outside the DWPF composition region. The components that varied in mass fractions in parentheses were SiO_2 (0.43 to 0.59), B_2O_3 (0.05 to 0.10), Na_2O (0.06 to 0.11), Li_2O (0.03 to 0.06), Fe_2O_3 (0.06 to .015), Al_2O_3 (0.025 to 0.08), CaO (0.003 to 0.02), MgO (0.005 to0.025), K_2O (0.015 to 0.038), U_3O_8 (0 to 0.055), MnO (0.01 to 0.03), NiO (0.001 to 0.02), TiO_2 (0.002 to 0.006), and Cr_2O_3 (0.001 to 0.003). The properties measured and reported included T_L with primary phases. Spinel was the primary phase for most of glasses while some glasses had a clinopyroxene primary phase. The compositions of the glasses were confirmed by chemical analyses after the report was issued. Those analyzed compositions, although not currently included in the database, did not show any significant deviation from target values.

SP-3, SP×4, Misc. (Vienna et al. 2001a)

This study compiled all the glasses in the spinel primary phase field, including MS, SG, and SP studies previously described, to develop a new model that can accurately predict the T_L of spinel. This reference includes the results of further studies on the spinel crystallization, designated as SP-3 and SP×4. The SP-3 study expanded the SP series by five components, CaO, K_2O, RuO_2, TiO_2, and ZrO_2, and the range of variation for SiO_2, Li_2O, and Fe_2O_3 was increased. Another study was also performed to determine T_L in the spinel primary crystalline phase field. This study, designated as SP×4, was based on the original baseline glass SP-1 but varied four components-at-a-time while maintaining the concentrations of all other components in constant relative proportions. The four components varied were Al_2O_3, Cr_2O_3, Na_2O, and NiO, which were found to have the strongest impact on the T_L of those that were varied in the original study. A number of glasses that had been fabricated for different purposes or studies were grouped into the "Misc." study and were used in T_L model validation.

2.2.6 Other Property-Composition Relation Studies

Composition vs. Properties Study (Chick et al. 1981)

The purpose of this study was to evaluate and refine the statistical methods used to produce the empirical property models. Ninety simplified waste-glass compositions—102 glasses including replicates—within an 11-component oxide composition matrix were tested for crystallinity, η, and MCC-1 releases. The η at 1250°C data and the results of crystallinity observations on quenched and CCC treated glasses were entered in the database.

WV HLW Formulation Study (Chick et al. 1984)

This report describes the statistically designed study performed at PNNL to develop the glass composition recommended for the vitrification of HLW stored at West Valley, New York. This study assessed the effects of seven oxide components: SiO_2, B_2O_3, CaO, Fe_2O_3, Al_2O_3, Na_2O, and waste mix on

glass properties. Over 100 melts combining the seven components into a wide variety of compositions were tested for η, ε, thermal expansion, crystallinity, and MCC-1 releases. The estimated temperatures at 10 Pa·s and 3 Pa·s and the results of crystallinity observation on quenched, CCC treated, and heat-treated glasses were recorded in the database.

HWVP 85 (Bates 1985)

This report describes the result of development of a reference-glass composition for the HWVP. The reference-glass composition developed from this study was designated HW39 and characterized for melt η, ε, and density.

SRL 165 Glasses (Pye 1985)

This report presented the results of the measurements of various physical and thermal properties of simulated nuclear waste glasses and their melts. Three SRL 165 glasses, designated as high iron, TDS, and high alumina, were provided by the Savannah River Laboratory. The properties measured included thermal diffusivity, thermal expansion, Young's modulus, shear modulus, modulus of rupture, Poisson's ratio, density, and viscosity. Density and viscosity at 1150°C were entered in the database.

ISV Glass (Carter, Koegler, and Bates 1988)

This report summarized the results of laboratory and pilot-scale tests of the *in situ* vitrification (ISV) process developed at PNNL that used actual Oak Ridge National Laboratory soil and limestone. The *T* data at 10 Pa·s for vitrified ISV products were recorded in the database.

WV Glasses by VSL and PNL (Johnston, Piepel, and Pulsipher 1990)[(k)]

This report describes the development of a database of PCT leach test results. The compositional and leach data pertinent to West Valley waste forms from the VSL at the Catholic University of America (CUA) and PNNL were gathered to compare the free-energy-of-hydration model with several empirical models that predict boron releases from chemical composition. The data from PNNL were included in another data set (Reimus et al. 1988) and so were excluded in this data set. The VSL PCT data, which were entered in the database, were those transferred to PNNL via diskettes at the time of this study.

West Valley Demonstration Project (WVDP) Support (Olson 1993 and 1994)

These data are from two studies conducted as part of glass-composition variability testing under the PNNL West Valley Support Program to support the establishment of a glass-composition control strategy by West Valley Nuclear Services (WVNS). The results of PCT releases for 20 glasses (PNL series, Alkali series) were reported in Olson (1993) while the results of viscosity measurement for the same 20 glasses and 10 more glasses of the Ratio series are reported in Olson (1994). The PCT releases and η at *T* data from this data set were entered in the database. The viscosity data for 10 glasses of the Ratio series were entered as part of another data set, "West Valley WQR" (WVNS 1995), which contained also the PCT data along with other West Valley waste-form qualification glasses.

West Valley CVS Glasses PCT (Olson et al. 1994)

To assist WVDP, the PCT method was used to evaluate 44 West Valley glasses. These glasses were fabricated as sets of CVS glasses for studies performed by the West Valley Support Task (WVST) at

(k) The Johnston et al. 1990 report is the only (incomplete) source available to us for this particular VSL data set.

PNNL and were initially tested with a modified MCC-3 test method. The glasses were retested with the PCT method after WAPS included the PCT in an acceptance specification.

Glass Dissolution Chemistry (Ramsey 1995)

This data set includes glasses from a statistically designed study of the following 6-component glass-composition region, which was intended to include alkali borosilicate glasses that successfully encapsulate the high-level defense wastes, SiO_2, Al_2O_3, B_2O_3, Fe_2O_3, CaO, and Na_2O. The analyzed compositions in the database contain the concentrations of iron oxides in both FeO and Fe_2O_3, which were calculated from the result of glass redox analysis. PCT releases in elemental leachate concentrations given in the reference were converted to normalized releases and entered in the database. Oksoy et al. (1994) used this data set to perform a study on the canonical correlation of glass compositions and PCT releases.

West Valley WQR (WVNS 1995)

WVNS developed a data set consisting of 58 glass compositions. These data were used to develop PCT release models for use in WVDP, a high-level nuclear waste glass facility. The 58 glasses were selected to evenly cover a glass-composition region centered on the WVDP target glass composition with the boundary taken to be three times the expected process variation. Only nine components known to influence PCT releases were varied in these glasses, and the composition data were provided based on these nine components. The full composition data entered in the database were those found in Piepel, Redgate, and Masuga (1996). Out of 58 glasses given in this report, 10 glasses of the alkali series (Alkali1 to Ref6Qtr2) were already included in data set of "WVDP Support" (Olson 1993 and 1994) and were not included in this data set. The viscosity data for 10 glasses of the Ratio series (Ratio2 to PNL190) were from Olson (1994).

DWPF PCT Model (Jantzen et al. 1995)

This study was conducted to develop the Thermodynamic Hydration Energy Reaction Model (THERMO) to predict glass PCT releases from a glass composition based on the estimated glass-hydration free energy. The THERMO is being used in DWPF to assess product consistency and quality. The result of this study was registered as a U.S. patent (Jantzen et al. 1998). The glasses examined in this study were fabricated under a variety of laboratory and pilot-scale conditions by various researchers and vendors. The target compositions and PCT data entered in the database were those supplied by the Savannah River Technology Center (SRTC) to PNNL in electronic data form. The analyzed compositions are from the SRTC report (Jantzen et al. 1995). PCT releases were converted to g/m^2 from g/L reported.

Plutonium Vitrification (Bulkley and Vienna 1997)

The objective of this study was to examine how variations in the waste-stream compositions would affect the key properties of glasses for immobilization of plutonium-bearing materials at Rocky Flats Environmental Technology Site (RFETS), Hanford, and other DOE sites. A one-component-at-a-time change matrix was designed, keeping the remaining components in the same relative proportions as in a baseline composition. The glasses were tested for viscosity and PCT releases. The published reference (Bulkley and Vienna 1997) contains only a part of the data, the temperature at 5 Pa·s, and PCT releases for B and Na, whereas the database contains all the data obtained during this study, including viscosity-at-temperature, Arrhenius coefficients for viscosity, PCT releases for Li and Si, and final pH from PCT.

The database also contains nine more glasses with different or replicate compositions that were not included in the reference.

Savannah River Site (SRS) M-Area Mixed Waste Glass (Fu et al. 1997)

This study was a third phase of glass-formulation studies to determine the feasibility of vitrifying Savannah River M-Area mixed wastes. This study reported the effect of varying the boron-to-total-alkali ratio and the effect of substitutions such as ZrO_2 for waste and TiO_2 for SiO_2 on the chemical durability and processability of M-Area waste glasses. The requirement for safe disposal of this waste stream is to pass the TCLP. The T_M and TCLP results were recorded in the database. The glass compositions given in mole% were converted to mass fraction for inclusion in the database.

TWRS Envelope D HLW Glass (Crawford et al. 1998)

This study was a radioactive demonstration of production and characterization of HLW glass, performed at SRTC, using the actual Hanford radioactive waste that consisted of HLW sludge slurry (Envelope D), elute waste streams containing high levels of ^{137}Cs and ^{99}Tc, and solids containing ^{90}Sr and TRU. The PCT of one quenched radioactive glass was recorded in the database.

2.2.7 LAW Glass Formulation Studies

Hanford LLW Glass Formulation (Feng et al. 1996)

This report presented the results of the glass formulation work for Hanford low-level waste to develop optimized compositions containing the maximum fraction of waste, acceptable processing characteristics, and adequate flexibility to handle waste variations. In addition, this report included an evaluation of the impacts of minor components, characterization of melter vendor glasses, and the determination of T_L and crystallization kinetics. This report also summarized relevant work on high-iron glasses for Hanford tank wastes conducted through the Mixed Waste Integrated Program and work at SRTC to optimize glass formulations with a Plackett-Burnam experimental design. The η at T and PCT releases of quenched glasses were entered in the database.

TWRS LAW Formulation (Muller and Pegg 1998)

This report presented the results of glass-formulation development with TWRS LAW simulants during TWRS Phase I, Part A. Glasses were formulated based on the LAW Envelope A, B, and C composition specifications provided by the TWRS contract. After specific glass-formulation design parameters were identified, glasses were formulated on the basis of previous experience with the objective of meeting the constraints imposed on those parameters and characterized with respect to T_L, η, ε, and PCT releases. It should be noted that PCT releases were measured at 20°C instead of the standard 90°C used in HLW glasses. The T_L, η at T, ρ, 20°C PCT releases of quenched glasses, and TCLP results were entered in the database. The T_L data were given as "greater or less than a reference temperature" without information on the primary phase.

TWRS LAW Formulation 2 (Ferrara et al. 1998)

This study characterized three LAW glasses produced from Hanford radioactive waste samples as part of a demonstration for BNFL. The three LAW glasses were produced from radioactive supernate samples that had been treated to remove most of the radionuclides. The TCLP results and PCT releases of quenched glasses are recorded in the database.

RPP-WTP LAW Formulation (Muller, Buechele, and Pegg 2001)

This report presented the results from LAW glass formulation development and testing activities performed at the VSL in support of Part B1 of the RPP-WTP privatization project led by BNFL, Inc. The selection of new glass formulation was guided by extensive past experience and the glass-property models and database developed and continuously updated at VSL. The development of glass formulations was an iterative process in that prospective glasses were formulated and characterized to obtain property-composition information. The results were then analyzed, and revised compositions were generated to optimize the properties of the glass to the imposed constraints. Therefore, the formulations were referred to as "actively designed" rather than "statistically designed." The resulting set of glass-composition-property data was summarized in this report. The crystallinity of heat-treated glasses, ρ, η at T, PCT of quenched glasses, and TCLP results were entered in the database.

HLP Glasses (Vienna et al. 2001b)

This report provided the results of a study to help determine the composition range of LAW glasses that will meet performance expectations of the Hanford site burial facility. This study was a continuation of the Hanford Immobilized Low Activity Waste Product Acceptance: Tanks Focus Area Testing Data Package II (Schulz et al. 2000). An original matrix of 55 glasses (Phase I, HLP-01 through -55) was developed to identify the impact of glass composition on long-term corrosion behavior and to develop an acceptable composition region for Hanford LAW glasses. A second matrix consisting of 20 glasses (Phase II, HLP-58 through -77) was developed to help determine the influence on the test responses of key glass components that were not varied systematically in Phase I. The ρ and PCT of quenched glasses were entered in the database.

3.0 Models for Viscosity

This section discusses the interim viscosity-composition models developed for Hanford HLW and LAW glasses and the portions of the database, discussed in Section 2.0, used to develop the models.

3.1 Initial Data Evaluation and Screening

The initial database available for developing the property-composition models (see Section 2.0) contained data from 2001 glass compositions expressed in terms of 71 components. Those glasses with viscosity (η)-temperature (T) data were selected for initial model development. A total of 623 glasses had at least 2 η-T data points. These 623 glasses were taken as the starting data set. For those glasses with both target and analyzed compositions, the compositions were compared. Any glass with more than 20% difference in target and analyzed concentrations of more than one major component, i.e., a component with more than 1 mass% in glass, were excluded from model fit. This removed 110 glass compositions, listed in Table 3.1. Of the remaining 513 glasses, 10 were reported with only analyzed compositions (no target composition was available), and one glass had a target composition that summed to less than 99% (LAWB42S); these 11 compositions (see Table 3-1) were removed from the data set, and target compositions were exclusively used in model development. Of the remaining 502 glasses, 55 were reported in their source documentation to be phase separated, either crystalline or amorphous, and were removed (also listed in Table 3-1). Of the 447 remaining glasses, 79 were found to be extreme in either η at 1150°C ($1 < \eta > 100$ Pa·s) and marked either $\eta < 1$ or $\eta > 100$ in Table 3-1; or extreme concentrations of single components were marked with either "value < component" or "value > component," where the values are in mass% of the oxide in glass. These restrictions were added to remove the influence of extreme compositions and/or property values on the property model. The component ranges for the remaining data can be used as an initial assessment of the model-validity region. Two additional glasses were removed (not in Table 3-1) because of large data scatter in the η-T relationship—CVS1-18 and CVS3-13. This left a total of 366 glasses for use in η-composition modeling. Some of these data were removed as outliers during the model fitting as described in the following sections.

Table 3-1. List of Glasses Excluded from Viscosity Model Development

Glasses excluded because of differences in target and analyzed composition							
LAWB18	CVS2-7	CVS2-38	LAWA16	LAWC4	LAWB34	LAWA19	HLWD1-01
IG2-04	CVS2-19	CVS2-39	LAWA17	LAWC5	LDM-2	LAWPC2	HLWD1-04
IG2-15	CVS2-20	CVS2-40	LAWA20	LAWPC7	LDM-3	LAWC3	HLWD1-14
IG2-23	CVS2-21	CVS2-41	LAWA21	LAWPC8	LDM-4	IG3-06	HLW98-03
IG2-26	CVS2-22	CVS2-43	LAWA24	LAWPC9	LDM-5412	IG3-10b	IG3-05
IG2-37	CVS2-25	CVS2-44	LAWB12	LAWPC10	LDMS-1	LAWA25H	IG1-08
IG3-08b	CVS2-28	CVS2-46	LAWB13	HLWD1-03	LRM-4	LAWA26H	IG2-10
IG3-15	CVS2-29	CVS2-49	LAWB14	HLWD3-01	LRMS-1	IG2-36	IG3-13
IG3-16	CVS2-30	CVS2-50	LAWB15	HLWD2-02	SSHTM-3	IG3-01	HLWD1-13
IG3-19	CVS2-31	CVS2-51	LAWB17	HLWD2-03	SBW1-42	IG3-20	HLWD1-17
IG3-26	CVS2-32	CVS2-58	LAWB20	HLW98-14	SBW1-43	LAWA15	IG3-09
IG3-29	CVS2-35	CVS2-97	LAWB28	HLW98-44	HLWD1-19	LAWC11 for AN107	CVS2-69
CVS1-15	CVS2-36	Alkali4	LAWB29	HLW98-61	HLWD2-04	LAWC12 for AN107	
CVS1-23	CVS2-37	Alkali9	LAWC2	LAWA98S	CVS2-52	LAWB16	
Glasses excluded because target glass compositions weren't available (or in the case of LAWB42S, were incomplete)							
Ratio2	Ratio5	LoTh4	HiFe2	HiFe4	LAWB42S		
Ratio4	LoTh2	LoTh5	HiFe3	PNL190			
Glasses excluded because they were reported as phase separated							
CVS3-16	CVS3-5	HLWD1-07	IG1-01	IG1-23	IG1-32	IG2-01	IG2-22
CVS3-17	HLW98-06	HLWD1-11	IG1-02	IG1-24	IG1-34	IG2-05	IG2-27
CVS3-20	HLW98-07	HLWD1-21	IG1-09	IG1-25	IG1-36	IG2-06	IG2-34
CVS3-38	HLW98-08	HLWD1-23	IG1-14	IG1-26	IG1-40	IG2-07	IG3-03
CVS3-39	HLW98-12	HLWD1-27	IG1-17	IG1-27	IG1-41	IG2-09	IG3-04
CVS3-4	HLW98-21	HLWD2-05	IG1-19	IG1-28	IG1-42	IG2-17	IG3-07
CVS3-40	HLWD1-05	HLWD3-04	IG1-21	IG1-31	IG1-44	IG2-18	
Glasses excluded because they were extreme in composition or viscosity at 1150°C							
Extreme	**Glass ID**	**Extreme**	**Glass ID**	**Extreme**	**Glass ID**	**Extreme**	**Glass ID**
>1Y_2O_3	LAWA47	>2TiO_2	LAWA42	η<1	CVS1-11	<25SiO_2	HLWD1-18
>1Y_2O_3	LAWPC3	>2TiO_2	LAWA82	η<1	CVS1-12	<4.5Na_2O	HLWD1-10
>25Na_2O	L7-30	>2TiO_2	LAWA89	η<1	CVS2-81	<4.5Na_2O	SRC-Na-1
>25Na_2O	L7-35	>2TiO_2	LAWABP1	η<1	CVS2-83	<4.5Na_2O, >10MnO, >20SrO, η<1	HLWMS-08
>2CdO	HLWD1-09	>2TiO_2	SRC-Ti-2	η<1	CVS2-92	<4.5Na_2O, >10MnO, >20SrO, η<1	HLWMS-11
>2CdO	HLWD3-03	>3Bi_2O_3	CVS3-28	η<1	CVS2-93	<4.5Na_2O, >20SrO	HLWMS-15
>2CdO, η<1	HLW99-15	>3Bi_2O_3	CVS3-29	η<1	CVS2-94	<4.5Na_2O, >2CdO	HLWD1-08
>2CdO, η<1	HLWD3-06	>3Bi_2O_3	CVS3-30	η<1	PNL 1	>10U_3O_8	CVS3-35
>2F	IG2-29	>3Bi_2O_3	CVS3-31	η<1	PNL 3	>10U_3O_8	CVS3-36
>2F	IG2-32	>4P_2O_5	IG1-35	η>100	CVS3-12	>1CoO	LAWA18
>2F	IG2-33	>4P_2O_5	LAWA84	η>100	CVS3-2	>1Cr_2O_3	CVS2-66
>2F	IG2-35	>4P_2O_5	LAWA96	η>100	CVS3-9	>1Cr_2O_3	CVS2-68
>2F	IG3-14	>5Ce_2O_3	SRC-Ce-3	η>100	IG2-14	>1Cr_2O_3	CVS2-70
>2F	IG3-23	>5Ce_2O_3	SRC-Ce-4	η>100	L4-615	>1Cr_2O_3	HW39
>2F	IG3-24	>5F	IG2-12	η>100	L6-3312	>1CuO, >1Y_2O_3	LAWPC5
>2F	IG3-25	>5Gd_2O_3	SRC-Gd-3	η>100	L7-15	>1Eu_2O_3	SRC-Eu-1
>2F	IG3-27	>5Gd_2O_3	SRC-Gd-4	η>100	L8-1	>1Ga_2O_3	LAWA46
>2F	IG3-28	>5SrO	HLW98-23	η>100	L8-2	>1SnO_2	SRC-Sn-1
>2PbO	SRC-Pb-2	>5SrO	HLW98-34	η>100	L8-3	>1SnO_2	SRC-Sn-2
>2PbO	SRC-Pb-3	>5SrO	LAWA64	η>100	LRM-3		

3.2 Composition Conversion

The glass compositions used in viscosity modeling are listed in Appendix A on a targeted mass fractions (g_i) of oxides and halogens basis. These compositions were converted into mole fractions (x_i) of oxides and halogens by standard methods. Several components were listed in the database with multiple oxidation states.[l] These components were combined into groups of like metal oxides according to:[m]

$$\begin{aligned}
Ce_2O_x &= Ce_2O_3 + 0.5\ CeO_2 \\
CoO_x &= CoO + 2\ Co_2O_3 \\
Fe_2O_x &= Fe_2O_3 + 0.5\ FeO \\
MnO_x &= MnO + MnO_2 \\
MoO_x &= MoO_3 + MoO \\
PdO_x &= PdO + PdO_2 \\
Pr_2O_x &= Pr_2O_3 + 3\ Pr_6O_{11} \\
ReO_x &= ReO_2 + 2\ Re_2O_7 + ReO \\
Rh_2O_x &= Rh_2O_3 + 0.5\ RhO_2 \\
Sb_2O_x &= Sb_2O_3 + Sb_2O_5 \\
SnO_x &= SnO_2 + SnO \\
Tl_2O_x &= Tl_2O_3 + Tl_2O \\
UO_x &= UO_3 + UO_2 + 3\ U_3O_8
\end{aligned}$$

When only one oxide form had at least one glass with non-zero concentration, this oxide form was used instead of the combined form, e.g., MnO was used instead of MnO_x if no glass had MnO_2. The resultant compositions were then normalized to 1. In addition, the lanthanide oxides and Y_2O_3 were combined to form a single component, LN_2O_3, given by

$$LN_2O_3 = Ce_2O_3 + Eu_2O_3 + Gd_2O_3 + La_2O_3 + Nd_2O_3 + Pr_2O_3 + Sm_2O_3 + Y_2O_3.$$

This combined component was formed because the separate components had insufficient concentrations and insufficient variations in most glasses to justify fitting separate coefficients for them. However, combined they had sufficient concentration and showed sufficient variation to support a combined coefficient. Generally, their effects on glass properties are similar and vary only with ionic radius; this variation with radius was not accounted for in this study.

After forming the combined components, the 366 glass compositions were expressed as normalized mole fractions of 49 components. The mole-fraction ranges of these 49 components are listed in Table 3-2. Those components with concentrations greater than 1.5 mole% in at least one glass were considered

(l) It is assumed that all glasses were equilibrated with air during melting or heat-treatment, and thus the proportions of valence states of multivalent oxides are uniquely determined for each glass by the temperature at which the glass has been equilibrated with the partial pressure of oxygen of 2.13×10^4 Pa. However, this proportion is rarely determined experimentally. The oxides are listed in databases as a certain nominal valency that may (Fe_2O_3) or may not (MnO_2) represent the dominant valence state of that oxide in glass

(m) These equations should not be interpreted as balanced equations, only actual steps performed to reduce the number of waste composition variables. Following these steps, the composition is renormalized.

as possible model components—leaving the 23 components between SiO_2 and ThO_2 in Table 3-2. This left a minimum sum of included components of 97.7 mole% for all glasses.

Table 3-2. Mole Fraction Range for Components in Viscosity Model Data Glasses

Component	Min	Max	Comp	Min	Max	Comp	Min	Max
SiO_2	0.3596	0.6589	V_2O_5	0.0000	0.0213	SeO_2	0.0000	0.0012
Na_2O	0.0484	0.2700	NiO	0.0000	0.0195	TeO_2	0.0000	0.0009
B_2O_3	0.0000	0.1953	P_2O_5	0.0000	0.0179	I	0.0000	0.0008
Li_2O	0.0000	0.1821	TiO_2	0.0000	0.0174	Ag_2O	0.0000	0.0007
CaO	0.0000	0.1445	Cl	0.0000	0.0168	Sb_2O_x	0.0000	0.0007
MgO	0.0000	0.1343	ThO_2	0.0000	0.0154	As_2O_5	0.0000	0.0007
Al_2O_3	0.0000	0.1326	SO_3	0.0000	0.0124	Br	0.0000	0.0006
Fe_2O_x	0.0000	0.1040	CdO	0.0000	0.0090	WO_3	0.0000	0.0006
ZrO_2	0.0000	0.0802	MoO_x	0.0000	0.0061	Tl_2O_x	0.0000	0.0005
K_2O	0.0000	0.0750	Cr_2O_3	0.0000	0.0038	PdO	0.0000	0.0005
F	0.0000	0.0414	PbO_x	0.0000	0.0034	SnO_x	0.0000	0.0004
MnO_x	0.0000	0.0343	Bi_2O_3	0.0000	0.0031	Rb_2O	0.0000	0.0003
ZnO	0.0000	0.0326	Cs_2O	0.0000	0.0027	ReO_x	0.0000	0.0003
SrO	0.0000	0.0293	CuO	0.0000	0.0023	Rh_2O_x	0.0000	0.0002
LN_2O_3	0.0000	0.0245	Ga_2O_3	0.0000	0.0019	Nb_2O_5	0.0000	0.0001
UO_x	0.0000	0.0237	CoO_x	0.0000	0.0019			
BaO	0.0000	0.0213	RuO_2	0.0000	0.0014			

3.3 Model for Logarithm Viscosity at 1150°C

3.3.1 Initial Model Fitting

The natural logarithm of viscosity at 1150°C was modeled as a linear combination of composition according to:

$$\ln[\eta_{1150}(Pa \cdot s)] = \sum_{i=1}^{N} h_i x_i \qquad (3.1)$$

where h_i and x_i are the i^{th} component coefficient and mole fraction in glass, respectively, and N is the number of components in the glass—initially 24, including 23 components listed above plus Others. Two glasses, CVS2-79 and CVS2-80, were found to have residuals > 1 in $\ln[\eta_{1150}(Pa \cdot s)]$ and were removed from the fit (Figure 3-1).[(n)] The resulting model is summarized in Table 3-3 along with R^2 and s

(n) Although it is preferable to determine whether glasses are "well-predicted" by a model using standardized residuals (residual/standard deviation), it is easier to use residuals, and for the purposes of this modeling effort, it was deemed the appropriate level of effort. However, final models developed for plant operation or waste-form qualification should use the full, more rigorous methods.

statistics.[o] Five of the components, Cl, NiO, Others, ZnO, and UO_x, had coefficients close to response values (the range of coefficient ± one standard error overlapped with the range of responses). An additional two components, SrO and ThO_2, had coefficients, slightly further from the response values (the range of coefficient ± two standard errors overlapped the property response range).[p] The effects of these components on $\ln[\eta_{1150}]$ are less significant than other components. Models were fitted to these two subsets of components; the 24 original components minus Cl, NiO, ZnO, and UO_x to make a 20-component model and the 20 components minus SrO and ThO_2 to make an 18-component model.[q] In these latter two models, only Others was found to have a coefficient within one standard error of the range of property responses, and SrO, ThO_2, TiO_2, and MgO were found to have coefficients within two standard errors of the range of property responses. Table 3-4 summarizes these two models. Further reduction in components, e.g., the removal of TiO_2 and MgO, was not deemed necessary for the purpose of this modeling effort. These models, as stated in the Introduction, are aimed at supplying reasonable estimates of viscosity over the relatively broad range of Hanford waste-glass composition regions.

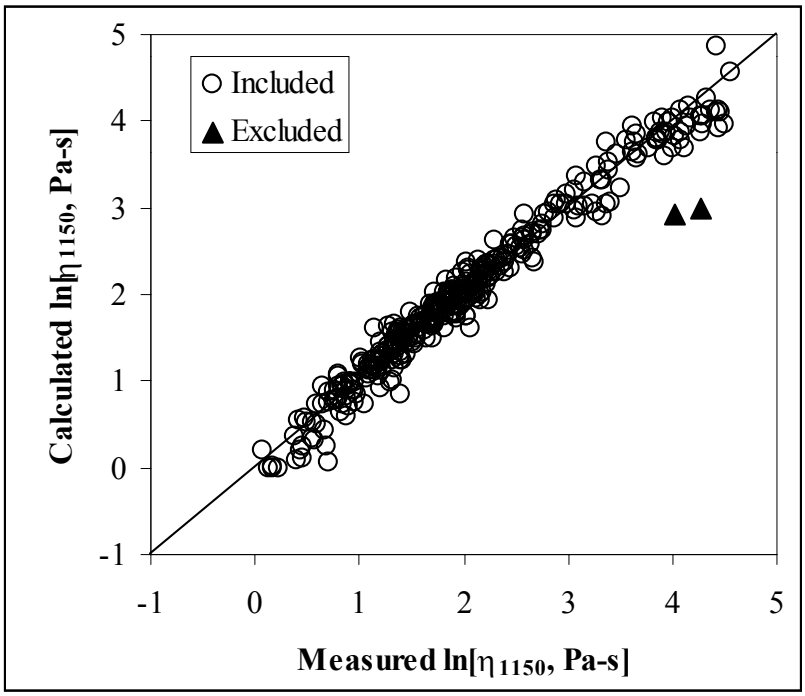

Figure 3-1. Comparison of Predicted and Measured $\ln[\eta_{1150}(Pa{\cdot}s)]$ by the Initial Model with Two Data Points (shown as solid triangles) Removed

(o) The R^2 statistic is a measure of the fraction of the variation in response accounted for by the model and s (or root mean square error) is a measure of the prediction uncertainty and is compared to measurement uncertainty (standard deviation, σ). Other methods are required to determine if there is a "statistical lack of fit".

(p) For detailed discussion of the rigorous methods used to reduce terms in a statistical model see Piepel and Redgate (1997). The less rigorous methods described here were deemed sufficient for the purposes of this effort.

(q) In all modeling efforts, the component Others is redefined to include the concentrations of all components other than those with coefficients.

Table 3-3. Summary of Initial Model for $\ln[\eta_{1150}]$

Component	h_i	std. err.	Statisitic	Value
Al_2O_3	19.832652	0.43823	R^2	0.9710
B_2O_3	-9.447488	0.254518	R^2_{adi}	0.9690
CaO	-5.212173	0.31748	R^2_{pred}	0.9654
Fe_2O_x	-3.598369	0.629876	s	0.176
K_2O	-8.77593	0.815398	Min	0.08
Li_2O	-16.28959	0.255676	Mean	2.01
MgO	-1.304641	0.418957	Max	4.55
Na_2O	-10.6205	0.252595	N	364
P_2O_5	14.779068	3.128487		
SiO_2	9.0365457	0.099332		
ZrO_2	13.266995	0.713292		
LN_2O_3	-15.78739	3.400612		
BaO	-7.564176	3.022988		
Cl	5.7657005	3.94834		
F	-9.069534	1.491206		
MnO	-7.457774	2.878181		
NiO	9.0815729	5.315329		
SrO	-4.150929	2.706841		
ThO_2	13.632387	5.527846		
TiO_2	-7.075945	3.26553		
UO_x	-1.625638	5.771282		
V_2O_5	-8.70675	3.211984		
ZnO	-0.614569	1.425769		
Others	-0.39505	3.1501		

Table 3-4. Summary of $\ln[\eta_{1150}]$ Models

Comp.	20 comp. h_i	20 comp. std. error	18 comp. h_i	18 comp. std. Error	Statisitic	Value
Al_2O_3	19.7913912	1.089093	19.7257004	1.045584	*20 component*	
B_2O_3	-9.5197338	1.027234	-9.5341696	0.981596	R^2	0.9707
CaO	-5.2862988	1.096003	-5.4241256	1.056964	R^2_{adj}	0.9691
Fe_2O_3	-3.4331938	1.266525	-3.3040116	1.239384	R^2_{pred}	0.9661
K_2O	-8.6783098	1.180412	-7.9009786	1.082242	s	0.175
Li_2O	-16.2455438	1.036035	-16.2528056	0.990857		
MgO	-1.3932898	1.157175	-1.3225766	1.093959	*18 component*	
Na_2O	-10.5253238	1.037976	-10.6596156	0.993271	R^2	0.9700
P_2O_5	14.7468362	3.361107	16.3538324	3.310263	R^2_{adj}	0.9685
SiO_2	9.0280829	0.995036	9.0741542	0.923224	R^2_{pred}	0.9658
ZrO_2	13.2464352	1.267737	12.9501184	1.233309	s	0.177
LN_2O_3	-11.5263138	2.272914	-12.1995456	2.240728		
BaO	-8.5073418	2.95368	-9.5766916	2.862491	*Data*	
F	-7.9212428	1.895651	-8.2422436	1.788564	min	0.08
MnO	-7.5777358	2.974306	-6.4337356	2.880346	mean	2.01
SrO	-4.6401028	2.849546			max	4.55
ThO_2	13.4430212	5.407617			n	364
TiO_2	-6.5164958	3.621772	-4.5216196	3.461289		
V_2O_5	-9.0378278	3.361092	-8.9763446	3.325748		
Others	0.5019462	0.994674	0.0253444	0.934159		

3.3.2 Model Evaluation and Selection

The value of a model is in its capability to predict the properties of glasses not used in model development. As all of the prescreened data were used in model development, we must rely on other bases to validate the models. One option is a leave-one-out crossvalidation method, wherein model predictions are made for each data point without using that point to fit the model. Special formulas implemented in software perform the calculations without actually having to refit the model leaving each data point out. The R^2_{pred} shown in Tables 3.3 and 3.4 summarize the leave-one-out crossvalidation performance of the models. The R^2_{pred} values of 0.965, 0.966, and 0.966 for the 24, 20, and 18 component models, respectively, are not much smaller than the R^2 or R^2_{adj} values for those models. Hence, the models have good crossvalidation performance.

Another option for model validation is to use the data that were removed during the screening process. However, model predictions for many of these points will be extrapolations beyond the region of validity for the models, which should be kept in mind when assessing the results. The 250 screened-out data points with η_{1150} values reported were used to validate the models. Figure 3-2 shows a comparison of the measured and predicted $\ln[\eta_{1150}]$ values from the validation data set, using each of the three models labeled 24, 20, and 18 for the number of components in each model. The resulting validation R^2 (R^2_{val}) values were 0.858, 0.866, and 0.860 for the 24, 20, and 18 component models, respectively. As can be seen in Figure 3-2, there are two data points with higher residuals by all three models than any other points—IG2-07 (near 4.5 measured and 1.5 predicted) and HLWD1-19 (near -1.1 measured and -2.9 predicted). If these two points (circled in Figure 3-2) are removed, the resulting R^2_{val} values were 0.887, 0.893, and 0.886 for the 24, 20, and 18 component models, respectively.

Figure 3.2 indicates a tendency for all three models on average to underpredict $\ln[\eta_{1150}]$, especially for smaller and larger values. This tendency was not observed in Figure 3.1, so it may be due to the extrapolative predictions for compositions removed from the modeling process.

Considering the R^2_{pred} and R^2_{val} values, there is very little difference in the predictive performances of the 24-, 20-, and 18-component models. Because of its slight advantage, the 20-component model is recommended for use in predicting $\ln[\eta_{1150}]$ of Hanford LAW and HLW glasses.

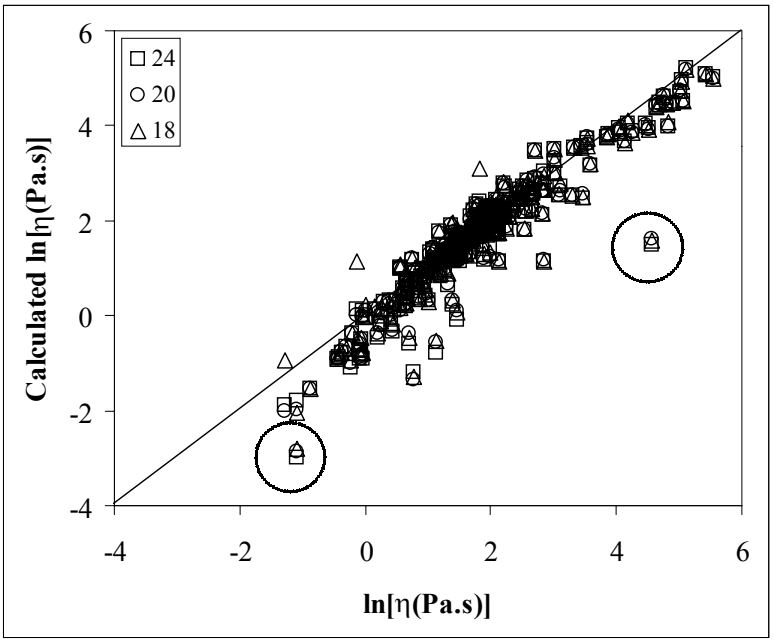

Figure 3-2. Comparison of Predicted and Measured ln[η] Values for Validation Glasses (not used in model fitting)

Table 3-5 compares the model coefficients of the new, 20 component, model with the previous model for $\ln[\eta_{1150}]$, the CVS model (Hrma et al. 1994). The percent difference shows that all new coefficients are within 40% of the old ones except the coefficient for the Others component, showing good general agreement. The Others coefficient should ideally be within the range of property responses (near the mean response value), which would indicate that it has a negligible effect on $\ln[\eta_{1150}]$. That is the case for the new model, but not the old model. The new model also accounts for the effects of several components that the old one did not—K_2O, P_2O_5, LN_2O_3, BaO, F, MnO, SrO, ThO_2, TiO_2, and V_2O_5—all of which are possibly significant components in Hanford HLW or LAW glasses.

Table 3-5. Comparison of Component Coefficients for the New Model with Previous, Hanford CVS Model

Component	20	CVS	% diff	Component	20	CVS	% diff
Al_2O_3	19.791	17.088	16%	BaO	-8.507		
B_2O_3	-9.520	-6.842	39%	F	-7.921		
CaO	-5.286	-6.279	-16%	MnO	-7.578		
Fe_2O_3	-3.433	-2.525	36%	SrO	-4.640		
K_2O	-8.678			ThO_2	13.443		
Li_2O	-16.246	-15.030	8%	TiO_2	-6.516		
MgO	-1.393	-1.198	16%	V_2O_5	-9.038		
Na_2O	-10.525	-11.017	-4%	Others	0.502	-3.561	
P_2O_5	14.747			R^2	0.9707	0.9447	
SiO_2	9.028	8.498	6%	R^2_{adj}	0.9691	0.9404	
ZrO_2	13.246	12.811	3%	R^2_{pred}	0.9661	0.9324	
LN_2O_3	-11.526						

From the model coefficients of all models, but specifically the recommended 20-component model, we can evaluate component effects on the viscosity of waste glasses. Those coefficients with values higher than the range of $\ln[\eta_{1150}]$ will increase η_{1150}, while those with values below the range will decrease η_{1150}. Those coefficients within the range of response generally have a small, but possibly statistically significant, effect on viscosity. The ranges of response in the model data set and validation data sets are $0.08 \leq \ln[\eta_{1150}] \leq 4.55$ and $-1.28 \leq \ln[\eta_{1150}] \leq 5.55$, respectively. Therefore, the following components decrease viscosity—in order of magnitude:

$$Li_2O>LN_2O_3>Na_2O>B_2O_3>V_2O_5>K_2O>BaO>F>MnO>TiO_2>CaO>SrO>Fe_2O_3>MgO$$

and the following components increase viscosity—in order of magnitude:

$$Al_2O_3>P_2O_5>ThO_2>ZrO_2>SiO_2$$

All other components of the 23 major components considered in this modeling effort, i.e., Cl, NiO, ZnO, and UO_3, have little impact on viscosity. These groupings are not surprising from our understanding of glass chemistry. However, the order of components within each category is of interest and suggests something about the chemical and physical processes responsible for viscous flow in waste-glass melts. Further evaluation of these chemical and physical processes is beyond the scope of this work.

Since it is not straight forward to directly convert the model's valid component concentration ranges from mole fractions to mass fractions, we have chosen to examine the composition region in mass fractions of oxides over which this model was found to predict well. The first step taken was to estimate the η_{1150} of all 623 glasses with η-T data. We then compared predicted and measured values of $\ln[\eta_{1150}]$ for each glass. Glasses with residuals, i.e., absolute value of predicted minus measured $\ln[\eta_{1150}(Pa{\cdot}s)]$, greater than 2s ($\geq$0.35) were marked as not well predicted—accounting for 92 data points. The data were then sorted by mass fractions of individual oxide components (corresponding to the 20 components with coefficients in the model) to determine the concentration ranges that separate those glasses with residuals $\geq$0.35 from those with residuals <0.35. By removing an additional 75 glasses with residuals <0.35, one could separate the removed glasses from the remaining glasses simply by limiting the mass fractions of single-component oxides to those levels listed in Table 3-6. Although this is not to be interpreted as the model validity range, which is given in mole fraction of oxides in Section 3.2, it can be used to estimate whether $\ln[\eta_{1150}]$ of glasses are likely to be well predicted by this model. It is interesting to note that the concentration ranges listed for Fe_2O_3, Al_2O_3, Na_2O, SiO_2, MnO, and SrO are narrower than in the glass compositions expected to be produced at Hanford.

Pair-wise distributions of single component concentrations of the glasses used in model fitting are shown in Figure 3-3. There are no correlation coefficients higher than |0.3| except for the Li_2O:Na_2O which has a correlation coefficient of -0.666. There is a good general distribution of the first 11 components and reasonable coverage of all components.

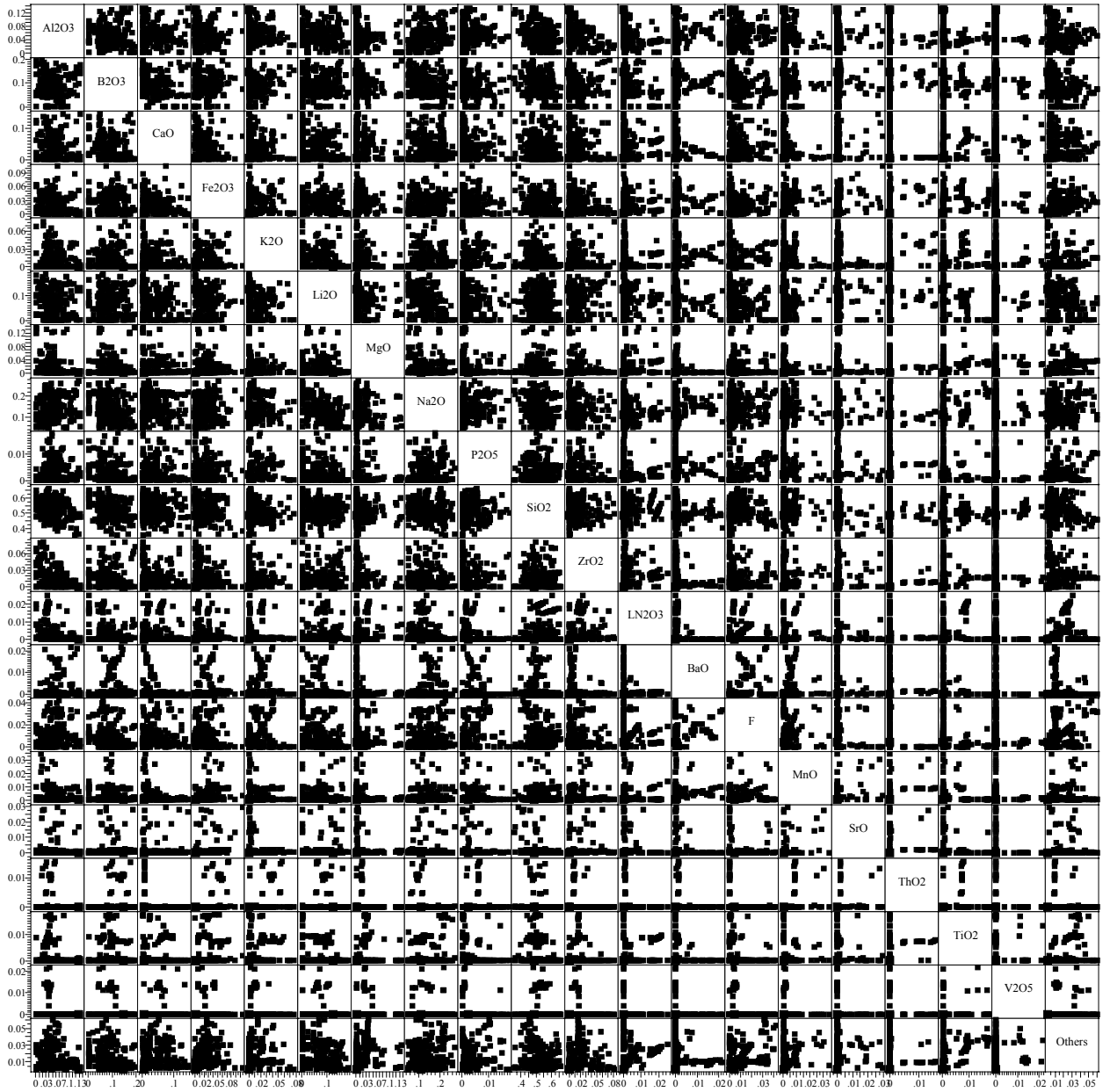

Figure 3-3. Scatter Plot Matrix for $\ln[\eta_{1150}]$ Model Data Component Concentrations

Table 3-6. Component Concentration Ranges (in mass fractions) for Accurate Prediction of $\ln[\eta_{1150}]$

Component	Min	Max	Component	Min	Max
Al_2O_3	0.0000	0.1821	ZrO_2	0.0000	0.1167
B_2O_3	0.0000	0.2000	LN_2O_3	0.0000	0.0356
CaO	0.0000	0.1200	BaO	0.0000	0.0387
Fe_2O_3	0.0000	0.1550	F	0.0000	0.0250
K_2O	0.0000	0.1000	MnO	0.0000	0.0310
Li_2O	0.0000	0.0846	SrO	0.0000	0.0917
MgO	0.0000	0.0800	ThO_2	0.0000	0.0534
Na_2O	0.0500	0.2500	TiO_2	0.0000	0.0501
P_2O_5	0.0000	0.0402	V_2O_5	0.0000	0.0598
SiO_2	0.3500	0.6278	Others	0.0000	0.1502

3.4 Model for Viscosity as a Function of Temperature

Although 1150°C is the current estimate of nominal Hanford waste-glass melter operation, there is value in predicting the melt viscosity as a function of temperature for several reasons, e.g., evaluation of melter idling conditions. It has been well established that the Vogel-Tamman-Fulcher (VTF) model can be used to estimate the effect of temperature on viscosity over nearly 20 orders of magnitude for silicate-based glasses (see Varsneya 1994, for example). However, fitting empirical composition models to the VTF model was found to require a great number of fit parameters that may not be justified for the purposes of this model, e.g., 30 parameters in the work by Hrma et al. (1994) on glasses with only 10 varied components. Over relatively narrow ranges of viscosity, e.g., 2 orders of magnitude, 1 to 100 Pa·s, the Arrhenius model can adequately approximate the η-T relationship, requires less fit parameters, and has the added advantage of being linear with inverse temperature (Hrma et al. 1994; Hrma et al. 2001). Therefore, we have chosen to use the Arrhenius model as the basis of our η-T-x_i model in this work.

3.4.1 Initial Model Development

The natural logarithm of viscosity as a function of temperature was modeled by means of the Arrhenius model with its parameters expanded as linear mixture models:

$$\ln[\eta_{1150}(Pa \cdot s)] = \sum_{i=1}^{N} A_i x_i + \frac{\sum_{i=1}^{N} B_i x_i}{T} \tag{3.2}$$

where a_i and b_i are the i^{th} component Arrhenius model coefficients, T is absolute temperature, and N is the number of components in the glass. We started with the normalized mole fractions of 24 components (23 components plus Others) and 366 glass compositions as discussed in Section 3.2. As with the $\ln[\eta_{1150}]$ model, outliers were identified (IG2-02, CVS1-09, CVS2-79, CVS2-80, and HLWD3-08), and the model

was refit. The resulting data set includes 361 glasses, 2868 η-T data points with η and T ranges of -0.713 ≤ ln[η(Pa·s)] ≤ 6.26 and 1130 ≤ T(K) ≤ 1769, respectively. The mean values for ln[η] and T of the model data set were 2.208 and 1413 K, which translate to 9.1 Pa·s and 1140°C, respectively.

Table 3-7 summarizes the new 24-component Arrhenius viscosity model. Figure 3-4 shows the predicted and measured ln[η(Pa·s)] for model glasses, with the excluded data points shown as squares. This model represents the data well with an R^2 value of 0.980. An examination of the coefficient values and their standard deviations suggests that the model may be improved by removing NiO and Cl as components, which led to the 22-component model summarized in Table 3-7. This model also represents the data well with an R^2 value of 0.979. The coefficients for ThO_2 and UO_3, both a_i and b_i, were found to have the values inconsistent with our current understanding of those components effects on properties and were removed. This left the 20-component model. In this latter model, only the BaO coefficient standard errors were found to be significantly higher than those for other components. The coefficients for BaO were removed, resulting in the 19-component model described in Table 3-7. Again, more rigorous methods for selection of model components were reported by Piepel and Redgate (1997). The methods used here were determined sufficient for the purposes of this study. There is a clear decrease in s and increase in both R^2 and R^2_{adj} values with increasing N. These models will be evaluated in Section 3.4.2.

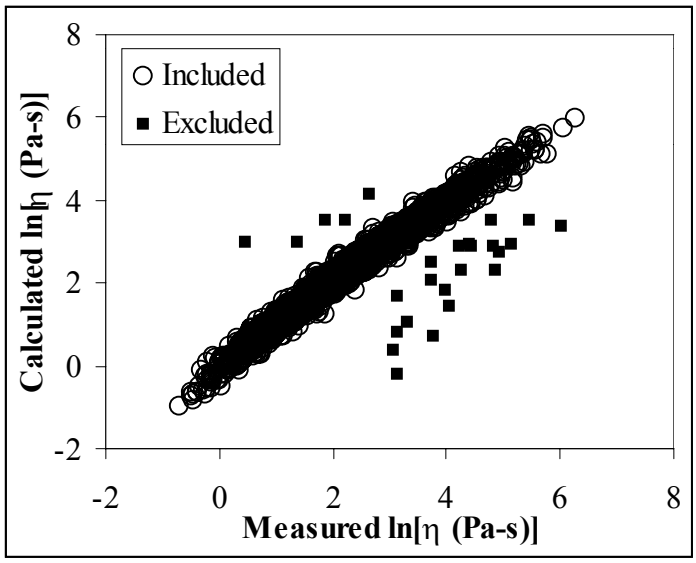

Figure 3-4. Comparison of Measured and Predicted ln[η(Pa·s)] from Initial 24-Component Arrhenius Model

Table 3-7. Summary of Arrhenius Viscosity Models

	24 Comp Model		22 Comp. Model		20 Comp. Model		19 Comp. Model	
Component	a_i	std. err.	a_i	std err.	a_i	std. err.	a_i	Std. err.
Al_2O_3	0.588065	1.9	2.0466138	1.9	2.5543153	1.9	3.5835442	2.0
B_2O_3	-24.38013	1.1	-23.51997	1.1	-23.12003	1.1	-23.08111	1.1
CaO	-12.39029	1.3	-12.10363	1.3	-11.83956	1.3	-12.58415	1.3
Fe_2O_3	-14.58128	2.9	-16.30602	2.9	-14.95076	2.9	-16.3428	2.9
K_2O	-16.22202	3.8	-12.49379	3.7	-8.379555	3.5	-6.828983	3.5
Li_2O	-5.703848	1.1	-7.953139	1.1	-7.886365	1.1	-8.340798	1.1

	24 Comp Model		22 Comp. Model		20 Comp. Model		19 Comp. Model	
Component	**a_i**	**std. err.**	**a_i**	**std err.**	**a_i**	**std. err.**	**a_i**	**Std. err.**
MgO	-20.24774	2.1	-18.63367	2.1	-18.47942	2.1	-19.68245	2.1
Na_2O	-9.885539	1.2	-10.68107	1.2	-11.0084	1.1	-11.15226	1.2
P_2O_5	-11.68989	12.3	-26.71842	11.9	-18.38244	11.7	-24.19039	11.9
SiO_2	-8.993515	0.4	-8.836743	0.4	-8.838998	0.4	-8.778731	0.4
ZrO_2	-52.86406	3.1	-52.76029	3.1	-53.97564	3.1	-54.78701	3.1
LN_2O_3	-26.83475	15.0	-54.45905	13.6	-51.51733	10.7	-69.37717	10.5
BaO	18.51618	15.4	38.454578	15.1	27.367476	14.9		
Cl	8.129332	16.4						
F	-10.68322	6.9	-12.05659	6.8	-13.86623	6.3	-13.95969	6.4
MnO	4.092693	14.4	-15.48788	13.9	-2.611432	13.0	0.9254979	13.1
NiO	-131.8808	22.1						
SrO	-8.467963	13.7	-6.60889	13.9	-3.083549	13.8	-6.377174	14.0
ThO_2	85.9681	30.1	82.000602	30.4				
TiO_2	-24.09365	14.3	-13.43509	13.5	-5.5078	13.4	-13.93102	13.6
UO_3	59.1457	28.1	37.547609	27.9				
V_2O_5	-47.79726	17.7	-44.6834	17.6	-45.53306	17.7	-43.20154	17.9
ZnO	-54.02427	6.6	-47.77983	6.6	-49.36786	6.4	-50.15485	6.5
Others	6.587927	14.1	-15.03723	10.4	-22.15227	7.6	-4.963217	7.0
	b_i	**std. err.**	**b_i**	**std. err.**	**b_i**	**std. err.**	**b_i**	**Std. err.**
Al_2O_3	26234.92	2681	24090.916	2690	23392.834	2710	21719.847	2736
B_2O_3	21190.53	1586	19792.599	1546	19322.371	1536	19196.345	1536
CaO	9971.479	1775	9561.6416	1765	9157.9755	1766	10349.85	1787
Fe_2O_3	14827.42	4097	17120.619	4093	15620.93	4030	17834.262	4085
K_2O	11162.71	5227	6310.3968	5083	1270.8166	4825	-1250.997	4840
Li_2O	-14470.56	1599	-11228.19	1554	-11261.19	1559	-10547.26	1581
MgO	26791.39	2913	24401.612	2901	24230.913	2921	26147.971	2955
Na_2O	-877.4744	1652	416.81426	1606	837.06103	1576	1030.831	1599
P_2O_5	31856.38	17031	53131.386	16553	43075.714	16346	51974.792	16559
SiO_2	25673.29	623	25429.115	625	25425.28	623	25354.665	626
ZrO_2	93724.64	4283	93497.131	4331	94861.187	4324	96153.204	4375
LN_2O_3	16960.1	20882	56108.16	19078	52422.177	15453	81198.69	15090
BaO	-34830.48	21190	-64629.16	20803	-50506.39	20525		
Cl	-1624.732	22542						
F	4421.361	9487	6930.2503	9404	9173.5771	8694	9754.377	8826
MnO	-14695.05	19871	11516.455	19297	-6619.81	18034	-12285.33	18188
NiO	198454.4	30716						
SrO	7303.827	18973	4807.0424	19145	-176.7816	19081	5392.7199	19270
ThO_2	-97982.25	41427	-91772.52	41895				
TiO_2	23127.85	19529	11669.5	18356	1826.5471	18341	14973.294	18520
UO_3	-99217.04	42594	-69099.76	42327				
V_2O_5	55467.67	24335	48929.976	24190	50114.369	24331	47875.034	24702
ZnO	78241.33	9126	69075.629	9048	71022.386	8853	73083.664	8925
Others	-12650.47	19628	24548.528	14294	33384.492	10669	5218.009	9762
Regression Statistics								
R^2	0.9797		0.9792		0.9787		0.9781	
R^2_{adj}	0.9793		0.9788		0.9784		0.9778	
s	0.166		0.168		0.170		0.173	

3.4.2 Model Evaluation and Selection

Four models were developed from the viscosity model set as described in Section 3.4.1. These models all fit the experimental data well with R^2 values ranging from 0.9781 to 0.9797—suggesting that roughly 98% of the variation in ln[η] is described by these models. Unfortunately, many of the model coefficients for the same components differ significantly from model to model. For example, the a_{MnO} varies from -15.5 in the 22-component model to + 4.1 in the 20-component model. In the same manner as the ln[η_{1150}] model selection (see Section 3.3.2), we turned to the data set excluded from model fitting to determine the most appropriate model. The four models were each used to calculate the viscosity of glasses excluded from model fitting (listed in Table 3-1). Figure 3-5 shows a comparison between the calculated and measured ln[η] values for the validation data set. It is clear from this figure that all four models predict fairly well the ln[η] of glasses not used in fitting them. The R^2_{val} values were 0.869, 0.874, 0.879, and 0.878 for the 24-, 22-, 20-, and 19-component models, respectively. It is also clear that a handful of data are not predicted as well as most. These data—glasses HLWD2-05, IG2-07, CVS3-05, CVS3-20, LAWB42S, LAWPC7, HLWD1-19, and IG2-10—were removed,(r) and the goodness of prediction was recalculated. The measured and calculated ln[η] values for this reduced validation data set are compared in Figure 3-6. The R^2_{val} values for the reduced data set were 0.916, 0.919, 0.925, and 0.923 for the 24-, 22-, 20-, and 19-component models, respectively. It is interesting to note that significantly more of the validation data were over predicted than under predicted. This tendency to over predict data outside the model validity region should be considered when attempting to expand the composition region of validity and may require adding interaction terms.

(r) Despite the differences in data used to model the ln[η1150] and this η-T-**x** model, the model validity single component concentration ranges are the same.

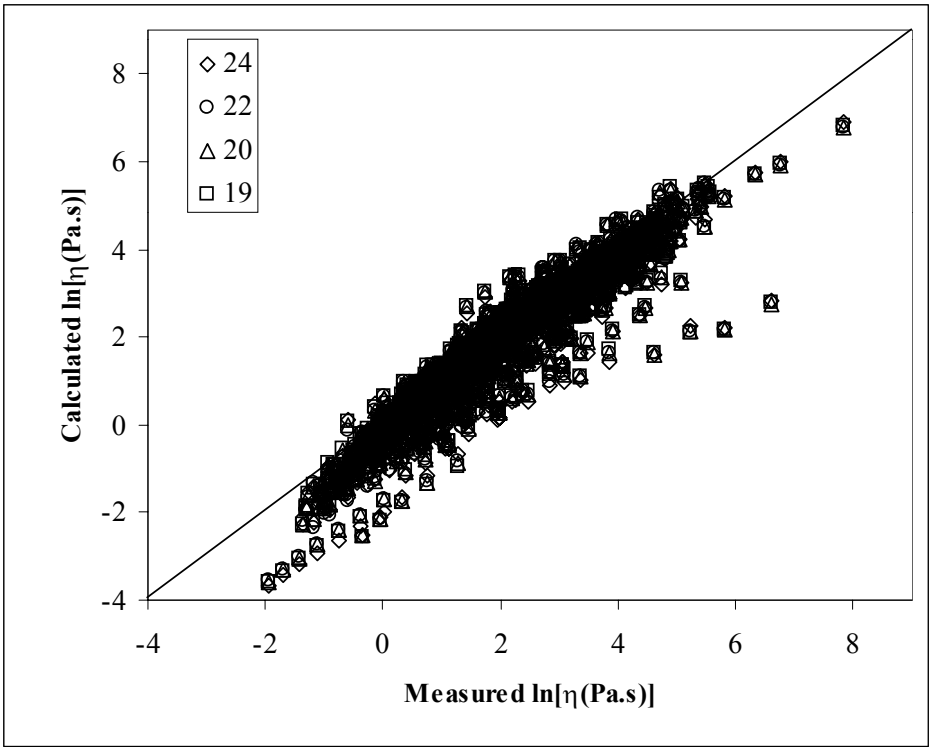

Figure 3-5. Comparison of Calculated and Measured ln[η] for the Complete Validation Data Set

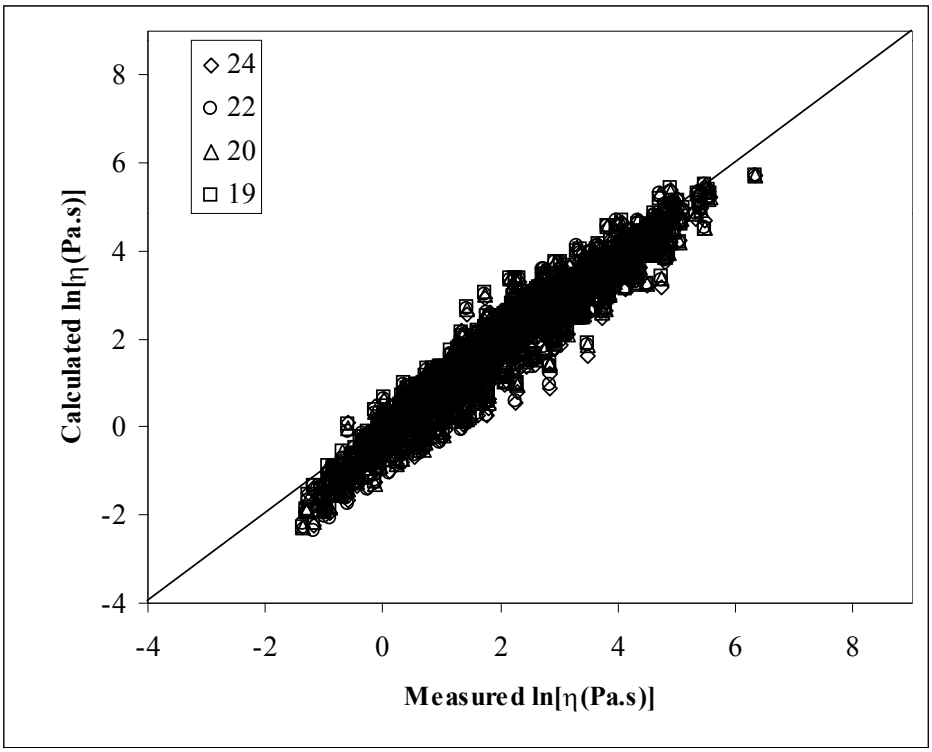

Figure 3-6. Comparison of Calculated and Measured ln[η] for the Reduced Validation Data Set

The coefficients for each model, along with those reported by Hrma et al. (1994) and Hrma et al. (2001), are compared in Figure 3-7 and Figure 3-8. It is clear from these figures that there is considerable overlap between the coefficients for each component with the exception of the LN_2O_3 and F coefficients from Hrma et al. (2001). The NiO coefficients from the 24-component model also appear to be outlying. Generally, the coefficient standard errors are higher for the Hrma et al. (2001) and Hrma et al. (1994) models than those developed in this study. The 20-component model had model coefficients with the lowest standard errors. The lower standard errors combined with the slightly improved R^2_{val} values lead us to recommend the use of the 20-component model for predicting ln[η] as functions of composition and temperature. However, for the prediction of $\ln[\eta_{1150}]$, we recommend the model selected in Section 3.3.2.

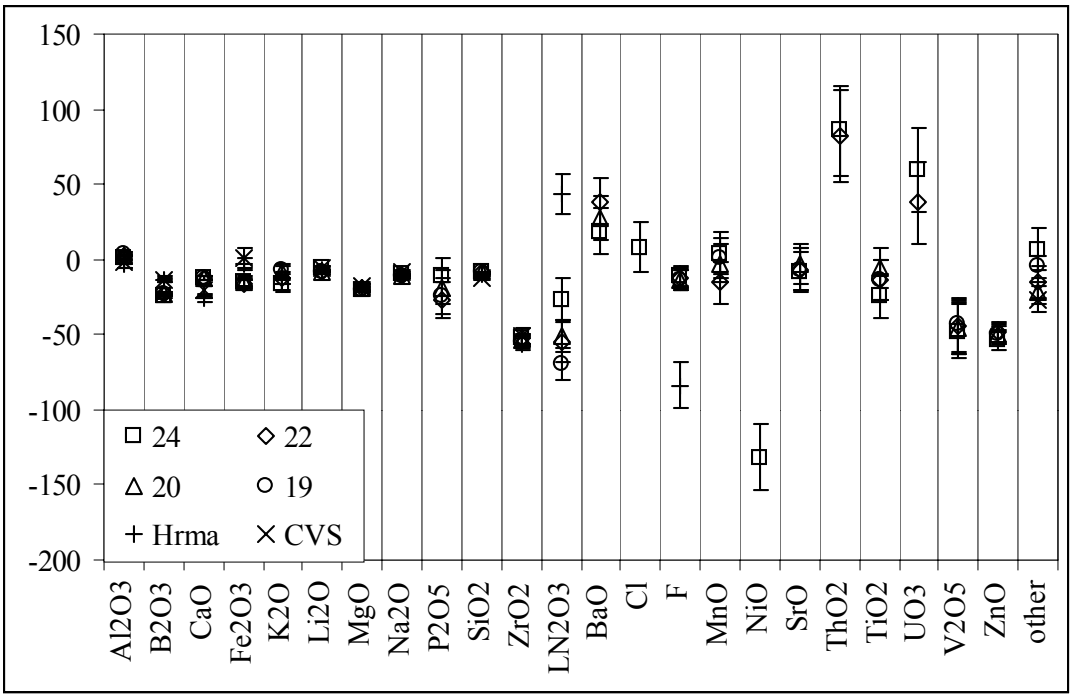

Figure 3-7. Comparison of a_i Values from Different Models (Hrma represents Hrma et al. 2001, and CVS represents Hrma et al. 1994)

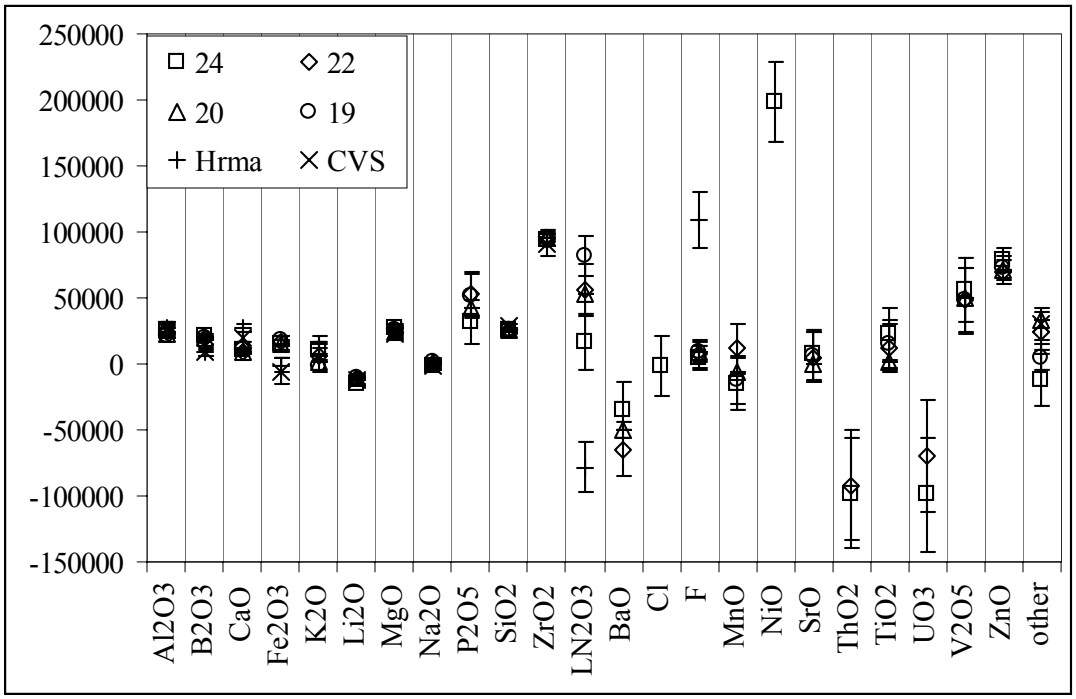

Figure 3-8. Comparison of b_i Values from Different Models (Hrma represents Hrma et al. 2001, and CVS represents Hrma et al. 1994)

4.0 Models for Liquidus Temperature

This section describes the development of models to predict the T_L of glass melts in the spinel and zircon primary phase fields.

4.1 Spinel Primary Phase Field

4.1.1 Model Selection

The ion potential (IP) model (Vienna et al. 2001) was selected as the basis for T_L model-development efforts in this work. Vienna (2002) compared this model form with other forms available at the time of this work. He concluded that only a purely empirical model could predict T_L data better than the IP model and only for some of the data sets. The *s,* root-mean squared error (RMSE), values for some of the validation data sets were lower by the IP model than by an empirical model and vise-versa, with only small differences overall. The IP model was selected since 1) only a small difference between the predictability of the empirical model and the IP model was found, 2) the IP model has the advantage that it estimates the effects of all electropositive components on the T_L of HLW glasses, and 3) the IP model has less than half the fitted parameters of the empirical model.

4.1.2 Composition Conversion and Initial Data Screening

The initial database available for developing property-composition models (see Section 2.0) contained data from 2001 glass compositions expressed in terms of 71 components. Those glasses with T_L data within the spinel primary phase field were selected for model development—yielding a total of 389 glasses. Of the 389 glasses, 43 glasses were reported with only analyzed compositions, 222 glasses were reported with only target compositions, and 124 were reported with both target and analyzed compositions. The glasses with both target and analyzed composition were evaluated for consistency between composition estimates. Only five glasses—CVS2-22, -24, -30, -46, and -49—showed more than 30% relative difference in analyzed and target concentrations of the major components.[(s)] These glasses were retained in the initial T_L modeling data set but will be discussed later.

As discussed above, the IP model form (Vienna et al. 2001a; Vienna 2002) was assumed. In this model, the composition is expressed in mole fractions of electropositive components, i.e., cations or oxides expressed in the form of single metals, e.g., $AlO_{3/2}$. For those components that were reported in more than one oxidation state, the most likely or prevalent oxidation state was chosen, e.g., Mn^{2+}, Fe^{3+}, and U^{6+}. The compositions of the 389 glasses were converted to this basis according to normal procedures. Of the 389 glasses, 42 were found to be extreme in either T_L values or single-component concentrations; e.g., when plotted on a histogram of all data, these compositions were significantly separated from most of the data. Table 4-1 lists the glasses and the extremes to which they correspond. These glasses were excluded from model fitting as they would likely be too influential in determining component effects.[(t)] This left a total of 347 glasses for use in modeling. Some of these data were removed as outliers during the model fitting, as described in the following sections.

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s) Major components were defined as those with ≥ 1 mass% in glass.

(t) One exception to the data-exclusion method was for ThO_2. There were only four glasses with ThO_2 that were left in the data set because the effect of ThO_2 on T_L is an important parameter—SPA-41, -42, -44, and -45.

Table 4-1. Glasses with Extreme Component Concentrations or T_L Values

Glasses	Mole% element
CVS1-17, SP-MC-8 and SP-MC-2	<2 Al
SP-B-5	>25 B
SP-B-1, SP-MC-8, CVS3-1 to -39 (minus-7 and -26)	<1 B
SPA-02 and SPA-04	>5 K
SP-Li-6	>20 Li
CVS2-22 and SP-Mg-3	>4 Mg
SP-MC-9	<8.5 Na
SP-Si-4 and SPA-07	<23 Si
SPA-04	>1 Sr
SP-MC-2	>2.5 Zr
SG29 and CVS2-24	T_L < 850°C
SPA-02, SPA-25, Sp-HLHH, and SP-Na-1	T_L > 1350°C

4.1.3 Model Development

The IP model (Vienna 2002; Vienna et al. 2001a), has the form:

$$T_L = \sum_{Ni,Cr,Mn} T_i x_i + \sum_{Alk,AlkE} (t_{ion} + \Theta_{ion} P_i) x_i + \sum_{remaining} (t_{cov} + \Theta_{cov} P_i) x_i \qquad (4.1)$$

where:

x_i = i^{th} electropositive component mole fraction in glass on a single metal oxide basis, e.g., $AlO_{3/2}$

P_i = Z_i/r_i, where Z_i is formal valence and r_i is ionic radius of the i^{th} component, respectively

T_i = i^{th} component coefficient (i=Ni, Cr, and Mn)

t_{ion} and Θ_{ion} = intercept and slope of the line relating the effect of alkali and alkaline earth components on T_L with their ion potential

t_{cov} and Θ_{cov} = intercept and slope of the line relating the effect of all other components on T_L with their P_i, respectively

T_L = liquidus temperature in °C.

This model was fit directly to the experimental data from the 347 glasses described in Section 4.1.1 by means of standard, i.e., unweighted least squares, regression techniques (minimizing s = RMSE values). The initial fit to experimental data resulted in several data points being outliers defined by high residuals, i.e., the absolute value of measured T_L minus calculated T_L. The glass with the highest residual was removed, and the model was refitted. This process was repeated until the residuals from model fit data were all less than 80°C.(u) The excluded data, generally, can be used to define the composition

(u) Occasionally, when the glass with the highest residual remaining in the fit data set was removed, a glass previously removed had a lower residual than the newly fitted model. In those cases, the glass was returned to the model fit data set, and the model was refit.

region of model validity. However, as discussed in Section 3.3, it is better to use standardized residuals. These excluded data will be discussed below.

Table 4-2 summarizes the model-fit results. Generally, the model-fit statistics and parameter estimates are similar to those reported by Vienna (2002) and reflect a more accurate estimate of Mn effects than those reported by Vienna et al. (2001a). Figure 4-1 compares the measured and calculated T_L values by this model. There were 320 glasses in the final model fit. The remaining 27 glasses, 7.8% of the data set, were defined as outliers. The 27 outliers are listed in Table 4-3. All of these outlying data were found to be either at extremes in composition, based on two component concentrations, or showed peculiar results for another reason, except SPA-13 and -24.

Table 4-2. Summary of IP Model

Item	Value
t_{ion}	-1,942
Θ_{ion}	1,996
t_{cov}	6,038
Θ_{cov}	-500
T_{Cr}	33,271
T_{Mn}	1,316
T_{Ni}	13,675
Count	320
Min T_L (°C)	859
Max T_L (°C)	1,310
Mean T_L (°C)	1,063
R^2	0.897
R^2_{Adj}	0.895
s (°C)	32.77
Max residual (°C)	78

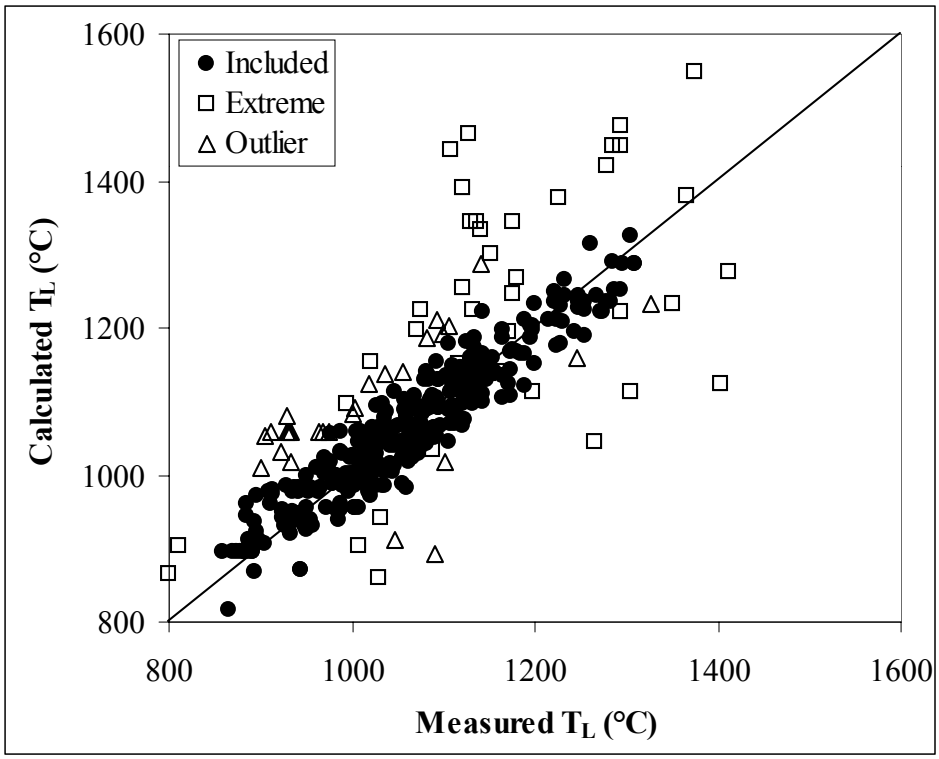

Figure 4-1. Comparison of Calculated and Measured T_L Values

These excluded points were used in combination with the extreme compositions discussed in Table 4-1 to define a model validity range. The model validity ranges were defined in terms of mass% of oxides as the glasses excluded were found to be at the edge of the composition region on both mole and mass fraction bases between the excluded glasses by both composition bases. These composition ranges of model validity are listed in Table 4-4. Also listed in the table are comments on those components with model-validity concentration ranges thought to be inadequate for the purpose of this global model for all Hanford HLW glasses. The adequacy of the concentration ranges was determined from three sources: 1) the study performed by Perez et al. (2001), 2) the current WTP contract specifications (BNI 2001), and 3) current knowledge of pretreatment options. Expansion of the model-validity concentration ranges will require additional data and modeling efforts. Based on these comments, future studies should aim at expanding the concentration ranges of SrO, ThO_2, Cr_2O_3, MnO, K_2O, U_3O_8, and CdO. As mentioned earlier, this model is aimed at providing relatively low precision T_L estimates over relatively broad (global) composition regions. Additional modeling, and possibly data collection, is required to develop more precise models that cover smaller (local) composition regions.

Table 4-3. Summary of Outlying Data

Glass ID	Study	T_L (°C)	calc T_L (°C)	Comment
AH 165AL	DWPF	933	1017	GF[(a)]
AH 165AL	DWPF	905	1052	GF
AH 165AV	DWPF	923	1031	GF
AH 165FE-RED	DWPF	1100	1191	reduced glass, GF
AH 200AL	DWPF	900	1010	GF
AH 202AL	DWPF	930	1081	GF
AH 202FE-RED	DWPF	1093	1210	reduced glass, GF
c106a-2	Misc	1004	1091	high Mg and low Li, high Mg and high Na
CVS1-11	CVS	1035	1138	GF, CaO>6
CVS1-17	CVS	1000	1083	GF, Al_2O_3 < 1%, CaO>6%
CVS2-30	CVS	1090	894	GF, B_2O_3 > 18.6%
CVS3-26	CVS	1047	912	GF
LSi-Cr-008	LSi	1107	1203	high Cr and Cd, high Cr and high Na
LSi-Cr-012	LSi	1140	1286	high Cr and Cd, high Cr and high Na
SG06a	SG	911	1060	SG06[(b)]
SG06b	SG	931	1060	SG06
SG06c	SG	929	1059	SG06
SG1-07(=SG06s1)	SG-1	965	1059	SG06
SG1-08(=SG06s2)	SG-1	968	1059	SG06
SG1-14(=SG06)	SG-1	934	1059	SG06
SG1-15(=SG06p1)	SG-1	974	1059	SG06
SPA-11	SPA	1326	1232	T_L > 1310°C, OM/XRD[(c)]
SPA-13	SPA	1246	1158	
SPA-16	SPA	1081	1187	high Si and high Sr
SPA-24	SPA	1055	1140	
SPA-42	SPA	1018	1123	high Th and high Sr
Sp-LHLH(b)	SPx4	1102	1019	different from Sp-LHLH with T_L = 1063°C

(a) GF—Measured by gradient furnace method with uncertainties as high as ±200°C (Plodinec 1999)
(b) SG06—The SG06 glass composition has been measured a number of times and repeatedly been found to be an outlier by a number of model forms. Of all the measurements, the last measurement was performed with significantly longer heat treatments to ensure redox equilibrium was obtained and this data point matches models the closest of any data points (988°C for SG1-20=SG06p2)
(c) OM/XRD—One hundred of the 347 glasses were measured by both the optical microscopy (OM) method and the X-ray diffraction (XRD) method. Of these 100 glasses, only six had a T_L difference of more than 50°C between the two methods, three of them with T_L by XRD below T_L by OM—SPA-25, SPA-11, and SP-Na-1. In that case, it is likely that the OM measurement was strongly affected by volatile losses.

Table 4-4. IP Model Validity Concentration Ranges (in mass% of oxides and F)

Component	min	max	Comments
Al_2O_3	1.0	16.1	may need higher Al_2O_3 concentrations
B_2O_3	1.0	18.6	adequate[(a)]
Bi_2O_3	0.0	7.0	adequate
CaO	0.0	6.0	adequate
CdO	0.0	2.0	CS[(b)] = 3
Cr_2O_3	0.0	0.8	need overlap with eskolaite phase field
F	0.0	2.0	adequate
Fe_2O_3	2.0	23.0	adequate
K_2O	0.0	4.5	most effective component at reducing T_L (and may be added at higher concentrations to optimize glass composition)
Li_2O	0.0	7.0	adequate
MgO	0.0	5.0	adequate
MnO	0.0	6.0	Sr/TRU ppt.[(c)]
Na_2O	5.8	25.0	adequate
Nd_2O_3	0.0	2.0	adequate
NiO	0.0	3.1	adequate
P_2O_5	0.0	2.5	adequate
SiO_2	30.0	60.0	adequate
SrO	0.0	2.0	Sr/TRU ppt.
ThO_2	0.0	2.0	CS = 4, only 4 data points
TiO_2	0.0	5.0	adequate
U_3O_8	0.0	5.5	CS = 8 as UO_2
ZnO	0.0	2.0	adequate
ZrO_2	0.0	6.2	adequate
Others	0.0	3.5	concentration of all other components combined
T_L °C	859	1310	adequate

[(a)] adequate—Based on current estimates, the concentration ranges are adequate to represent expected Hanford HLW glasses.
[(b)] CS—Current WTP contract specifications (for defining minimum waste loading) include higher concentrations than the current maximum model validity concentration.
[(c)] Sr/TRU ppt.—SrO and MnO concentrations may be very high in HLW glasses due to chemical additives for Sr and TRU precipitation (ppt) from LAW. The concentration of MnO may be further increased if permanganate oxidative leaching is applied to HLW.

Table 4-5 lists the Z_i, r_i, P_i, and T_i (where $T_i = T_i$ for i=Mn, Ni, and Cr, $T_i=t_{ion}+\Theta_{ion}P_i$ for i=alkali and alkaline earth components, and $T_i=t_{cov}+\Theta_{cov}P_i$ for i=all other components) for typical glass components.

Table 4-5. Z_i, r_i, P_i, and T_i Values for Typical HLW Components (i)

Element (i)	Z_i[(a)]	r_i[(b)] (Å)	T_i (°C)	Element (i)	Z_i	r_i (Å)	T_i (°C)
Ag	1	1.080	5575.7733	P	5	0.310	-2021.2207
Al	3	0.530	3209.9674	Pb	2	1.430	5339.5773
As	5	0.475	778.4574	Pd	2	1.000	5039.0584
B	3	0.250	42.0572	Pr	3	1.266	4854.3351
Ba	2	1.560	616.3770	Rb	1	1.750	-801.8076
Bi	3	1.170	4757.1763	Rh	3	0.805	4176.2222
Ca	2	1.260	1225.5628	Ru	4	0.760	3408.4580
Cd	2	1.090	5121.5777	S	6	0.260	-5493.0826
Ce	4	1.010	4059.4483	Sb	5	0.740	2662.1065
Co	2	0.720	4650.4027	Se	6	0.420	-1100.1145
Cr	3	0.755	33271.4288	Si	4	0.400	1041.4574
Cs	1	1.880	-880.6648	Sm	3	1.219	4808.6798
Cu	2	0.870	4889.7227	Sr	2	1.400	908.7862
Fe	3	0.630	3658.9343	Te	4	0.800	3539.9580
K	1	1.650	-732.6927	Th	4	1.080	4187.7175
La	3	1.300	4885.3045	Ti	4	0.560	2469.1721
Li	1	0.900	275.2329	U	6	0.870	2592.2509
Mg	2	0.860	2698.9425	V	5	0.680	2364.1931
Mn	2	0.970	1316.4376	W	6	0.740	1986.8360
Mo	6	0.730	1931.3344	Y	3	1.159	4745.0157
Na	1	1.160	-221.7787	Zn	2	0.740	4687.9178
Nd	3	1.249	4838.2182	Zr	4	0.860	3714.2720
Ni	2	0.830	13674.8724				

[(a)] For multivalent components, the most abundant valence states were assumed.
[(b)] The crystal radii from Shannon (1976) were used assuming the most abundant coordination environment.

4.2 Zircon Primary Phase Field

4.2.1 Initial Data Evaluation and Conversion

A total of 72 glasses was reported with zircon or an unknown zirconia-containing phase on the primary phase field. Of the 72 glasses in this data set, two, Sp-MC-7 and Sp-Zr-2, were reported to have an unknown zirconia-containing primary phase, four, CVS1-07, CVS1-08, CVS2-14, and CVS2-80, were reported as inequalities (e.g., $T_L > 1117$°C), and one, CVS3-21, was from an alkali-aluminosilicate glass family. The 65 remaining glasses were used in initial model development.

To determine if the IP model form may be applicable to the zircon primary phase field, compositions were first converted to the basis of that model, e.g., mole fractions of single metal oxides, e.g., $AlO_{3/2}$, as was done in Section 4.1.1.

4.2.2 Model Development

A first-order empirical fit of the zircon T_L data was made. Table 4-6 summarizes this empirical fit. In this fit, one glass, Zr-27, was found to be an outlier with a residual of 130°C. It is not clear why this glass is not accurately predicted by the first-order approximation, but it was excluded from the fit. Figure 4-2 shows the correlation between P_i and T_i for the expansion of zircon T_L in composition. Missing from this figure is T_{Zr}, which is off scale for the plot and a major component of zircon ($ZrSiO_4$) and T_{Others}. "Others" represents the sum of other components besides the nine used in the fit and therefore does not have a distinct P_i value. It is clear from the plot that the relationship between T_i and P_i remains valid in the zircon primary phase field—yielding two straight lines with the equations:

$$T_i = t_{ion} + \Theta_{ion} P_i \tag{4.2}$$

where $t_{ion} = -3834$, $\Theta_{ion} = 3247$, and i = Ca, Li, Mg, Na and

$$T_i = t_{cov} + \Theta_{cov} P_i, \tag{4.3}$$

where $t_{cov} = 3865$, $\Theta_{cov} = -270$, and i = Al, B, Fe, Si. This relationship leads directly to an IP model of the form:

$$T_L = T_{Zr} x_{Zr} + \sum_{Alk,AlkE} (t_{ion} + \Theta_{ion} P_i) x_i + \sum_{remaining} (t_{cov} + \Theta_{cov} P_i) x_i \tag{4.4}$$

which was fitted to the 64 data points used in the empirical expansion. Table 4-7 summarizes the results of the IP model fit to the zircon data, and Figure 4-3 compares the predicted and measured values. The goodness of fit, as judged by R^2, R^2_{adj}, and s, are only slightly better for the empirical fit with 10 fitted parameters than for the IP model with only 5 fitted parameters.

Table 4-6. T_i Values for the First-Order Model Calculated from the Zircon Data Set

Element	T_i	Std. Error	Statistic	Value
Al	2,240.85	281.12	R^2	0.926
B	717.98	235.62	R^2_{adj}	0.914
Fe	2,692.88	546.07	s (°C)	23.31
Si	1,044.30	217.21	min response (°C)	897
Ca	1,054.86	327.31	mean response (°C)	1068
Li	129.36	214.33	max response (°C)	1350
Mg	3,788.52	325.78	Observations	64
Na	-1,195.28	260.23		
Zr	11,465.94	633.87		
Others	1,850.97	207.28		

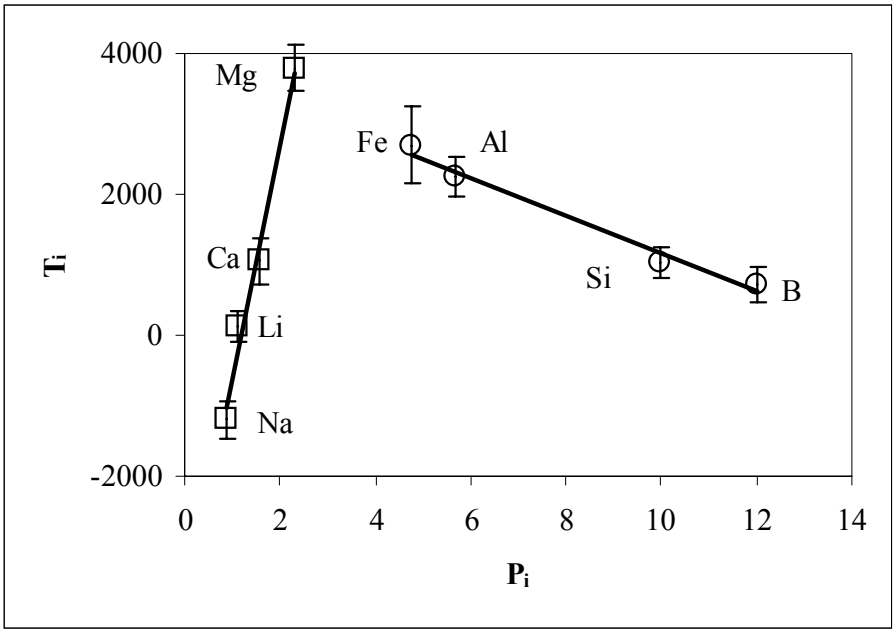

Figure 4-2. Plot of Fitted T_i Values for Zircon as Functions of P_i.

Table 4-7. Summary of Zircon IP Model Fit

Parameter	Value
t_{ion}	-3,979
Θ_{ion}	3,524
t_{cov}	2,505
Θ_{cov}	-146
T_{Zr}	12,254
R^2	0.868
R^2_{adj}	0.859
s (°C)	29.9
Observations	64

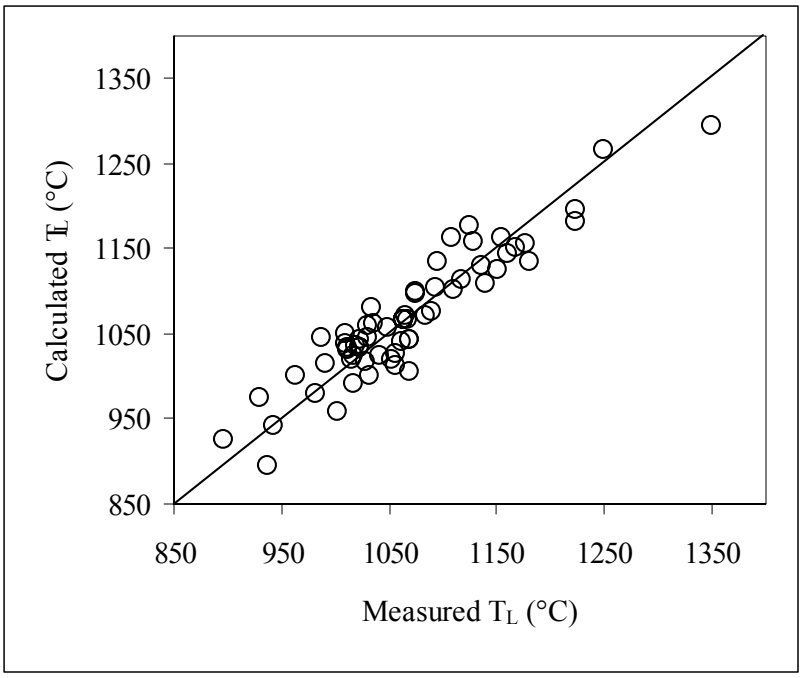

Figure 4-3. Plot Comparing Measured and Calculated Zircon T_L Values from IP Model

Table 4-8 lists the Z_i, r_i, P_i, and T_i (where $T_i = T_i$ for i = Mn, Ni, and Cr, $T_i = t_{ion}+\Theta_{ion}P_i$ for i = alkali and alkaline earth components, and $T_i = t_{cov}+\Theta_{cov}P_i$ for i = all other components) for typical glass components.

Table 4-8. Z_i, r_i, P_i, and T_i Values for Typical HLW Components (i)

Element (i)	Z_i	r_i (Å)	T_i (°C)	Element (i)	Z_i	r_i (Å)	T_i (°C)
Ag	1	1.08	2369.8763	Nd	3	1.25	2154.0937
Al	3	0.53	1677.725	Ni	2	0.83	2152.9655
B	3	0.25	750.90633	P	5	0.31	147.26404
Ba	2	1.56	538.88459	Pb	2	1.43	2300.7737
Bi	3	1.17	2130.3837	Pr	3	1.13	2117.1144
Ca	2	1.26	1614.6523	Rb	1	1.75	-1965.503
Cd	2	1.09	2236.9947	Re	4	0.77	1745.7892
Ce	4	1.01	1926.2531	Rh	3	0.81	1960.4171
Co	2	0.72	2099.1456	Ru	4	0.76	1735.7964
Cr	3	0.76	1924.336	Sb	5	0.74	1517.4403
Cs	1	1.88	-2104.757	Se	6	0.42	416.74721
Cu	2	0.87	2169.1621	Si	4	0.40	1043.2956
Fe	3	0.63	1809.0769	Sm	3	1.22	2145.4519
Gd	3	1.19	2137.6107	Sn	4	0.83	1800.6894
K	1	1.65	-1843.452	S	6	0.26	-868.4802
La	3	1.30	2167.8695	Sr	2	1.40	1055.2531
Li	1	0.90	-63.54531	Te	4	0.80	1774.2686
Mg	2	0.86	4216.509	Ti	4	0.56	1460.9945
Mn	2	0.97	2203.8095	W	6	0.74	1319.88
Mo	6	0.73	1303.6421	Y	3	1.16	2126.826
Na	1	1.16	-941.2234	Zn	2	0.74	2110.1211
Nb	5	0.78	1568.0967	Zr	4	0.86	12253.597

The ranges of model-fit data were used to determine the model-validity ranges, which are reported in terms of mass% of oxides in Table 4-9. Also listed in the table is the composition of the outlier glass, Zr-27, which appears to be at the upper edge of Li_2O and SiO_2 concentrations and at the lower edge of the concentration ranges for a number of components. The concentration ranges and model in general are not yet adequate for the intended purposes. However, to date, it appears to be the best predicting model for T_L in the zircon primary phase field and should be used until further data and models are available. As mentioned earlier, this is a global model aimed at providing lower-precision T_L estimates over broader composition regions (relative to local models). Additional modeling, and possibly data collection, is required to develop more precise local models that cover smaller composition regions.

Table 4-9. Concentration Ranges and Outlier Composition (in mass%) for the Data that Were Used to Fit the T_L Model in the Zircon Primary Phase Field

Oxide	min	max	Zr-27
Al_2O_3	0.0	10.3	3.0
B_2O_3	2.0	20.0	5.0
Bi_2O_3	0.0	10.0	0.0
CaO	0.0	8.0	0.1
CdO	0.0	1.3	0.0
CeO_2	0.0	3.0	0.0
Fe_2O_3	0.0	7.4	0.0
La_2O_3	0.0	1.2	0.0
Li_2O	1.0	9.0	9.0
MgO	0.0	8.0	0.0
MnO	0.0	1.9	0.0
Na_2O	4.0	15.0	11.5
Nd_2O_3	0.0	2.2	0.0
NiO	0.0	1.0	0.0
P_2O_5	0.0	5.0	0.2
SiO_2	41.0	59.6	57.2
ZrO_2	3.7	16.5	13.5

5.0 Models for Product Consistency Test Response

This section discusses initial data evaluation, screening/conversion, and modeling of normalized boron, lithium, and sodium releases during PCT.

5.1 Initial Data Evaluation, Screening, and Conversion

Of the 2001 data in the database, 1252 data points (glasses) report normalized releases of either B, Na, or Li by the product consistency test (PCT) (ASTM 1998), denoted r_B, r_{Na}, r_{Li}, respectively. Only PCT release values for quenched glasses are considered. Of the 1252 glasses, there are 1229, 887, 1152, and 1050 that have r_B, r_{Li}, r_{Na}, and r_{Si} values, respectively. To determine the impacts of CCC on PCT release, the reader should turn to other documents, e.g., Riley et al. (2001). Analyzed compositions were available for 881 of the glasses while target compositions were available for 1053 of the 1252 glasses.

Preliminary calculations and previous experience suggested that fitting PCT release models with all the experimental data would not yield acceptable results. So initial glass screening was performed. The data were evaluated to select a subset of data that was appropriate for model fitting according to the following procedure (in order of operation).

- Results from the WTP glass formulation activities (Muller, Buechele, and Pegg 2001; Kot and Pegg 2001), the Tanks Focus Area melter study (Perez et al. 2001), and glass-formulation experience were used to narrow the likely composition region for Hanford waste glasses. Table 5-1 lists the concentration ranges of components used to restrict the database to those compositions thought to be of interest to Hanford. This process removed 424 glasses from the model fit data set listed in Table 5-2.
- The target and measured compositions of test glasses were compared for those glasses with both types of compositions. Any glass with more than two major components, i.e., >1 mass% in target concentration, with more than 20% difference between analyzed and target concentrations was removed. This procedure resulted in the removal of 34 glasses.
- Those glasses with compositions that summed to less than 95 mass% for analyzed or 99 mass% for target were excluded. This procedure resulted in the removal of 5 additional glasses.
- Those glasses reported to be multi-phased were removed from the data set (26 additional glasses).
- Those glasses that were highly reduced—$Fe^{2+}/(Fe^{2+}+Fe^{3+})>5\%$—were removed so that FeO and Fe_2O_3 could be combined into a single component. This procedure removed an additional 25 glasses.
- Finally, one glass was reported to have foamed over and out of the crucible during fabrication.

This screening resulted in the removal of 515 glasses, leaving 737 in the preliminary data set for model fitting. Table 5-2 (for composition ranges) and Table 5-3 (for other purposes) list the glasses removed from the initial model-fit data set. It should be noted that a number of excluded glasses may have fit in more than one of the categories described above, but each glass is marked with only one category determined by the order of exclusion.

Table 5-1. Ranges of Selected Glass Components (mass% oxide or halogen)

Component	Min	Max	Component	Min	Max	Component	Min	Max
Al_2O_3		20	Ga_2O_3		0.5	SiO_2	30	60
B_2O_3	4	20	Gd_2O_3		2	Sm_2O_3		1
CaO		10	K_2O		10	SnO_2		1
Ce_2O_3		2	MoO_3		1	TiO_2		5
Cr_2O_3		2	Na_2O	5	20	Y_2O_3		2
Eu_2O_3		2	Nd_2O_3		5	ZrO_2		15
F		2	NiO		3			
Fe_2O_3		25	P_2O_5		3			

Table 5-2. Glasses Excluded from Model Development Because Their Compositions are Outside the Region of Expected Hanford Waste Glasses (concentrations of components are in mass% of the oxide or halogen)

Glass ID	Conc.	Glass ID	Conc.	Glass ID	Conc.	Glass ID	Conc.	Glass ID	Conc.
4	Na>20	CVS3-6	Nd>5	HLP-15	Ti>5	IG2-22	K>10,Na<5	P2-3Ca-0F	Si>60
7	Na>20	CVS3-7	Nd>5	HLP-16	Na>20	IG2-27	F>2	P2-3Ca-4F	F>2
9	Na>20	CVS3-8	B<4,Na>20,Nd>5	HLP-18	Na>20	IG2-29	F>2	P2-3Ca-5F	F>2
10	Na>20	CVS3-9	B<4,Nd>5	HLP-20	Na>20	IG2-32	F>2	P2-9Ca-3F	F>2
13	Na>20	DP-1	Ca>10,F>2	HLP-23	Na>20	IG2-33	F>2	P2-9Ca-4F	F>2
15	Na>20	DP-10	F>2	HLP-27	Na>20	IG2-34	F>2,Mo>1	P2-9Ca-5F	F>2
16	Na>20	DP-11	F>2	HLP-29	Na>20	IG2-35	F>2	PBG3-.5C	Ce>2,Gd>2
18	Na>20	DP-12	Ca>10,F>2	HLP-31	Na>20	IG2-36	F>2	PEI	B<4
19	Na>20	DP-13	Ca>10,F>2	HLP-33	Na>20	IG2-37	F>2	SBW1-20	Na>20
20	Na>20	DP-14	Ca>10,F>2	HLP-35	Na>20	IG3-01	F>2	SBW1-30	Na>20
30	Na>20	DP-15	Ca>10,F>2	HLP-37	Na>20,Ti>5	IG3-02b	Ca>10,Mo>1	SBW1-32	Si>60
31	Na>20	DP-16	F>2	HLP-38	Ti>5	IG3-03	Mo>1	SBW1-36	Na>20
ARM-1-7	Ce>2,Mo>1,Nd>5	DP-17	F>2	HLP-39	Na>20,Ti>5	IG3-05	Ca>10,F>2,Mo>1	SBW1-37	Na>20
ARM-1-7 (10/91)	Ce>2,Mo>1,Nd>5	DP-18	F>2	HLP-40Q	Ti>5	IG3-06	Ca>10,F>2	SBW1-41	Na>20
ARM-1-7 (12/90)	Ce>2,Mo>1,Nd>5	DP-19	F>2	HLP-42Q	Ti>5,Zn>4	IG3-07	Mo>1	SF10	Si>60,Na<5,P>3
ARM-1-7 (4/88)	Ce>2,Mo>1,Nd>5	DP-2	Ca>10,F>2	HLP-48	Zn>4	IG3-08b	Mo>1	SRC-Al-1	Ce>2,Gd>2
ARM-1-7 (4/93)	Ce>2,Mo>1,Nd>5	DP-20	F>2	HLP-52	B<4,Na>20	IG3-09	F>2,Mo>1	SRC-Al-2	Ce>2,Gd>2
ARM-1-7 (5/89)	Ce>2,Mo>1,Nd>5	DP-21	Ca>10,F>2	HLP-61	Ti>5,Zn>4	IG3-10b	F>2	SRC-B-1	B<4,Ce>2,Gd>2
ARM-1-7 (5/91)	Ce>2,Mo>1,Nd>5	DP-22	F>2	HLP-62	Ti>5	IG3-11	Ca>10	SRC-B-2	Ce>2,Gd>2
ARM-1-7 (7/90)	Ce>2,Mo>1,Nd>5	DP-23	Ca>10,F>2	HLP-63	Na>20,Ti>5	IG3-13	F>2	SRC-B-3	Ce>2,Gd>2
ARM-1-7 (8/93)	Ce>2,Mo>1,Nd>5	DP-24	F>2	HLP-64	Zn>4	IG3-14	F>2	SRC-Ca-1	Ce>2,Gd>2
ARM-1-7 (10/92)	Ce>2,Mo>1,Nd>5	DP-3	F>2	HLP-66	Na>20	IG3-15	F>2	SRC-Ca-2	Ce>2,Gd>2
ARM-1-7 (6/93)	Ce>2,Mo>1,Nd>5	DP-4	F>2	HLP-67	Na>20,Zn>4	IG3-19	F>2	SRC-Ca-3	Ce>2,Gd>2
BATCH 1 STUDY-10B-7	Si>60	DP-5	F>2	HLP-69	Ti>5,Zn>4	IG3-20	F>2	SRC-Ce-1	Gd>2
BATCH 1 STUDY-15-7	Si>60	DP-6	F>2	HLW98-12	Na<5	IG3-23	F>2	SRC-Ce-2	Ce>2,Gd>2
CU37	Ti>5	DP-7	F>2	HLW98-32A	Na<5	IG3-24	F>2	SRC-Ce-3	Ce>2,Gd>2
CU38	Cr>2	DP-8	F>2	HLWD1-08	Na<5	IG3-25	F>2	SRC-Ce-4	Ce>2,Gd>2
CU39	Cr>2	DP-9	F>2	HLWD1-10	Na<5	IG3-27	F>2	SRC-Eu-1	Ce>2,Eu>4

Table 5.2 (Contd)

Glass ID	Conc.	Glass ID	Conc.	Glass ID	Conc.	Glass ID	Conc.	Glass ID	Conc.
CU40	Cr>2	DP-BL1	Ca>10,F>2	HLWD1-11	Si<30,Fe>25	IG3-28	F>2	SRC-Gd-1	Ce>2
CU43	Zn>4	DP-BL2	Ca>10,F>2	HLWD1-14	Si<30	L1-12	Si>60,B<4	SRC-Gd-2	Ce>2,Gd>2
CU44	Cu>1	DP-centroid	Ca>10,F>2	HLWD1-17	Si<30	L1-15	Si>60,B<4	SRC-Gd-3	Ce>2,Gd>2
CU46	Cu>1	DWRG	Si>60, Na<5	HLWD1-18	Si<30	L1-9	Si>60,B<4	SRC-Gd-4	Ce>2,Gd>2
CU49	Ni>3	DZr-10-78-38	Ca>10,F>2	HLWD1-19	Si<30,F>2	L4-69	Si>60	SRC-K-1	Ce>2,Gd>2
CU53	Na<5,P>3	DZr-10-78-40	Ca>10,F>2	HLWD1-20	Si<30,F>2	L4-96	Si>60	SRC-K-2	Ce>2,Gd>2
CU54	Na<5,P>3	DZr-9-78-38	Ca>10,F>2	HLWD2-03	Si<30	L5-1212	B<4,Ca>10	SRC-Li-1	Ce>2,Gd>2
CU55	Na<5 P>3	DZr-9-78-40	Ca>10,F>2	HLWD2-04	Si<30,P>3	L5-1215	B<4,Ca>10	SRC-Li-2	Ce>2,Gd>2
CU56	Na<5,P>3	DZr-CV-1	Ca>10,F>2	HLWD2-05	Si<30	L5-129	B<4,Ca>10	SRC-Li-3	Ce>2,Gd>2
CU57	Na<5,P>3	DZr-CV-10	Ca>10,F>2	HLWD3-03	Si<30,P>3	L5-612	B<4	SRC-Mg-1	Ce>2,Gd>2
CU58	Si>60,Na<5,P>3	DZr-CV-11	Ca>10,F>2	HLWD3-04	Si<30,F>2	L5-615	B<4	SRC-Mg-2	Ce>2,Gd>2
CUOD	Na<5,P>3	DZr-CV-12	Ca>10,F>2	HLWD3-06	Si<30,P>3	L5-69	Si>60,B<4	SRC-Na-1	Ce>2,Gd>2,Na<5
CUOI	Na<5,P>3	DZr-CV-13	Ca>10,F>2	HLWD3-07	Si<30	L5-912	B<4	SRC-Na-2	Ce>2,Gd>2
CUOJ	Si>60,Na<5,P>3	DZr-CV-14	Ca>10,F>2	HLWD3-08	Si<30,Na>20	L5-915	B<4	SRC-Pb-1	Ce>2,Gd>2
CUOK	Na<5,P>3	DZr-CV-15	Ca>10,F>2	HLWMS-08	Na<5	L5-96	Si>60,B<4	SRC-Pb-2	Ce>2,Gd>2
CUOL	Si>60,Na<5,P>3	DZr-CV-16	Ca>10,F>2	HLWMS-09	Na<5	L5-99	B<4	SRC-Pb-3	Ce>2,Gd>2
CVS2-52	Na<5	DZr-CV-17	Ca>10,F>2	HLWMS-10	Na<5	L6-3312	B<4	SRC-Si-1	Ce>2,Gd>2
CVS2-57	Nd>5	DZr-CV-18	Ca>10,F>2	IG1-01	P>3	L6-546	Si>60	SRC-Si-2	Ce>2,Gd>2
CVS2-65	Zr>15	DZr-CV-19	Ca>10,F>2	IG1-02	P>3	L7-15	Si>60	SRC-Sm-1	Ce>2,Sm>1
CVS2-67	Al>20	DZr-CV-2	Ca>10,F>2	IG1-03	Na>20,P>3	L7-25	Na>20	SRC-Sn-1	Ce>2,Gd>2,Sn>1
CVS2-68	Cr>2	DZr-CV-20	Ca>10,F>2	IG1-04	P>3	L7-30	Na>20	SRC-Sn-2	Ce>2,Gd>2,Sn>1
CVS2-69	Cr>2,P>3	DZr-CV-21	Ca>10,F>2	IG1-05	Na>20,P>3	L7-35	B<4,Na>20	SRC-Ti-1	Ce>2,Gd>2
CVS3-1	B<4,Nd>5	DZr-CV-22	Ca>10,F>2	IG1-08	P>3	L8-2	B<4	SRC-Ti-2	Ce>2,Gd>2,Ti>5
CVS3-10	B<4,Nd>5	DZr-CV-23	Ca>10,F>2	IG1-09	Na>20,P>3	L8-3	B<4	SRC-Zr-1	Ce>2,Gd>2
CVS3-11	B<4,Nd>5	DZr-CV-24	Ca>10,F>2	IG1-14	P>3	L8-5	B<4	SRC-Zr-2	Ce>2,Gd>2
CVS3-12	B<4,Nd>5	DZr-CV-3	Ca>10,F>2	IG1-15	P>3	L8-6	B<4	SS-ARM-1	Ce>2,Mo>1,Nd>5
CVS3-13	B<4,Nd>5	DZr-CV-4	Ca>10,F>2	IG1-16	P>3	LAWA104	Na>20	SS-ARM-1	Ce>2,Mo>1,Nd>5
CVS3-14	B<4,Nd>5	DZr-CV-5	F>2	IG1-17	P>3	LAWA105	Na>20	T-ARM-1	Ce>2,Mo>1,Nd>5
CVS3-15	B<4,Nd>5	DZr-CV-6	Ca>10,F>2	IG1-18	P>3	LAWA46	Ga>0	TC27	Na<5
CVS3-16	B<4, Al>20	DZr-CV-7	Ca>10,F>2	IG1-19	P>3	LAWA47	Y>2	WV205	Si>60,Na<5,P>3
CVS3-17	B<4,Nd>5	DZr-CV-8	Ca>10,F>2	IG1-20	P>3	LAWA48	Ga>0	WVCM57	Na<5,P>3
CVS3-18	B<4,Nd>5	DZr-CV-9	Ca>10,F>2	IG1-21	P>3	LAWA49	Ga>0	WVDG-16	P>3
CVS3-19	B<4,Nd>5	FRIT-165-7	Si>60	IG1-22	P>3	LAWA50	Ga>0	WVDG-20	P>3

Table 5.2 (Contd)

Glass ID	Conc.	Glass ID	Conc.	Glass ID	Conc.	Glass ID	Conc.	Glass ID	Conc.
CVS3-2	Si>60, B<4,Nd>5	FRIT-202-CLEAR	Si>60	IG1-23	P>3	LAWA51	Ga>0	WVDG-21	P>3
CVS3-20	B<4,Nd>5,Zr>15	FRIT-202-INT	Si>60	IG1-24	P>3	LAWA84	P>3	WVDG-23	P>3
CVS3-21	B<4,Nd>5	FRIT-202-WHITE	Si>60	IG1-25	P>3	LAWA86	P>3	WVDG-25	P>3
CVS3-22	B<4,Nd>5	Frit-5-78-30	Ca>10,F>2	IG1-26	P>3	LAWA96	P>3	WVDG-27	P>3
CVS3-23	B<4,Nd>5	Frit-5-78-35	Ca>10,F>2	IG1-27	P>3	LAWB30	Zn>4	WVDG-29	P>3
CVS3-24	B<4,Ce>2,Nd>5	Frit-5-78-37	Ca>10,F>2	IG1-28	P>3	LAWB33	P>3	WVDG-39	P>3
CVS3-25	B<4	Frit-5-78-40	Ca>10,F>2	IG1-32	P>3	LAWB37	P>3	WVDG-41	P>3
CVS3-27	B<4,Nd>5	GLA 78-10-14	F>2,P>3	IG1-34	P>3	LAWB38	P>3	WVDG-42	P>3
CVS3-28	B<4,Nd>5	GLA 78-10-15	F>2,P>3	IG1-35	P>3	LAWC12	Zn>4	WVDG-45	P>3
CVS3-29	B<4,Nd>5	GLA 78-10-16	F>2,P>3	IG1-40	P>3	LD5-912	B<4	WVDG-47	P>3
CVS3-3	B<4,Nd>5	GLA 78-21	Ca>10,F>2	IG1-41	P>3	LDM-1	B<4	WVDG-48	Ce>2,P>3
CVS3-30	B<4,Nd>5	GLA 78-22	Ca>10,F>2	IG1-42	P>3	LDM-2	B<4	WVDG-6	P>3
CVS3-31	B<4,Nd>5	GLA 78-23	Ca>10,F>2,P>3	IG1-43	P>3	LDM-912	B<4	WVUTH31	P>3
CVS3-32	B<4	GLA 78-9-11	Ca>10,F>2,P>3	IG1-44	P>3	LDMS-1	B<4	Zr-12	Na<5,Zr>15
CVS3-33	B<4	GLA 78-9-15	Ca>10,F>2	IG2-01	F>2	LRM-1	B<4	Zr-13	Zr>15
CVS3-34	B<4	GLA 78-9-18	Ca>10,F>2,P>3	IG2-02	Ca>10	LRM-2	B<4	Zr-15	Zr>15
CVS3-35	B<4	HLP-02	Na>20	IG2-03	F>2	LRM-912	B<4	Zr-17	Na<5,Zr>15
CVS3-36	B<4	HLP-04	Na>20	IG2-05	Ca>10	LRMS-1	B<4	Zr-18	Zr>15
CVS3-37	B<4,Nd>5	HLP-05	Na>20	IG2-07	Ca>10,F>2	MG 18-7	Na>20	Zr-19	Zr>15
CVS3-38	B<4,Nd>5,P>3	HLP-08	Na>20	IG2-08	Ca>10	MG 9-7	Na>20	Zr-20	Zr>15
CVS3-39	B<4,Nd>5,P>3	HLP-10	Na>20	IG2-09	Ca>10,F>2	NBS SRM 623-7	Si>60	Zr-21	Na<5
CVS3-4	B<4,Ce>2,Nd>5	HLP-11	Na>20	IG2-10	F>2	P2-0Ca-0F	Si>60	Zr-25	Na<5
CVS3-40	B<4,Nd>5,P>3	HLP-13	Na>20	IG2-12	F>2	P2-0Ca-4F	F>2	Zr-3	Zr>15
CVS3-5	B<4,Ce>2,Nd>5	HLP-14	Na>20	IG2-17	F>2	P2-0Ca-5F	F>2		

Table 5-3. List of Glasses Excluded Due to Data Problems

Glass ID	Type[(A)]	Glass ID	Type	Glass ID	Type	Glass ID	Type
SBW1-38B	foam	HLW99-52	h	T-EA	red	Alkali3	t-a
IG1-31	h	SBW1-24	h	SS-EA-19	red	22	t-a
IG1-36	h	SBW1-25	h	SS-EA-15	red	23	t-a
IG2-06	h	SBW1-33A	h	SS-EA-1-7	red	29	t-a
IG2-18	h	WVUTH8	lcomp	SS-EA-2-7	red	32	t-a
IG3-04	h	WVUTH38	lcomp	SRS-SEA-A-7	red	33	t-a
Envelope D	h	WVUTH49	lcomp	SRS-SEA-B-7	red	HLWD2-02	t-a
HLWD1-02	h	WVUTH81	lcomp	CUASEA-A-7	red	HLW98-61	t-a
HLWD1-03	h	HLWD1-25	lcomp, h	CUASEA-B-7	red	LAWB34	t-a
HLWD1-04	h	HG-3-2-7	red	MG 25-7	red	HLP-22	t-a
HLWD1-05	h	HG-3-3-7	red	MG 28-7	red	SSHTM-3	t-a
HLWD1-07	h	AH-165 FE-7	red	IG1-33	t-a	B1G9-0IIC4	t-a
HLWD1-13	h	AH-131 AV-7	red	IG3-16	t-a	B1G9-013C5	t-a
HLWD1-21	h	AH-131 FE-7	red	IG3-26	t-a	B1G9-014C	t-a
HLWD1-23	h	AH-168 Al-7	red	IG3-29	t-a	D1G4-022P2	t-a
HLWD1-27	h	AH-168 AV-7	red	CVS2-5	t-a	M1G1-008P	t-a
HLWD2-01	h	AH-168 FE-7	red	CVS2-14	t-a	M1G1-011P	t-a
HLW98-21	h	AH-200 FE-7	red	CVS2-19	t-a	V1M2 6 32 040 P2	t-a
HLW98-53A	h	AH-202 FE-7	red	CVS2-28	t-a	V1M3 6 32 059 P1	t-a
HLW98-59	h	EA-1-7	red	CVS2-46	t-a	V1M3 6 32 075 P2	t-a
HLW98-60	h	EA-1-7	red	CVS2-51	t-a	SBW-16-18.5	t-a
HLW99-15	h	EA-2-7	red	CVS2-97	t-a	HLWD1-01	t-a, h
HLW99-27	h	EA-7	red	BATCH 1 STUDY-6-7	t-a		

(a) The type of exclusion indicates whether the glasses were excluded due to foaming out of the crucible during fabrication (foam), contained multiple phases (h), had component concentrations that summed to less than 99% for target or 95% for analyzed (lcomp), were excessively reduced (red), or had significant differences between target and analyzed compositions (t-a).

The compositions of the resulting 737 glasses were converted into mole fractions of oxides and (with a single oxide representing each multivalent element) by standard techniques. The concentration ranges of oxide components were evaluated to assure that coverage of the composition region over which models will be fit was adequate. Extreme compositions were excluded from model fitting by plotting the component concentrations in a histogram and removing data that were far from the bulk of the compositions. This was performed by evaluating each component in alphabetical order, excluding any outliers, before moving to the next component. By this method, the glasses with extreme concentrations of a component may be different before and after the removal of other data. Therefore, the procedure was repeated iteratively until the data covered the resulting composition region with a more or less normal distribution. Fifty-eight glasses were removed by this procedure (listed in Table 5-4), resulting in 679 glasses for model development.

Table 5-4. Glasses with Extreme Compositions Excluded from PCT Model Development Data Set (with components that were in extreme concentrations listed)

Glass ID	Comp	Glass ID	Comp	Glass ID	Comp	Glass ID	Comp
IG2-04	Al_2O_3	P2-3Ca-2F	F	IG2-11	Li_2O	HLW98-51R	SrO
IG2-14	Al_2O_3	P2-3Ca-3F	F	IG2-13	Li_2O	LAWA64	SrO
CVS2-63	Al_2O_3	P2-9Ca-2F	F	IG2-30	Li_2O	CU36	TiO_2
WSTC	Al_2O_3	6	Fe_2O_3	Zr-11	Li_2O	LAWA82	TiO_2
SBW1-35	Al_2O_3	8	Fe_2O_3	Zr-23	Li_2O	LAWA89	TiO_2
SBW1-40	BaO	17	Fe_2O_3	Zr-27	Li_2O	HLP-32	TiO_2
SBW1-45	BaO	EnvDSR1	Fe_2O_3	SBW1-63	Li_2O	HLP-34	TiO_2
HLWD1-09	CdO	IG1-06	K_2O	HLW98-34	MnO	HLP-75	TiO_2
HLP-47	Cl	IG1-12	K_2O	HLWD3-01	Na_2O	HLWD3-02	U_3O_8
HLP-76	Cl	IG1-13	K_2O	CU47	NiO	HLW98-50	U_3O_8
HLP-77	Cl	IG3-12	La_2O_3	LAWA76	SO_3	LAWC14	V_2O_5
202P w/o Mn-7	Cu	IG3-21	La_2O_3	SBW-11-30	SO_3	CU42	ZnO
IG2-23	F	CU52	La_2O_3	HLW98-22	SrO	LAWA42	ZnO
P2-0Ca-2F	F	IG1-07	Li_2O	HLW98-23	SrO	HLP-17	ZnO
P2-0Ca-3F	F	IG1-10	Li_2O				

The value of a model lies in its capability to predict the properties of glasses not used in model development. Therefore, a subset of the 679 glass data set was removed for use in model evaluation and validation. To select the glasses to be removed, the data were sorted by $\ln[r_B]$ values, and every fifth data point was chosen as a validation data point. This resulted in roughly 20% of the data being used to validate models. Table 5-5 lists the glasses selected for use in the validation data set. The remaining 534 glasses were used in model development.

Table 5-5. Glasses Selected for Validation of PCT Release Models

Glass ID	Glass ID	Glass ID	Glass ID	Glass ID	Glass ID	Glass ID	Glass ID
WVCM42	WVUTH103	IG2-19	CVS2-49	HG-2-2-7	BLEND 2-3611	HLW98-31	LD6-5510
WVCM45	WVDG-3	IG2-21	CVS2-58	HG-2-3-7	HM 1-3824	HLW98-62	LDM-4
WVCM47	WVDG-7	IG2-24	CVS2-66	AH-165 Al-7	HM-2-2 (4099A)	LAWA87	SBW1-02
WVUTH7	WVDG-14R	IG3-17	CVS2-75	AH-2-7	HM-3-3 (4357)	LAWA88	SBW1-19
WVUTH19	WVDG-18	IG3-30	CVS2-77	AH-5-7	HM-4-2 (5641)	LAWB39	SBW1-28
WVUTH22	WVDG-26	CVS1-4	CVS2-80	AH-7-7	PX 2-2 (4509)	LAWB41	SBW1-46
WVUTH28	HiFe3	CVS1-16	CVS2-86	AH-13-7	PX 3-2 (5818)	LAWC13	SBW1-50
WVUTH41	HiFe4	CVS1-17	CVS2-88	SFRIT1	PX 5-10 (6972)	LAWC21S	SBW1-52
WVUTH42	FY93#3	CVS1-20	CVS2-95	SFRIT2	H-GLAS-0112	PNLREF (LD6-5412)	SBW1-57
WVUTH51	FY93#4	CVS2-21	CVS2-99	202G w/o Mn-7	H-GLAS-0293	TFA-BASE (HLP-01)	SBW1-59
WVUTH53	FY93#5	CVS2-24	CVS2-100	200R-7	H-GLAS-0308	HLP-19	SBW1-60
WVUTH66	FY93#9	CVS2-25	CVS2-101	131-TDS-3A-SOPER-7	H-GLAS-0421	HLP-24	SBW-13-18.5
WVUTH67	FY94#3	CVS2-26	CVS2-102	BLEND 1.6-7	CUOE	HLP-28	SBW-14-18.5
WVUTH68	Sigma1	CVS2-37	CVS2-109	BATCH 2-1.6	CUOO	HLP-46	SBW-17-18.5
WVUTH73	Sigma3	CVS2-38	CVS2-117	BATCH 4-7 (2)	CU34	HLP-55	SBW-18-18.5
WVUTH94	IG1-11	CVS2-39	HG-1-1-7	BLEND 1-3457	Alkali5	L4-915	SBW-22-18.5
WVUTH98	IG1-38	CVS2-42	HG-2-1-7	BLEND 1-3526	HLW98-04	L8-1	SBW-25-25

5.2 Normalized Boron Release

The data set for modeling $\ln[r_B]$ was developed as described in Sections 2.0 and 5.1. A histogram of the $\ln[r_B]$ values was plotted and found to be roughly normal without significant outliers. For initial model fitting, we assumed that $\ln[r_B]$ was linear in composition, e.g.,

$$\ln[r_j] = \sum_{i=1}^{N} r_{j,i} x_i \tag{5.1}$$

where, r_j is the normalized release of the j^{th} component from glass (in g/m^2), $r_{j,i}$ and x_i are the i^{th} component r_j coefficient and mole fraction in glass, respectively, and N is the number of model components. We also assumed that required model components would be the set of components with at least one mole% in at least one glass. All other components were combined into a pseudo-component called Others.

Through an iterative process, several data points were determined to be outliers, and several model components were determined to have insignificant effects on $\ln[r_B]$. The outlying data were determined by a histogram plot of the residuals after each preliminary model fit to the data. Those data with residuals that were outside of a roughly normal distribution were considered outliers for the purpose of this model development. The resulting model is summarized in Table 5-6. Eighteen glasses—listed in Table 5-7—were excluded from the model fit as outliers.

Table 5-6. Summary of 20-Component Linear Mixture Model for $\ln[r_B]$

Comp	$r_{B,i}$	std. err.	Comp	$r_{B,i}$	std. err.	Statistic	value
Al_2O_3	-28.4828	6.08	NiO	34.4786	14.95	R^2	0.749
B_2O_3	13.7490	6.10	P_2O_5	-24.5220	8.96	R^2_{adj}	0.739
CaO	-11.5370	5.91	SiO_2	-4.3515	6.01	R^2_{pred}	0.724
F	15.9574	9.10	SO_3	75.5175	19.79	s	0.547
Fe_2O_3	-9.6922	6.45	SrO	-9.8242	15.48	min response	-2.72
K_2O	8.0550	6.27	ThO_2	-17.1074	11.13	mean response	-0.658
Li_2O	9.0610	6.10	TiO_2	-27.1564	8.26	max response	3.22
MgO	7.0305	6.24	ZnO	-3.5114	8.18	Observations	525
MnO	-17.7517	7.21	ZrO_2	-19.6106	6.14		
Na_2O	11.5079	6.17	Others	1.9089	6.00		

Table 5-7. Glasses Omitted from ln[r_B] Model as Outliers

2	CVS2-82	PX 5-5 (6839)
PX 5-8 (6884)	CVS2-84	PX 5-4 (6820)
IG1-30	CVS2-30	CVS2-76
PX 6-1 (7340)	Zr-29	CVS1-7
Ratio5	PX 5-6 (6862)	CVS2-32
PX 5-7 (6871)	PX 5-3 (6812)	IG1-37

The single component concentration ranges of ln[r_B] model data are listed in Table 5-8 and pair-wise component concentrations are shown in Figure 5-1. Generally, the correlations between components are small and the coverage of pair-wise component concentrations is good. Seven of the component pairs have correlation coefficients > |0.50| -- MnO:Fe_2O_3 (0.55), Na_2O:Li_2O (-0.64), NiO:MnO (0.56), ThO_2:Fe_2O_3 (0.54), P_2O_5:ThO_2 (0.64), F:Others (0.53), S:Others (0.51).

Table 5-8. Component Concentration Ranges for Data Used to Fit ln[r_B] Model (mole%)

Component	Min	Max	Component	Min	Max
Al_2O_3	0.00	11.29	NiO	0.00	1.47
B_2O_3	3.88	19.53	P_2O_5	0.00	1.37
CaO	0.00	12.07	SiO_2	39.28	64.19
F	0.00	3.41	SO_3	0.00	0.91
Fe_2O_3	0.00	8.08	SrO	0.00	1.92
K_2O	0.00	5.87	ThO_2	0.00	1.67
Li_2O	0.00	15.82	TiO_2	0.00	2.59
MgO	0.00	13.43	ZnO	0.00	2.54
MnO	0.00	3.43	ZrO_2	0.00	7.75
Na_2O	4.82	22.40	Others	0.00	2.49

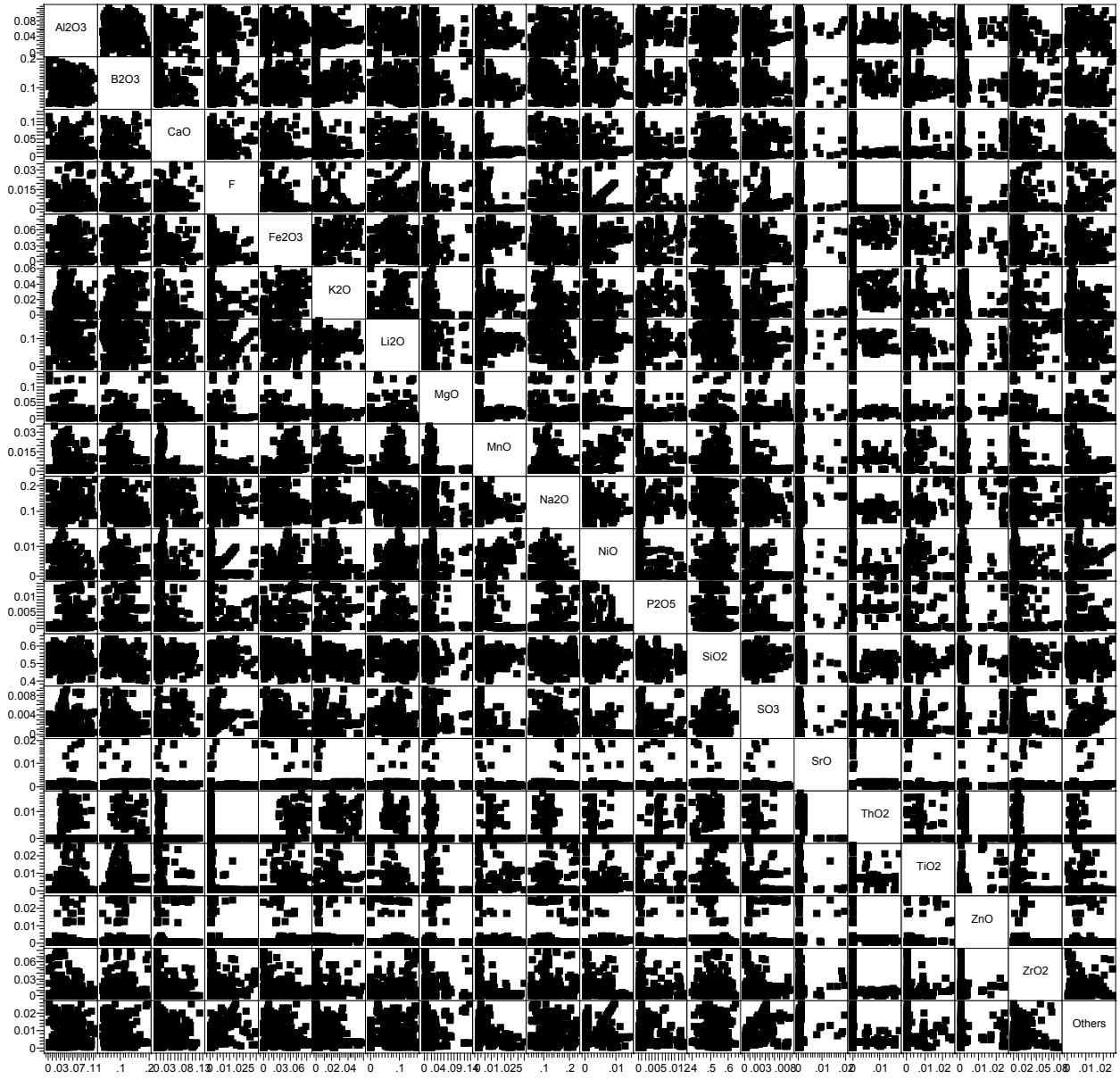

Figure 5-1. Scatter Plot Matrix for ln[r_B] Model Data Component Concentrations

Table 5-9 compares this model with two of the previously reported models. The previously reported models were those reported by Hrma et al. (1994) (CVS) and Hrma et al. (2001) (Interim). It should be noted that all three models were fit on a mole fraction of oxide component basis, and the Interim model was based on a glass composition normalized to only the model components. However, the other two, current and CVS, lumped additional components into Others. We first consider the differences in goodness of fit as judged by R^2, R^2_{adj}, and s values. The current model reports a lower R^2 value than the previous two models. However, the R^2 values are better for both the model data set (all 534 data, before removal of outliers) and for the validation data set. This discrepancy is due to the use of a significantly broader data set for the current study than those used in either the CVS or the Interim model development. As the purpose of these models is to give reasonably accurate predictions of properties from glasses over a very broad composition region, we conclude that the current model is superior to the other two. Second,

we look at the number of model coefficients. The current model uses 20 coefficients while the previous two models used 10 and 12 coefficients. An attempt was made to further reduce the number of coefficients in the model by either removing coefficients for components with relatively small concentrations in glass (SO_3, NiO, ThO_2) or removing components with relatively uncertain coefficients (those coefficients that would be within the range of the property responses if the standard error were added or subtracted to the coefficient—K_2O, MgO, Li_2O, SiO_2) or removing both. However, each attempt at removing one or more of the components resulted in a marked increase in s or in the number of outliers. Therefore, the number of coefficients stayed at 20. In earlier iterations, coefficients for BaO, V_2O_5, U_3O_8, and Cl were removed.

We also consider the coefficient values themselves. There is a reasonable match between the current coefficients, those reported earlier, and our expectations based on knowledge of the physical and chemical processes responsible for PCT release for Al_2O_3, B_2O_3, CaO, Fe_2O_3, Li_2O, SiO_2, ZrO_2, and Others. The coefficient for F, 15.957, suggests that additions of F strongly increase r_B, which matches our expectations well. The coefficient for K_2O, 8.055, suggests that additions of K_2O increase r_B, which matches our expectations well, but is different from that from the interim model, -1.547, which suggests little effect of K_2O on r_B. The coefficients for MgO from this study, 7.031, and the CVS, 7.044, match closely with our expectations that MgO increases r_B; however, that for the Interim model, 3.513, suggests that MgO has little effect on r_B. The coefficients for MnO in the current study and the interim model, -17.752 and -21.220, match fairly closely, but are difficult to explain from our current knowledge of the physical and chemical processes that control PCT release. More work will be required to further understand this result. The Na_2O coefficient in this study, 11.508, is significantly lower than those from the CVS and Interim studies, 17.258 and 17.013. While all three suggest that r_B is strongly increased by adding Na_2O, the current study suggests that the effect is not as strong as previously measured. There is no explanation for this change. The NiO coefficient, 34.479, is very high, suggesting that the addition of NiO strongly increases r_B. This is difficult to explain from our current knowledge of the physical and chemical processes that control PCT release. More work will be required to further understand this result. There is a significant difference in P_2O_5 coefficients between this study, -24.522, and the Interim model, -41.830. Both suggest a decrease in r_B, as would be expected, but this study suggests that the decrease would not be as extreme as in the Interim model. The coefficient from this study is a more moderate and likely more accurate assessment of the average effect of P_2O_5 over a broader composition region. The coefficient for SO_3, 75.517, determined only in this study, suggests that sulfur increases r_B more strongly than any other component. This is hard to justify with our current understanding of the physical and chemical processes responsible for PCT release and will require further study to verify. The coefficients for SrO, ThO_2, TiO_2, and ZnO all match expectations but were not reported previously. To summarize, most coefficients seem appropriate and reproducible between studies. The exceptions that require further study include SO_3, NiO, MnO, and possibly Na_2O. This study should be the focus of further research.

As stated repeatedly, the purpose of this model is to supply a tool for the prediction of r_B over the entire composition region expected of Hanford waste glasses. Further research, i.e., model development and possibly data generation, is required to generate models with higher precision over narrower composition regions. In addition, the exploration of other model types and forms should be considered for future study.

Table 5-9. Comparison of $\ln[r_B]$ Linear Mixture Models

Comp	Current	CVS	Interim
Al_2O_3	-28.483	-41.077	-33.419
B_2O_3	13.749	13.009	13.403
CaO	-11.537	-7.473	-9.183
F	15.957		
Fe_2O_3	-9.692	-9.027	-11.947
K_2O	8.055		-1.547
Li_2O	9.061	10.431	9.382
MgO	7.031	7.044	3.513
MnO	-17.752		-21.220
Na_2O	11.508	17.258	17.013
NiO	34.479		
P_2O_5	-24.522		-41.830
SiO_2	-4.351	-3.917	-4.106
SO_3	75.517		
SrO	-9.824		
ThO_2	-17.107		
TiO_2	-27.156		
ZnO	-3.511		
ZrO_2	-19.611	-21.246	-14.458
Others	1.909	-1.067	

Statistic	Current	CVS	Interim
As Reported			
R^2	0.749	0.806	0.814
R^2_{adj}	0.739	0.790	0.808
s	0.547		0.531
# of glasses	525	123	383
Model Data Set (534 glasses)			
$R^2_{(val)}$	0.705	0.496	0.561
$R^2_{adj, (val)}$	0.694	0.488	0.552
$s_{(val)}$	0.647	0.837	0.783
Validation Data Set (136 glasses)			
R^2_{val}	0.702	0.498	0.586
$R^2_{adj,val}$	0.653	0.462	0.549
s_{val}	0.685	0.852	0.780

5.3 Normalized Lithium Release

The data set for modeling $\ln[r_{Li}]$ was developed as described in Sections 2.0 and 5.1. Of the 534-glass model data set, only 394 reported r_{Li} values. A histogram of the $\ln[r_{Li}]$ values was plotted, and three glasses were found to be outliers (WVDG-30 and IG1-37 with $\ln[r_{Li}] < -2.5$ and Frit-131-7 with $\ln[r_{Li}] > 3$), leaving 391 glasses for initial model fitting. For initial model fitting, we assumed that $\ln[r_{Li}]$ was linear in composition as done for r_B models in Section 5.2. We also assumed that required model components would be the set of components with at least one mole% in at least one glass. All other components were combined into a pseudo-component called Others.

Through an iterative process, several data points were determined to be outliers, and several model components were determined to have insignificant effects on $\ln[r_{Li}]$. The outlying data were determined by a histogram plot of the residuals after each preliminary model fit to the data. Those data with residuals that were outside of a roughly normal distribution, estimated by gross visual interpretation, were considered outliers for the purpose of this model development. The resulting model is summarized in Table 5-10. Twenty glasses—listed in Table 5-11—were excluded from the model fit as outliers.

Table 5-10. Summary of 18 Component Linear Mixture Model for $\ln[r_{Li}]$

Comp.	$r_{Li,i}$	std. err.	Statistic	value
Al_2O_3	-28.8662	4.42	R^2	0.769
B_2O_3	11.0871	4.37	R^2_{adj}	0.757
CaO	-7.3671	4.28	R^2_{pred}	0.739
F	24.6314	7.64	s	0.485
Fe_2O_3	-10.0128	4.80	min response	-1.635
K_2O	2.9308	4.96	mean response	-0.457
Li_2O	8.9964	4.25	max response	2.09
MgO	5.3232	4.50	observations	371
MnO	-17.6948	5.41		
Na_2O	12.6156	4.34		
NiO	28.8398	12.10		
P_2O_5	-8.0281	10.95		
SiO_2	-3.9379	4.30		
SrO	-20.2103	17.11		
TiO_2	-20.2039	11.00		
ZnO	14.4925	17.43		
ZrO_2	-18.6611	4.18		
Others	0.6400	4.22		

Table 5-11. Glasses Omitted from r_{Li} Model as Outliers

PX 5-6 (6862)	CVS1-21	AH-202 Al-7	CVS2-30
P2-3Ca-1F	PX 5-5 (6839)	CVS2-32	SBW-23-25
CVS1-2	PX 5-4 (6820)	WVDG-22	SBW-23-20
CVS2-33	Ratio5	CVS1-7	SBW-23-18.5
PX 6-1 (7340)	PX 5-3 (6812)	P2-0Ca-1F	SBW-23-15

The single component concentration ranges of $\ln[r_{Li}]$ model data are listed in Table 5-12 and pair-wise component concentrations are shown in Figure 5-2. Generally, the correlations between components are small and the coverage of pair-wise component concentrations is good. Four of the component pairs have correlation coefficients > |0.50| -- MnO:Fe_2O_3 (0.51), NiO:MnO (0.56), Fe_2O_3:TiO_2 (0.57), TiO_2:K_2O (0.56), and ZnO:SrO (0.54).

Table 5-12. Component Concentration Ranges for Data Used to Fit $\ln[r_{Li}]$ Model (mole%)

Component	Min	Max	Component	Min	Max	Component	Min	Max
Al_2O_3	0.00	11.29	Li_2O	0.63	15.82	SiO_2	39.28	64.19
B_2O_3	3.88	19.53	MgO	0.00	13.43	SrO	0.00	1.92
CaO	0.00	12.07	MnO	0.00	3.43	TiO_2	0.00	2.59
F	0.00	3.41	Na_2O	4.82	22.40	ZnO	0.00	1.81
Fe_2O_3	0.00	8.08	NiO	0.00	1.47	ZrO_2	0.00	7.75
K_2O	0.00	5.56	P_2O_5	0.00	1.36	Others	0.00	3.21

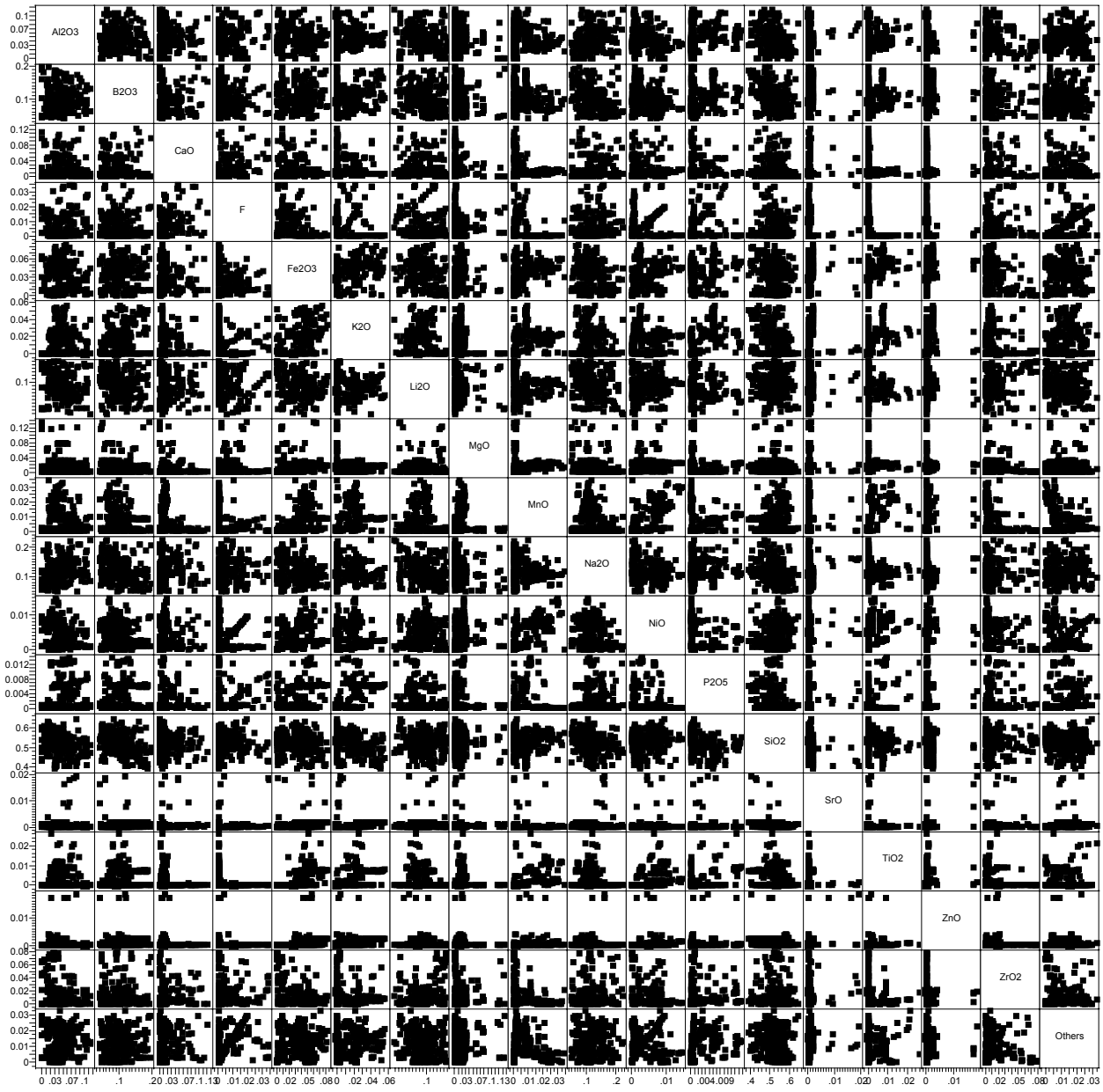

Figure 5-2. Scatter Plot Matrix for ln[r_{Li}] Model Data Component Concentrations

This model was compared with two of the previously reported models in Table 5-13. The previously reported models were those reported by Hrma et al. (1994) (CVS) and Hrma et al. (2001) (Interim). It should be noted that all three models were fit on a mole fraction of oxide component basis, and the Interim model was based on a glass composition normalized to only the model components. However, the other two, i.e., current and CVS, lumped additional components into Others. We first consider the differences in goodness of fit as judged by R^2, R^2_{adj}, and s values. The current model reports a lower R^2 value than the previous two models. However, the R^2 values are better for both the model data set—all 394 data, before removal of outliers or extreme release glasses—and for the validation data set. This discrepancy is due to the use of a significantly broader data set for the current study than those used in

either the CVS or the Interim model development. Interestingly, the R^2 for the validation data set is higher than that for the model data set. This result is due to the influence of the 20 outliers removed during the model fit. As the purpose of these models is to give reasonably accurate predictions of properties from glasses over a very broad composition region, we conclude that the current model is superior to the other two.

Second, we look at the number of model coefficients. The current model uses 18 coefficients while the previous two models used 10 and 12 coefficients. An attempt was made to further reduce the number of coefficients in the model by either removing coefficients for components with relatively small concentrations in glass (NiO) and/or components with relatively uncertain coefficients, e.g., those coefficients that would be within the range of the property responses if the standard error were added or subtracted to the coefficient—K_2O, MgO, SiO_2. However, each attempt at removing one or more of the components resulted in a marked increase in s or in the number of outliers. Therefore, the number of coefficients stayed at 18. In earlier iterations, coefficients for SO_3, ThO_2, BaO, V_2O_5, U_3O_8, and Cl were removed.

We also consider the coefficient values themselves. There is a reasonable match between the current coefficients, those reported earlier, and our expectations based on knowledge of the physical and chemical processes responsible for PCT release for Al_2O_3, B_2O_3, CaO, Fe_2O_3, Li_2O, Na_2O, SiO_2, ZrO_2 and Others. The coefficient for F, 24.631, suggests that additions of F strongly increase r_{Li}, which matches our expectations. The coefficient for K_2O, 2.931, suggests that additions of K_2O increase r_{Li}, which matches our expectations well, but is different from that from the interim model, -0.814, which suggests little effect of K_2O on r_{Li}. The coefficients for MgO from this study, 5.323, and the CVS, 4.592, match closely with our expectations that MgO increases r_{Li}; however, that for the Interim model, 1.719, suggests that MgO has no effect on r_{Li}. The coefficients for MnO in the current study and the interim model, -17.695 and -15.880, match fairly closely, but are difficult to explain from our current knowledge of the physical and chemical processes that control PCT release. More work will be required to further understand this result. The NiO coefficient, 28.840, is very high, suggesting that adding NiO strongly increases r_{Li}. This is difficult to explain from our current knowledge of the physical and chemical processes that control PCT release. More work will be required to further understand this result. There is a significant difference in P_2O_5 coefficients between this study, -8.028, and the Interim model, -31.893. Both suggest a decrease in r_{Li}, as would be expected, but this study suggests that the decrease would not be as extreme as that of the Interim model. The coefficient from this study is a more moderate and likely more accurate assessment of the average effect of P_2O_5 over a broader composition region. The coefficient for TiO_2 matches expectations but was not reported previously. The coefficients for ZnO and SrO appear to be high and low relative to expectations, 14.493 and -20.210, and have high standard errors, suggesting that more data are required to more accurately predict their effects. Interestingly, they are opposite the trend as seen in the r_{Na} model. To summarize, most coefficients seem appropriate and reproducible between studies. The exceptions that require further study include NiO, MnO, SrO, and ZnO. This study should be the focus of further research.

As stated repeatedly, the purpose of this model is to supply a tool to predict r_{Li} over the entire composition region expected of Hanford waste glasses. Further research, i.e., model development and possibly data generation, is required to generate models with higher precision over narrower composition regions. In addition, the exploration of other model types and forms should be considered for future study.

Table 5-13. Comparison of r_{Li} Models

	Current	CVS	Interim
Al_2O_3	-28.866	-36.078	-29.999
B_2O_3	11.087	11.044	11.238
CaO	-7.367	-4.629	-6.144
F	24.631		
Fe_2O_3	-10.013	-12.051	-13.028
K_2O	2.931		-0.814
Li_2O	8.996	8.487	9.279
MgO	5.323	4.592	1.719
MnO	-17.695		-15.880
Na_2O	12.616	13.719	13.404
NiO	28.840		
P_2O_5	-8.028		-31.893
SiO_2	-3.938	-2.904	-3.431
SrO	-20.210		
TiO_2	-20.204		
ZnO	14.493		
ZrO_2	-18.661	-20.152	-12.906
Others	0.640	0.247	

Statistic	Current	CVS	Interim
As Reported			
R^2	0.769	0.785	0.797
R^2_{adj}	0.757	0.768	0.791
s	0.485		0.468
Model Data Set (394 glasses)			
R^2	0.692	0.603	0.643
R^2_{adj}	0.678	0.593	0.633
s	0.620	0.697	0.662
Validation Data Set (100 glasses)			
R^2	0.727	0.599	0.667
R^2_{adj}	0.670	0.559	0.625
s	0.591	0.683	0.630

5.4 Normalized Sodium Release

The data set for modeling $\ln[r_{Na}]$ was developed as described in Sections 2.0 and 5.1. Of the 534-glass model data set, only 484 reported r_{Na} values. A histogram of the $\ln[r_{Na}]$ values was plotted, and three glasses were found to be outliers (Frit-131-7, CVS2-82, and CVS2-83 with $\ln[r_{Na}] > 3$), leaving 481 glasses for initial model fitting. For initial model fitting, we assumed that $\ln[r_{Na}]$ was linear in composition as done for r_B and r_{Li} models in Section 5.2. We also assumed that required model components would be the set of components with at least one mole% in at least one glass. All other components were combined into a pseudo-component called Others.

Through an iterative process, several data points were determined to be outliers, and several model components were insignificant. The outlying data were determined by a histogram plot of the residuals after each preliminary model fit to the data. Those data with residuals that were outside of a roughly normal distribution, estimated by gross visual interpretation, were considered outliers for the purpose of this model development. The resulting model is summarized in Table 5-14. Thirty-six glasses were excluded from the model fit as outliers—listed in Table 5-15.

Table 5-14. Summary of 19-Component Linear Mixture Model for Ln[r_{Na}]

Comp	$r_{Na,i}$	std. err.	Comp	$r_{Na,i}$	std. err.	Statistic	Value
Al_2O_3	-27.3698	4.64	NiO	39.9792	11.93	R^2	0.772
B_2O_3	8.9811	4.61	P_2O_5	-19.3508	8.18	R^2_{adj}	0.762
CaO	-4.0404	4.39	SiO_2	-4.6689	4.48	R^2_{pred}	0.747
F	11.9897	6.58	SrO	17.3596	13.18	s	0.446
Fe_2O_3	-11.5968	4.98	TiO_2	-30.9056	7.20	min response	-2.749
K_2O	11.8066	5.14	ZnO	-21.4935	6.03	mean response	-0.710
Li_2O	7.1754	4.55	ZrO_2	-17.0450	4.68	max response	2.64
MgO	9.0581	4.71	SO_3	49.9505	18.07	observations	445
MnO	-11.3707	5.42	Others	-1.9870	4.47		
Na_2O	15.1889	4.55					

Table 5-15. Glasses Omitted from r_{Na} Model as Outliers

CVS2-114	Zr-29	CVS1-21	CVS2-90	SBW-23-25	PX 5-3 (6812)
Ratio5	CVS2-1	PX 5-8 (6884)	SBW-23-15	SBW-23-20	PX 5-4 (6820)
24	PX 5-2 (6795)	V1M2 6 32 011 P1	CVS2-32	SBW-23-18.5	CVS2-33
CVS2-115	CVS2-53	V1M4 6 32 088 P1	HLP-30	CVS2-76	CVS2-30
CU41	V1M4 6 32 096 P2	5	PX 5-7 (6871)	PX 5-5 (6839)	PX 6-1 (7340)
CVS2-84	CVS2-6	CVS1-7	2	PX 5-6 (6862)	IG1-37

The single component concentration ranges of ln[r_{Na}] model data are listed in Table 5-16 and pair-wise component concentrations are shown in Figure 5-3. Generally, the correlations between components are small and the coverage of pair-wise component concentrations is good. Three of the component pairs have correlation coefficients > |0.50| -- MnO:Fe_2O_3 (0.54), Na_2O:Li_2O (-0.64), and NiO:MnO (0.65).

Table 5-16. Component Concentration Ranges for Data Used to Fit ln[r_{Na}] Model (mole%)

Component	Min	Max	Component	Min	Max
Al_2O_3	0.00	11.29	NiO	0.00	1.47
B_2O_3	3.88	19.53	P_2O_5	0.00	1.36
CaO	0.00	12.07	SiO_2	39.28	64.19
F	0.00	3.41	SO_3	0.00	0.88
Fe_2O_3	0.00	8.08	SrO	0.00	1.92
K_2O	0.00	5.87	TiO_2	0.00	2.59
Li_2O	0.00	15.82	ZnO	0.00	2.54
MgO	0.00	13.43	ZrO_2	0.00	7.75
MnO	0.00	3.43	Other	0.00	2.64
Na_2O	4.82	22.40			

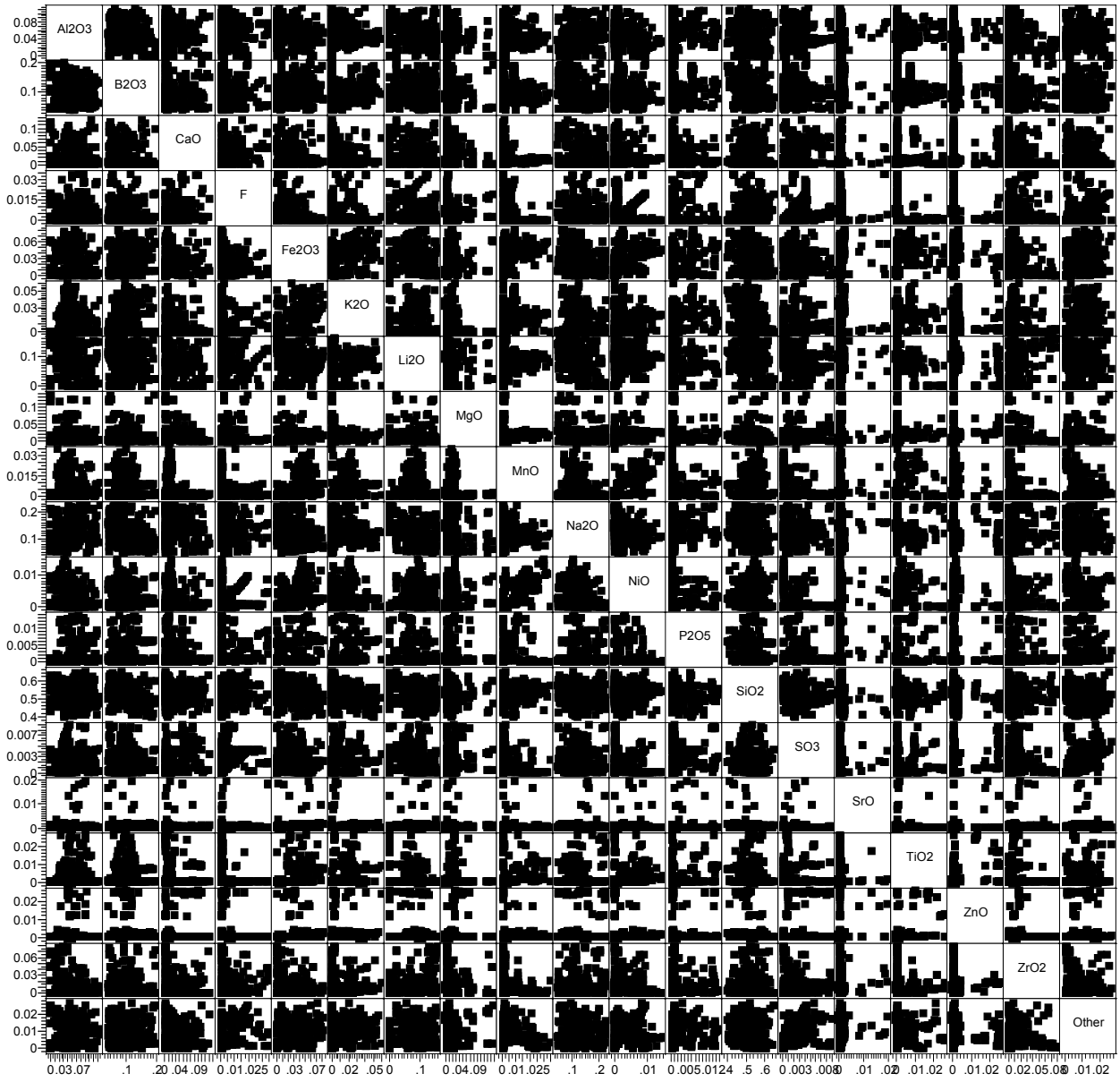

Figure 5-3. Scatter Plot Matrix for ln[r_{Na}] Model Data Component Concentrations

This model was compared with two of the previously reported models in Table 5-17. The previously reported models were those reported by Hrma et al. (1994) (CVS) and Hrma et al. (2001) (Interim). It should be noted that all three models were fit on a mole fraction of oxide component basis, and the Interim model was based on a glass composition normalized to only the model components, while the other two, current and CVS, lumped additional components into Others. We first consider the differences in goodness of fit as judged by R^2, R^2_{adj}, and s values. The current model reports a lower R^2 value than the previous two models. However, the R^2 values are better for both the model data set, all 484 data, before removal of outliers or extreme release glasses, and for the validation data set. This discrepancy is due to the use of a significantly broader data set for the current study than those used in either the CVS or

the Interim model development. Interestingly, the R^2 for the validation data set is higher than that for the model data set. This result is due to the influence of the 36 outliers removed during the model fit. As the purpose of these models is to give reasonably accurate predictions of properties from glasses over a very broad composition region, we conclude that the current model is superior to the other two. Second, we look at the number of model coefficients. The current model uses 19 coefficients while the previous two models used 10 and 12 coefficients. An attempt was made to further reduce the number of coefficients in the model by either removing coefficients for components with relatively small concentrations in glass (NiO, SO_3) or removing components with relatively uncertain coefficients, e.g., those coefficients that would be within the range of the property responses if the standard error were added or subtracted to the coefficient (CaO, Li_2O, SiO_2, SrO) or removing both. However, each attempt at removing one or more of the components resulted in a marked increase in s or in the number of outliers. Therefore, the number of coefficients stayed at 19. In earlier iterations, coefficients for ThO_2, BaO, V_2O_5, U_3O_8, and Cl were removed.

We also consider the coefficient values themselves. There is a reasonable match between the current coefficients, those reported earlier, and our expectations based on knowledge of the physical and chemical processes responsible for PCT release for Al_2O_3, B_2O_3, Fe_2O_3, Li_2O, Na_2O, SiO_2, ZrO_2 and Others. The coefficient for F, 11.990, suggests that additions of F strongly increase r_{Na}, which matches our expectations. The coefficient for K_2O, 11.807, suggests that additions of K_2O increase r_{Na}, which matches our expectations well, but is different from that from the interim model, 2.363, which suggests little effect of K_2O on r_{Na}. The coefficients for MgO from this study, 9.058, and the CVS, 7.483, match closely with our expectations that MgO increases r_{Na}; however, that for the Interim model, 3.549, suggests that MgO has little effect on r_{Na}. The coefficients for MnO in the current study and the interim model, -11.371 and -16.419, match fairly closely, but are difficult to explain from our current knowledge of the physical and chemical processes that control PCT release. More work will be required to further understand this result. The NiO coefficient, 39.979, is very high, suggesting that adding NiO strongly increases r_{Na}. This is difficult to explain from our current knowledge of the physical and chemical processes that control PCT release. More work will be required to further understand this result. There is a significant difference in P_2O_5 coefficients between this study, -19.351, and the Interim model, -39.952. Both suggest a decrease in r_{Na}, as would be expected, but this study suggests that the decrease would not be as extreme as in the Interim model. The coefficient from this study is a more moderate and likely more accurate assessment of the average effect of P_2O_5 over a broader composition region. The coefficient for SO_3, 49.951, determined only in this study, suggests that sulfur increases r_{Na} more strongly than any other component. This is hard to justify with our current understanding of the physical and chemical processes responsible for PCT release and will require further study to verify. The coefficients for SrO and ZnO appear to be high and low relative to expectations, 17.360 and -21.493, and to have high standard errors, suggesting that more data are required to more accurately predict their effects. Interestingly, they are opposite the trend as seen in the r_{Li} model. The coefficient for TiO_2 matches expectations but was not reported previously. To summarize, most coefficients seem appropriate and reproducible between studies. The exceptions that require further study include SO_3, NiO, ZnO, SrO, and MnO. This study should be the focus of further research.

As stated repeatedly, the purpose of this model is to supply a tool to predict r_{Na} over the entire composition region expected of Hanford waste glasses. Further research (model development and possibly data generation) is required to generate models with higher precision over narrower composition

regions. In addition, the exploration of other model types and forms should be considered for future study.

Table 5-17. Comparison of r_{Na} Models

	Current	CVS	Interim
Al_2O_3	-27.370	-41.070	-32.668
B_2O_3	8.981	10.237	9.558
CaO	-4.040	-1.770	-3.488
F	11.990		
Fe_2O_3	-11.597	-10.975	-10.257
K_2O	11.807		2.363
Li_2O	7.175	8.688	7.434
MgO	9.058	7.483	3.549
MnO	-11.371		-16.419
Na_2O	15.189	18.937	18.794
NiO	39.979		
P_2O_5	-19.351		-39.952
SiO_2	-4.669	-3.994	-4.243
SO_3	49.951		
SrO	17.360		
TiO_2	-30.906		
ZnO	-21.493		
ZrO_2	-17.045	-22.752	-16.091
Others	-1.987	-2.825	

Statistic	Current	CVS	Interim
As reported			
R^2	0.772	0.840	0.824
R^2_{adj}	0.762	0.828	0.819
s	0.446		0.474
Model data set (484 glasses)			
$R^2_{(val)}$	0.696	0.511	0.561
$R^2_{adj,(val)}$	0.685	0.502	0.550
$s_{(val)}$	0.610	0.767	0.729
Validation data set (101 glasses)			
R^2_{val}	0.711	0.641	0.653
$R^2_{adj, val}$	0.652	0.605	0.610
s_{val}	0.649	0.691	0.687

6.0 Models for Molar Volume/Density

This section discusses initial data evaluation and screening for molar volume/density as well as processes for converting the composition of samples, initially developing models, and evaluating and selecting models.

6.1 Initial Data Evaluation and Screening

Out of 2001 glasses in the database, 392 had density data. Before modeling density, some glasses were removed from the data set because of the characteristics that are considered undesirable for density modeling. These characteristics include glasses a) identified in the database as multi-phase, i.e., crystallized or amorphous phase separated, b) with extreme density values, and c) with extreme component concentrations. Justifications for removing these glasses are a) the density of glasses with crystalline phases can be significantly different from those of single-phase glasses, b) glasses with high density value could degrade predictive performance of models, and c) glasses with extreme component concentration values can be very influential in developing property-composition models. Glasses with measured densities ≥ 3.15 g/cm^3 were not used for modeling; the remaining glasses have densities < 3 g/cm^3. A summary of the glasses deleted from the density data set during the above data screening is in Table 6-1. This left a total of 368 glasses for use in the density-composition modeling. Table 6-1 also contains three glasses deleted later as model outliers, which will be explained in Section 6.3.2.

Regarding multi-phase glasses, it should be noted that most of the glasses in the database did not have information indicating whether they were single-phase or multi-phase. Hence, some multi-phase glasses could remain in the subsets of glasses used to develop density models. On the other hand, the glasses identified as multi-phase do not have information on the amount of crystalline phases. Hence, some multi-phase glasses could have a very small fraction of crystals so that the effect on density may be virtually negligible.

6.2 Composition Conversion

The same procedure as in Section 3.2 to convert mass fractions to mole fractions and to combine like oxides into groups was applied to the density data set. After forming the combined components, the 368 glass compositions were expressed as normalized mole fractions of 48 components. The mole fractions ranges of these 48 components are listed Table 6-2. Those components with concentrations greater than 1.0 mole% in at least one glass were first considered as possible model components. However, components without a sufficient number of glasses with reasonable distribution, i.e., Bi_2O_3, Cl, Cr_2O_3, and V_2O_5, were excluded from the model components—leaving the 22 components from Al_2O_3 to UO_x in Table 6-2.

Table 6-1. Glasses Deleted during Screening for Density Model Development (composition expressed in mole fraction)

Glass	Study	Reason
IG2-01	INEEL CVS Phase 2	Multi-phase
IG2-03	INEEL CVS Phase 2	Multi-phase
IG2-05	INEEL CVS Phase 2	Multi-phase
IG2-06	INEEL CVS Phase 2	Multi-phase
IG2-07	INEEL CVS Phase 2	Multi-phase
IG2-09	INEEL CVS Phase 2	Multi-phase
IG2-10	INEEL CVS Phase 2	Multi-phase
IG2-14	INEEL CVS Phase 2	Multi-phase
IG2-17	INEEL CVS Phase 2	Multi-phase
IG2-18	INEEL CVS Phase 2	Multi-phase
IG2-22	INEEL CVS Phase 2	Multi-phase
IG2-27	INEEL CVS Phase 2	Multi-phase
IG2-34	INEEL CVS Phase 2	Multi-phase
IG3-03	INEEL CVS Phase 3	Multi-phase
IG3-04	INEEL CVS Phase 3	Multi-phase
IG3-05	INEEL CVS Phase 3	Multi-phase
IG3-07	INEEL CVS Phase 3	Multi-phase
IG3-09	INEEL CVS Phase 3	Multi-phase
IG3-13	INEEL CVS Phase 3	Multi-phase
HLWMS-11	RPP-WTP HLW Formulation	$\rho > 3$ g/cm^3 (3.37)
HLW99-05	RPP-WTP HLW Formulation	$\rho > 3$ g/cm^3 (3.15)
IG2-12	INEEL CVS Phase 2	High F = 0.1828, for all other glasses $F \leq 0.1137$
HLW98-34	RPP-WTP HLW Formulation	High SrO = 0.0495, for all others $SrO \leq 0.0278$
HLP-52	HLP glasses	$B_2O_3 = 0$, for all others $B_2O_3 \geq 0.0274$
HLW99-08	RPP-WTP HLW Formulation	Outlier
HLW99-13	RPP-WTP HLW Formulation	Outlier
SPA-43	SPA Glasses	Outlier

Table 6-2. Mole Fraction Range for Components in Density Model Data Glasses

Component	Min	Max	Component	Min	Max	Component	Min	Max
Al_2O_3	0.0000	0.1325	ZnO	0.0000	0.0369	I	0.0000	0.0007
B_2O_3	0.0274	0.2113	BaO	0.0000	0.0213	MoO_3	0.0000	0.0062
CaO	0.0000	0.1445	CdO	0.0000	0.0170	PbO	0.0000	0.0033
Fe_2O_3	0.0000	0.0737	LN_2O_3	0.0000	0.0111	PdO	0.0000	0.0007
K_2O	0.0000	0.0682	ThO_2	0.0000	0.0106	Rb_2O	0.0000	0.0003
Li_2O	0.0000	0.1922	UO_x	0.0000	0.0220	ReO_x	0.0000	0.0003
MgO	0.0000	0.1342	Ag_2O	0.0000	0.0008	Rh_2O_3	0.0000	0.0002
Na_2O	0.0451	0.2830	As_2O_3	0.0000	0.0007	RuO_2	0.0000	0.0014
NiO	0.0000	0.0292	Bi_2O_3	0.0000	0.0115	Sb_2O_x	0.0000	0.0007
P_2O_5	0.0000	0.0189	Br	0.0000	0.0006	SeO_2	0.0000	0.0020
SiO_2	0.3276	0.6417	Cl	0.0000	0.0166	SnO_2	0.0000	0.0007
ZrO_2	0.0000	0.0792	CoO	0.0000	0.0020	SO_3	0.0000	0.0085
F	0.0000	0.1137	Cr_2O_3	0.0000	0.0121	TeO_2	0.0000	0.0009
MnO_x	0.0000	0.0621	Cs_2O	0.0000	0.0007	Tl_2O_3	0.0000	0.0003
SrO	0.0000	0.0278	CuO	0.0000	0.0023	V_2O_5	0.0000	0.0213
TiO_2	0.0000	0.0739	Ga_2O_3	0.0000	0.0018	WO_3	0.0000	0.0006

Table 6-3 shows the composition range of 368 glasses in mass fraction. The components included in LN_2O_3 were separately shown in Table 6-3.

Table 6-3. Mass Fraction Range for Components in Density Model Data Glasses

Component	Min	Max	Component	Min	Max	Component	Min	Max
Al_2O_3	0.0000	0.2043	CdO	0.0000	0.0300	CuO	0.0000	0.0027
B_2O_3	0.0300	0.2001	ThO_2	0.0000	0.0410	Ga_2O_3	0.0050	0.0050
CaO	0.0000	0.1200	UO_3	0.0000	0.0847	I	0.0000	0.0013
Fe_2O_3	0.0000	0.1577	Ce_2O_3	0.0000	0.0044	MoO_3	0.0000	0.0135
K_2O	0.0000	0.0993	Gd_2O_3	0.0000	0.0007	PbO	0.0000	0.0100
Li_2O	0.0000	0.0894	La_2O_3	0.0000	0.0500	PdO	0.0000	0.0014
MgO	0.0000	0.0800	Nd_2O_3	0.0000	0.0513	Rb_2O	0.0000	0.0009
Na_2O	0.0450	0.2514	Pr_6O_{11}	0.0000	0.0019	ReO_2	0.0000	0.0011
NiO	0.0000	0.0300	Sm_2O_3	0.0000	0.0009	Rh_2O_3	0.0000	0.0009
P_2O_5	0.0000	0.0402	Y_2O_3	0.0000	0.0009	RuO_2	0.0000	0.0027
SiO_2	0.2801	0.6044	Ag_2O	0.0000	0.0025	Sb_2O_3	0.0000	0.0032
ZrO_2	0.0000	0.1548	As_2O_3	0.0000	0.0020	SeO_2	0.0000	0.0036
F	0.0000	0.0334	Bi_2O_3	0.0000	0.0700	SnO_2	0.0000	0.0016
MnO	0.0000	0.0600	Br	0.0005	0.0008	SO_3	0.0000	0.0110
SrO	0.0000	0.0405	Cl	0.0000	0.0085	TeO_2	0.0000	0.0020
TiO_2	0.0000	0.0859	CoO	0.0000	0.0020	Tl_2O_3	0.0000	0.0020
ZnO	0.0000	0.0430	Cr_2O_3	0.0000	0.0297	V_2O_5	0.0000	0.0570
BaO	0.0000	0.0470	Cs_2O	0.0000	0.0027	WO_3	0.0000	0.0020

6.3 Initial Model Development

6.3.1 General Forms of the Density and Molar Volume Models

The composition model for density can have different forms, depending on which properties are used for modeling, i.e., density, molar volume, or specific volume. Molar volume (V) is expressed as

$$V = \frac{\sum_{i=1}^{N} M_i x_i}{\rho} \tag{6.1}$$

where

M_i = molecular weight of i-th oxide component
x_i = mole fraction of i-th component
N = number of oxide component in glass
ρ = density of glass.

When the mass fraction is used for glass composition, it is common to use the specific volume ($1/\rho$).

The general form of the composition models for ρ or V can be written as

$$\rho = \sum_{i=1}^{N} \rho_i x_i \text{ , or } V = \sum_{i=1}^{N} V_i x_i \tag{6.2}$$

where ρ_i and V_i are the $_i$-th component partial molar density and partial molar volume. When the specific volume is used, x_i is replaced by the mass fraction, g_i, in Equation 6.2. These models are linear-mixture models of the form (1.4) presented in Section 1.3.

Only a limited number of components can be included in modeling, although the present glass composition-property database is based on 71 glass components, mainly because some components are present only in a very small number of glasses. For components not included in the model, two different approaches can be applied: 1) use an Others component as a sum of all the components not included in the model and 2) use compositions normalized to sum to one after deleting the components not included in the model. Therefore, the density models of four different forms are considered: 1) ρ-based with the Others component, 2) V-based with the Others component, 3) ρ-based with normalized composition, and 4) V-based with normalized composition.

The advantage of using density is its simplicity compared to using molar volume, which requires a conversion from density for model prediction. However, using molar volume has an advantage in that it can lead to a better understanding of the relation between the model coefficients and the effect of each component on glass structure. This can lead to estimation of the component coefficients that are not available from the model fit or in the literature to make the model more applicable to wider composition regions.

6.3.2 Selection of Model Forms for Density Modeling

To make a fair comparison between models, the 368 glasses in the density data set after the first screening were sorted in the order of density (then glass ID) and were divided into two subsets by reserving every fifth glass for use in validating models. This process resulted in 73 validation glasses. The other 295 glasses were used for model development, i.e., model glasses. The following 15 components selected as model components in preliminary modeling studies[(v)] were used to evaluate the different model forms: Al_2O_3, B_2O_3, CaO, Fe_2O_3, K_2O, Li_2O, MgO, Na_2O, SiO_2, ZrO_2, F, MnO_x, SrO, TiO_2, and ZnO.

The results of the model statistics for four different model forms are summarized in Table 6-4. The R^2_{val} is calculated for glasses that were not used in the model development but reserved for validation. When comparing the models calculated based on different properties, it is necessary to compare the R^2 statistics that were calculated based on the same property, in this case, the density. For models based on molar volume, the R^2 statistics calculated based on density are also included in Table 6-4. The R^2 statistics that were calculated based on density are more important because the main objective of the modeling efforts is to be able to predict the density.

The models using an Others component as the sum of all the components not included in the model have better R^2 statistics than the models using compositions normalized to sum to one after deleting the components not included in the model. This suggests that one or more components included in Others have an effect on density. Models for density and molar volume when an Others component is used have R^2 values almost the same, but the molar-volume model had a better R^2_{val} value. In summary, the molar-volume–based model using an Others component performed best.

Table 6-4. Comparison of Model Statistics for Different Density Model Forms from the Reduced Data Set, where 20% of Data were Not Included in the Model Development But Were Used for Model Validation

	Model			
	Using Others Component		**Using Normalized Composition**	
Model Statistics	**Density**	**Molar Volume**	**Density**	**Molar Volume**
Number of glasses	295	295	295	295
R^2	0.900	0.930	0.765	0.924
R^2_{adj}	0.895	0.927	0.752	0.920
R^2_{val}	0.876	0.941	0.731	0.930
R^2 Statistics Calculated Based on Density				
R^2	0.900	0.893	0.765	0.883
R^2_{adj}	0.895	0.888	0.752	0.876
R^2_{val}	0.876	0.916	0.731	0.900

(a) The data set used in preliminary modeling studies had 248 glasses and contained the glasses of which density was re-measured later because some of their data were suspect (Hanford CVS 1 and 2 glasses).

One thing to note in Table 6-4 is that in molar-volume models, the R^2_{val} is larger than the model R^2 values. This rather unusual result seems to be caused by a few outlying data points included in model glasses. Table 6-5 shows the R^2 comparisons when all 368 the glasses were used for model calculation. There was little difference between density-based and *V*-based models. In this model, however, it was found that the three glasses that had been poorly predicted had a strong influence on the model in *V*-based models. So the model calculations were also compared for this reduced data set after removing these three glasses. By removing the three glasses, the R^2 increased slightly. For the final density modeling, these three glasses were deleted (as listed in Table 6-1). In conclusion, the models with an Others component are better than the models with normalized compositions. The *V*-based model is at least equal to or better than the density-based model.

Table 6-5. Comparison of Model Statistics for Different Model Forms for Different Data Sets; all R^2 Statistics are Calculated Based on Density

	Model			
	Using Others Component		**Using Normalized Composition**	
Model Statistics	**Density**	**Molar Volume**	**Density**	**Molar Volume**
Using all 368 glasses				
Number of glasses	368	368	368	368
R^2	0.899	0.900	0.765	0.889
R^2_{adj}	0.894	0.895	0.752	0.883
Using 365 glasses after deleting three outliers				
Number of glasses	365	365	365	365
R^2	0.894	0.910	0.778	0.897
R^2_{adj}	0.890	0.906	0.766	0.893

In selecting the proper model forms, the simplicity of the density-based model is appealing from a practical-application point of view. However, the better performance and other benefits discussed in Section 6.3.1 can justify the use of a molar-volume–based model. Hence, the molar-volume–based model with an Others component was selected for density modeling. The 365 glasses after deleting three outliers were used for model development in the following section.

6.4 Model Evaluation and Selection

6.4.1 Final Density Model Based on Molar Volume

The molar-volume model that used 365 glasses was initially developed with 23 components (22 components selected in Section 6.2 plus Others), which were identified as the maximum number of components that have reasonable ranges of mole fractions and distributions of mol-fraction values within the range to consider including them in the density models. Then the next models were calculated based on the reduced number of components, removing the component(s) of higher uncertainty or of less importance. As mentioned earlier, see Piepel and Redgate (1997) for description of more rigorous method for component removal from model. Table 6-6 shows which components were included in the 23-, 21-, 20-, 18-, 17-, and 16-component molar-volume–based models by providing model coefficient values, i.e.,

partial molar volumes. Summary statistics from the regression analysis for each of these models based on molar volume and R^2 statistics calculated based on density are also included in Table 6-6.

Table 6-6. Summary Statistics for Molar-Volume–Based Models for Density Modeling

	Model					
Component	**23-Comp.**	**21-Comp.**	**20-Comp.**	**18-Comp.**	**17-Comp.**	**16-Comp.**
Al_2O_3	46.169	46.084	46.076	46.149	45.551	46.148
B_2O_3	30.268	30.200	30.068	30.048	30.095	29.899
CaO	14.848	14.891	15.231	15.214	16.211	15.727
Fe_2O_3	40.287	39.833	39.215	39.158	37.110	38.706
K_2O	35.166	35.879	36.855	37.741	35.147	36.126
Li_2O	10.018	9.926	9.946	9.943	9.871	9.581
MgO	13.076	12.967	13.105	13.028	13.376	12.863
Na_2O	19.849	19.954	19.797	19.834	20.033	19.825
SiO_2	25.264	25.319	25.341	25.316	25.509	25.489
ZrO_2	26.494	26.647	27.275	27.081	26.861	27.042
F	5.704	6.634	7.788	7.526	9.262	7.422
MnO_x	10.611	11.164	12.566	13.175		13.142
SrO	14.703	17.745	18.167	17.611	10.733	16.744
TiO_2	18.458	18.213	17.913	17.964	16.456	17.170
ZnO	14.059	15.545	13.884	15.069	19.312	18.398
NiO	30.007	20.500	13.773	12.668	21.202	
P_2O_5	64.435	63.405				
BaO	22.767	20.115	17.309	18.866	24.713	
CdO	3.757					
Ln_2O_3	50.709	43.808	29.078			
ThO_2	82.812					
UO_x	32.308	39.944	42.121			
Others	41.782	34.392	44.749	42.812	29.431	32.725
Model Statistics						
Number of Glasses	365	365	365	365	365	365
R^2	0.954	0.952	0.949	0.949	0.934	0.942
R^2_{adj}	0.951	0.949	0.946	0.946	0.931	0.939
R^2_{pred}	0.942	0.944	0.942	0.942	0.924	0.935
s (RMSE)	0.2453	0.2507	0.2574	0.2577	0.2921	0.2729
R^2 Statistics Based on Density						
R^2	0.930	0.926	0.922	0.921	0.896	0.910
R^2_{adj}	0.925	0.922	0.918	0.918	0.892	0.906

When selecting the components to remove for the next model with a reduced number of components, the following were considered: 1) the ratio of a component coefficient to its standard deviation,[w] 2) the comparison of component coefficients with the partial molar volume data found in literature, and 3) the relative importance of the components to the application for Hanford waste. For example, the partial molar volume for CdO and ThO_2 in the 23-component model in Table 6-6 were unreasonably low or high compared to the literature values (Table 6-7 below), indicating that these components may not be appropriate for inclusion in the model component, which was also supported by the low ratio of the component coefficient to its standard deviation—not shown in Table 6-6.

In selecting the components for the final model, consideration was given that it would be useful to have as many components as possible with reasonably low uncertainty, i.e., reliability. Before making final selection of the model components, the model coefficients obtained in this study were compared with literature data by Appen (1970). The partial molar volumes for 34 components were published, which are reproduced in Table 6-7. For B_2O_3, SiO_2, TiO_2, CdO, and PbO, the coefficients are given as a range of coefficients, which vary with the range of specified component compositions.

Table 6-7. Partial Molar Volumes for Glass Components Published by Appen (1970)

Component	Coefficient	Component	Coefficient
Al_2O_3	40.4	Na_2O	20.2
B_2O_3	18.5-38.0	Nb_2O_5	56
BaO	22	NiO	13
BeO	7.8	PbO	21.0-23.5
Bi_2O_3	45	Rb_2O	43
CaO	14.4	Sb_2O_3	47
CdO	17.0-18.2	Sc_2O_3	28
CoO	14.5	SiO_2	26.1-27.25
Cs_2O	47	SnO_2	28.8
FeO	16.5	SrO	17.5
Ga_2O_3	42.5	Ta_2O_3	52
HfO_2	27.5	ThO_2	31.7
K_2O	34.1	TiO_2	19.0-22.5
Li_2O	11	Tl_2O	63
La_2O_3	40	Y_2O_3	35
MgO	12.5	ZnO	14.5
MnO	17.2	ZrO_2	23

The coefficients obtained from the 21-component model are compared with Appen's coefficient in Figure 6-1. For those components with the range of coefficient values, i.e., CdO, PbO, SiO_2, and TiO_2, center values were used in Figure 6-1 with the error bars indicating the range of coefficients. The coefficient of La_2O_3 in Appen (1970) was used to compare with that of LN_2O_3 in the model fit, and the

(w) The ratio of a coefficient to its standard error forms a t-statistic, which is used to assess whether the coefficient is statistically different from zero. In a linear-mixture model, this hypothesis is not directly related to the significance of the effect of the component coefficient. However, by considering several other things, this information can be considered in reducing the number of components in a model.

coefficient of FeO was multiplied by two to compare with that of Fe_2O_3 in the model fit. Also included in Figure 6-1 are two lines. One is the 45-degree line representing the perfect agreement between Appen's and linear mixture model coefficients. The other is the least-squares fit between the two sets of coefficients, with equation $y = 0.7982x + 3.6581$ and $R^2 = 0.9216$. In the least-squares fit for the components with coefficient ranges, the center value was used.

As can be seen in Figure 6-1, the agreement between two coefficient sets is reasonable except for two components, MnO_x and NiO. This may indicate that the reliability of the model coefficients for MnO_x and NiO obtained in the 21-component model may not be good enough because of the lack of a sufficient data range. The similar comparison for the 18-component model is shown in Figure 6-2, with the fitted line given by $y = 0.7802x + 4.2796$ with $R^2 = 0.9548$. Comparing Figure 6-2 with Figure 6-1 shows better agreement between the 18-component model and Appen coefficients compared to the 21-component model, which is also supported by a slighltly larger R^2 value. The discrepancy in MnO_x and NiO coefficients is decreased.

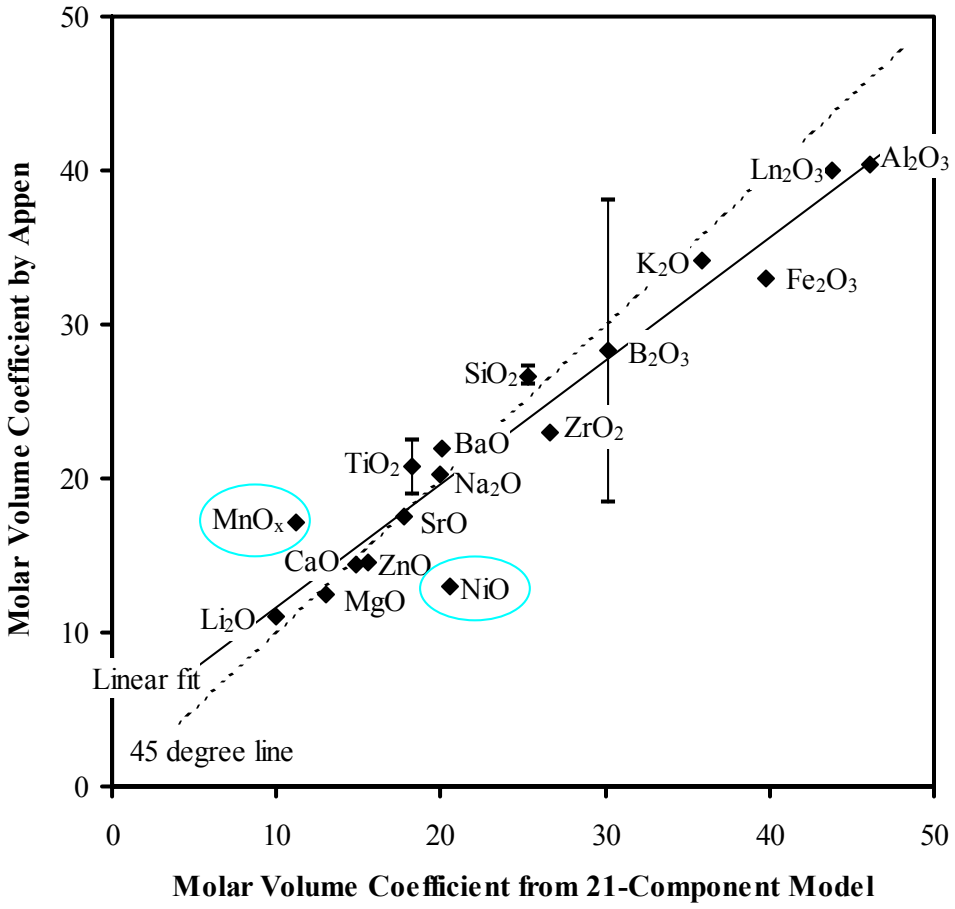

Figure 6-1. Plot of Appen's Molar Volume Coefficients Versus Model Fit Coefficients from the 21-Component Linear Mixture Model (the bars on selected points cover range of reported values with mean values used as data points)

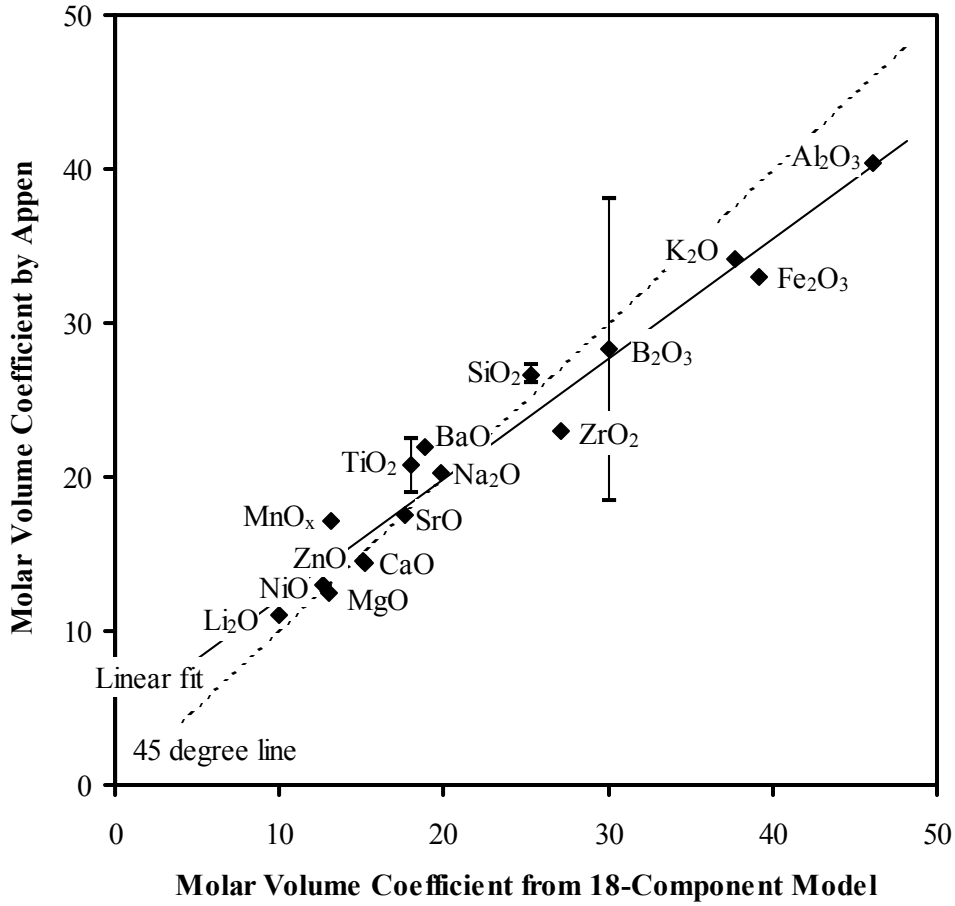

Figure 6-2. Plot of Appen's Molar Volume Coefficients versus Model Fit Coefficients from the 18-Component Linear Mixture Model (error bars cover range of reported values with mean values used as data points)

In both Figure 6-1 and Figure 6-2, the linear-fit line deviates from 45-degree line, indicating that there are differences in the partial molar volumes determined by fitting a linear-mixture model as compared to Appen's values. The linear-mixture model coefficients are significant extrapolations of the partial molar volumes because the data used to fit the linear-mixture models are for a constrained subspace of the full mixture space. The overall agreement is good considering that Appen's coefficients were mainly obtained from 3 to 5 component glasses, which may imply that the coefficients for those components can be extrapolated from rather simple glasses to the multi-component HLW glasses.

Based on the above analysis, the 18-component model was selected as the final model. The model coefficients, standard errors, and the regression statistics are included in Table 6-8.

Table 6-8. Model Coefficients and Standard Errors for the Final 18-Component Linear Mixture Model for Molar Volume

	Final Molar Volume Model	
Component	**Coefficient**	**Std. Error**
Al_2O_3	46.149	0.577
B_2O_3	30.048	0.342
CaO	15.214	0.456
Fe_2O_3	39.158	0.947
K_2O	37.741	1.381
Li_2O	9.943	0.347
MgO	13.028	0.507
Na_2O	19.834	0.308
SiO_2	25.316	0.133
ZrO_2	27.081	0.993
F	7.526	0.995
MnO_x	13.175	2.127
SrO	17.611	3.656
TiO_2	17.964	1.568
ZnO	15.069	2.075
NiO	12.668	4.350
BaO	18.866	3.709
Others	42.812	1.917
Model Statistics		
Number of Glasses	365	
R^2	0.949	
R^2_{adj}	0.946	
R^2_{pred}	0.942	
s (RMSE)	0.2577	
R^2 Statistics Based on Density		
R^2	0.921	
R^2_{adj}	0.918	

Figure 6-3 is the calculated-versus-measured plot for the data points used to fit the density model. Figure 6-4 shows the calculated-versus-measured plot for the glasses that were deleted from the screening process as discussed in Section 6.1. Surprisingly, the glasses deleted because of extreme density and concentration values fit the model very well. For those glasses deleted because they were crystallized, only two glasses showed the noticeable deviation from the model, which may suggest that the crystallinity in rest of the glasses was sufficiently low so that the density was not affected. Based on the observations in Figure 6-4 and also considering the high R^2_{val} values discussed in Section 6.3.2, the present density model may be extrapolated outside the composition region used to develop the model with reasonably high confidence.

The two glasses with noticeable deviation from the model (Figure 6-4) had unusually low density (~2.3 g/cm^3) below the expected limit for typical multicomponent glasses, considering that the density of pure crystalline SiO_2 (cristobalite) is 2.3 g/cm^3 and SiO_2 glass is 2.2 g/cm^3. The observed lower bound of density for the glasses used in the model was 2.4 g/cm^3 as seen in Figure 6-3, which seems reasonable.

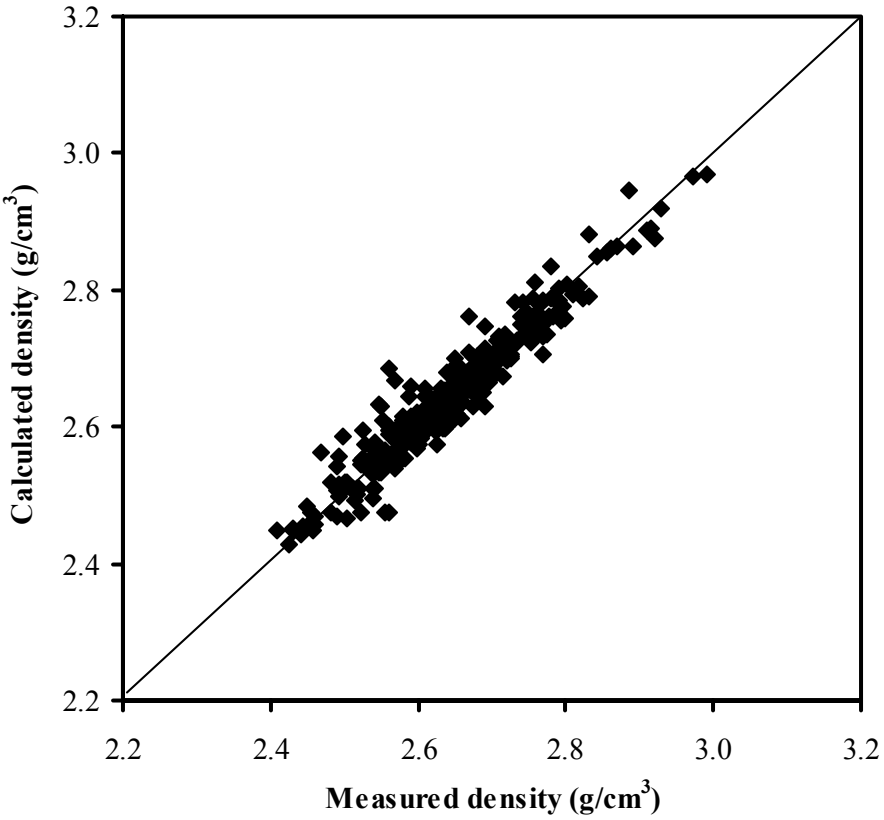

Figure 6-3. Plot of Calculated Versus Measured Density Values for Data Used to Fit the 18-Component Molar Volume Model

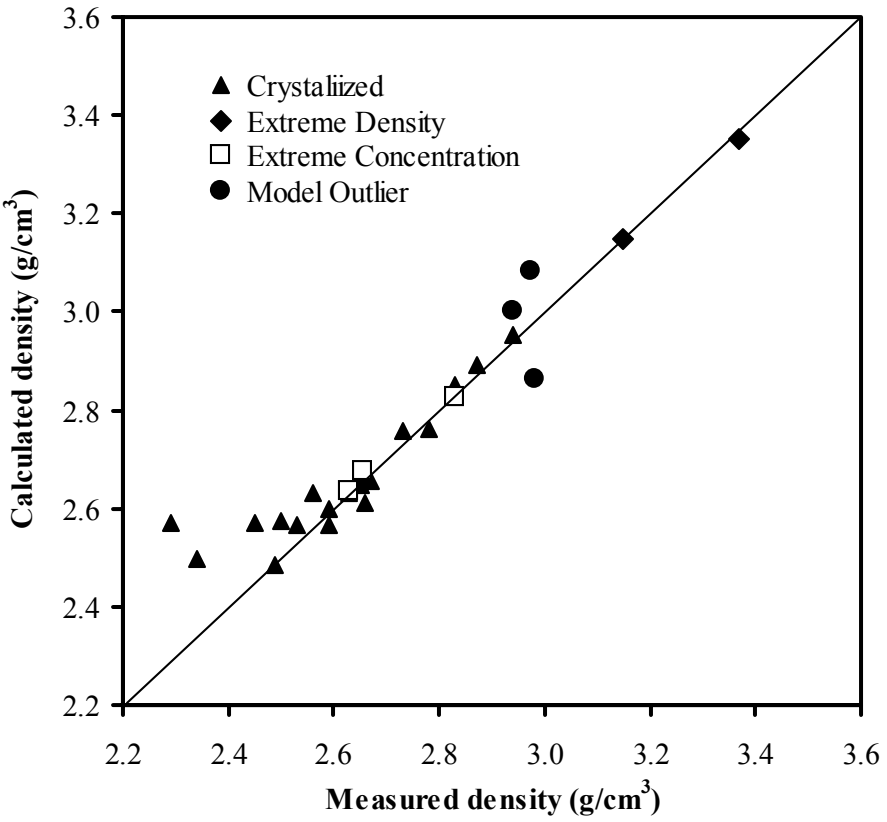

Figure 6-4. Plot of Calculated Versus Measured Density Values for the Glasses Deleted and Not Used to Develop the 18-Component Linear Mixture Model

6.4.2 Density Model with Expanded Model Components

As discussed in Section 6.4.1, the reasonable agreement between model coefficients and Appen's coefficients suggest that Appen's coefficients can be used for those components that could not be included in the model because of lack of data. Although Appen's coefficients can cover the majority of components of interest to HLW glass formulation, there are still some important components that are not included in Appen, like UO_3, P_2O_5, etc.

Considering that the molar volume of glass will be proportional to the volume of cation and oxygen ions, the partial molar volume per cation structural unit (not oxide) can be expressed as a sum of the contributions by cation and oxygen ions as indicated below:

$$v_i = ar_O^3 \frac{Z_i}{2} + br_i^3 \tag{6.3}$$

where

Z_i = valence of cation in component i
v_i = "apparent" partial molar volume per cation ($v_i = V_i$ if $Z_i = 2, 4, 6$; $v_i = 1/2V_i$ if $Z_i = 1, 3, 5$)
r_i = ionic radius of cation
r_O = radius of oxygen ion
a and b = constants.

The expression, "apparent," was used because v_i is not exactly the partial molar volume per cation obtained from the condition that satisfies $\Sigma y_i = 1$, where y_i is the mole fraction of cation in glass normalized to total cations. Here the term, $r_O^3 Z_i/2$, represents the volume of oxygen ions per cation, while r_i^3 represents the volume of the cation. If the molar volume depends only on the total volume of anions and cations, then a equals b in Equation 6.3. Then, v_i in Equation 6.3 will be inversely proportional to the overall packing fraction. However, Equation 6.3 assumes that the contribution to the packing fraction by oxygen would be different from that by cations, depending on the structure of glass to obtain two empirical constants, a and b. Rewriting Equation 6.3 leads to

$$\frac{v_i}{Z_i} = a' + b\frac{r_i^3}{Z_i} \tag{6.4}$$

where $a' = ar_O^3/2$.

For the purpose of applying Equation 6.4, it would be more appropriate to calculate the model coefficients based on the concentration of cations instead of oxides. However, since the Appen coefficients are given as oxide coefficients, the models were fit based on oxides to make direct comparison with Appen and to obtain combined coefficients with Equation 6.4.

The 18-component model coefficients, 17 glass components plus Others, from Table 6-8 and Appen's coefficients were fitted to the Equation 6.4 by plotting the v_i/Z_i as a function of r_i^3/Z_i, as shown in Figure 6-5, to obtain the constants a' and b. Table 6-9 summarizes constants a' and b for three different cases of model fit, Appen, and both.

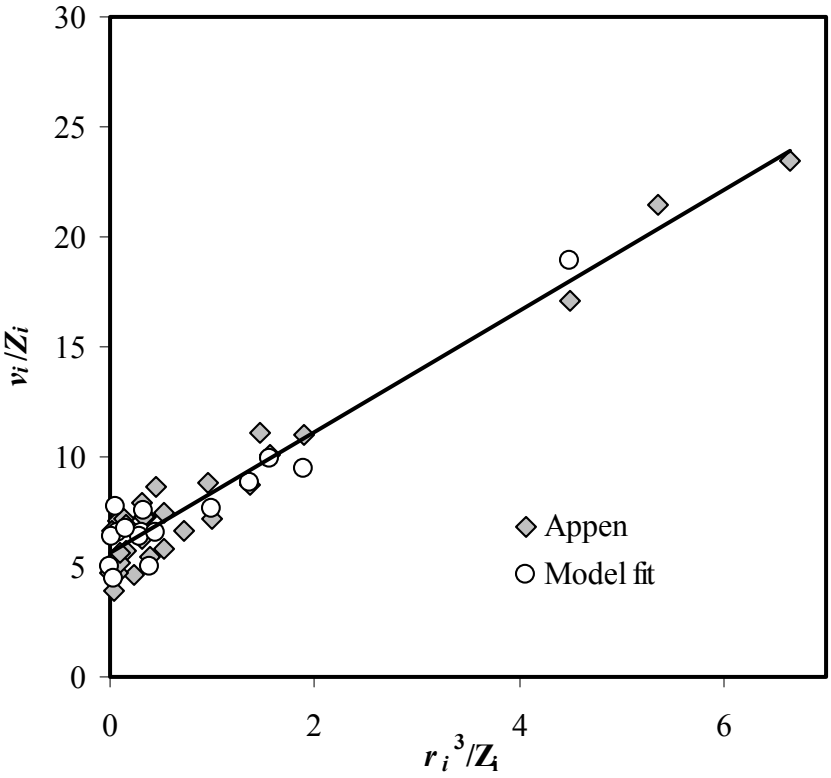

Figure 6-5. Plot of Appen's Molar Volume Coefficients Versus Model Fit Coefficients from 18-Component Model

Table 6-9. Constants in Equation 6.4

	Model Fit	**Appen**	**Model Fit and Appen**
# of data points	16	33	49
a'	5.56	5.59	5.58
B	2.76	2.76	2.76
R^2	0.9119	0.9508	0.9428

The values *a'* and *b* are the proportionality constants for the change of molar volume as the number of oxygens per cation, i.e., valence of cation, and the volume of the cation change. Applying the r_O = 1.28 Å, then $a \sim a'$. So the fit results, $a \sim 5.6$ and $b \sim 2.8$, imply that the molar-volume change is almost twice by the added number of anions (oxygen) from higher valence cations than the increase of cation size. This is what would be expected if the packing fraction of ions were about 0.5. However, the packing fraction cannot be estimated from these constants because the v_i in this study is not true partial molar volume per cation.

Based on above discussion, the model coefficients and Appen data fit Equation 6.4 well, which may imply that Equation 6.4 can be extrapolated to the components not covered by Model and Appen data. The second and the third columns in Table 6-10 show the fit statistics obtained when Appen coefficients and Equation 6.4 are used to calculate the molar volume and density. The 18-component model results are also shown for comparison, and the combined final expanded model is given in the last column. In

the Appen column, only the two fit parameters, F and Others coefficients, are calculated with the least squares method. The parameters *a* and *b* are additional fit parameters in Equation 6.4. The component Ln_2O_3 is no longer used in the models with expanded components.

The Appen coefficients and Equation 6.4 predict the multi-component HLW glasses reasonably well, although they are subject to many inevitable errors. The Appen coefficients were obtained from rather simple glasses. Also, some of them, such as B_2O_3 given as concentration range, were dependent on the glass composition, which was not considered in this study. The use of Equation 6.4 also involves several inherent errors because 1) only one valence state of the multivalent cations was assumed, 2) the composition dependence of coordination number of cations was not considered, and 3) the ionic radii of cations and oxygen in crystals were used.

In summary, the 18-component linear mixture model is recommended for glasses with a small total fraction of Others component, and the combined model in Table 6-10 is recommend for glasses with a relatively high concentration of those components included in Others.

Table 6-10. Comparison of Partial Molar Volumes and Fit Statistics Obtained from Linear-Mixture Model Fit, Appen, and Equation 6.4 and Those Obtained by Combining the Three Models

	Models					Models			
Component	**18-Comp Fit**	**Appen**	**Eq. (6.4) Fit**	**Combined***	**Component**	**18-Comp Fit**	**Appen**	**Eq. (6.4) Fit**	**Combined***
Al_2O_3	46.149	40.400	36.435	46.149	Ag_2O			20.000	20.000
B_2O_3	30.048	28.250	35.570	30.048	As_2O_5			59.810	59.810
BaO	18.866	22.000	24.145	18.866	Ce_2O_3			45.341	45.341
CaO	15.214	14.400	18.315	15.214	Cr_2O_3			38.262	38.262
F	7.526	8.989	6.871	7.526	CuO			13.960	13.960
Fe_2O_3	39.158	33.000	37.092	39.158	Eu_2O_3			46.855	46.855
K_2O	37.741	34.100	40.983	37.741	Gd_2O_3			46.491	46.491
Li_2O	9.943	11.000	14.348	9.943	MoO_3			36.731	36.731
MgO	13.028	12.500	13.887	13.028	Nd_2O_3			48.117	48.117
MnO_x	13.175	17.200	14.785	13.175	P_2O_5			59.307	59.307
Na_2O	19.834	20.200	21.955	19.834	PdO			15.069	15.069
NiO	12.668	13.000	13.679	12.668	Pr_2O_3			48.640	48.640
SiO_2	25.316	26.675	23.853	25.316	Rh_2O_3			38.855	38.855
SrO	17.611	17.500	20.729	17.611	RuO_2			25.070	25.070
TiO_2	17.964	20.750	24.216	17.964	SeO_3			35.709	35.709
ZrO_2	27.081	23.000	25.710	27.081	Sm_2O_3			47.227	47.227
ZnO	15.069	14.500	14.035	15.069	SO_3			35.526	35.526
BeO		7.800	12.047	7.800	TeO_2			25.307	25.307
Bi_2O_3		45.000	45.865	45.000	UO_3			37.606	37.606
CdO		17.600	18.011	17.600	V_2O_5			61.155	61.155
CoO		14.500	14.073	14.500	WO_3			36.784	36.784
Cs_2O		47.000	54.956	47.000	Others	42.812	37.088	46.276	33.479
Ga_2O_3		42.500	36.942	42.500	*Model Statistics Based on Molar Volume*				
HfO_2		27.500	25.639	27.500	Number of Components**	18	35 (2)	56 (4)	56 (20)
La_2O_3		40.000	49.730	40.000	Number of Glasses	365	365	365	365
Nb_2O_5		56.000	62.195	56.000	Range of Others	0 - 0.0791	0 - 0.0567	0 - 0.0166	0 - 0.0166
PbO		22.250	21.314	22.250	R^2	0.949	0.900	0.854	0.946
Rb_2O		43.000	46.613	43.000	R^2_{adj} (Adjusted)	0.946	0.890	0.828	0.937
Sb_2O_5		47.000	61.745	47.000	*R^2 Statistics Based on Density*				
Sc_2O_3		28.000	39.968	28.000	R^2	0.921	0.846	0.771	0.917
SnO_2		28.800	25.502	28.800	R^2_{adj}	0.918	0.831	0.730	0.902
Ta_2O_3		52.000	62.195	52.000					
ThO_2		31.700	27.734	31.700					
Y_2O_3		35.000	45.575	35.000					

* The 18-component model coefficients were used for the first group of components from Al_2O_3 to ZnO, Appen coefficients for the second group from BeO to Y_2O_3, and the coefficients obtained from Equation 6.3 for the third group from Ag_2O to WO_3. The Others coefficient was recalculated.

**The number in parenthesis represents the actual number of fit parameters, including model coefficients.

7.0 Other Key Properties

Sections 3.0 through 6.0 discuss the development of models for viscosity, T_L, PCT release, and density of waste glasses. However, several more glass properties are important for the successful immobilization of waste glasses at Hanford. The status of modeling these properties is described below.

7.1 Toxicity Characteristic Leaching Procedure Response

Most Hanford tank waste is listed as being toxic, primarily due to organic content. Current plans include the delisting of the glass products made from these wastes to dispose of them as radioactive, not mixed, waste. One of the criteria typically applied to determine whether a material is toxic is to examine the release of toxic metals from the material exposed to an aqueous solution under the conditions of the TCLP (EPA).

An evaluation of the TCLP data currently included in the database suggested that an effective TCLP response model could not be developed. It is strongly recommended that a TCLP response-composition model be eventually developed for Hanford waste glasses. The TCLP of preliminary glass compositions developed for the WTP suggest that the TCLP release of Cd may limit the composition of glasses produced from at least some of the initial Hanford HLWs (Kot and Pegg 2001). Preliminary models based on limited data were developed to predict TCLP based on glass composition (Vienna et al. 1998; Fu and Pegg 2000; Gan and Pegg 2002). However, the predictive ability of these models is not expected to be high, and the validity regions are relatively narrow.

It is recommended that the model reported by Gan and Pegg (2002) be used as an indication of TCLP response until sufficient additional data are available, and an improved model is developed. However, it is recommended that due to the high uncertainty of this model, the glass composition should not be restricted by its application. In other words, it is recommended that the model be employed to give property indications but not used to calculate glass compositions or waste loadings.

7.2 Vapor Hydration Test Response

One of the current contract specifications for WTP LAW glass performance is an alteration rate of less than 50 $g \cdot m^{-2} \cdot d^{-1}$ by the VHT method conducted at 200°C (BNI 2001). However, as a relatively new technique in waste-glass characterization, there are currently insufficient data to accurately model composition effects on the VHT response. Attempts were made to develop preliminary models for VHT (Vienna et al. 2001b; Lu et al. 2002). These attempts clearly showed that a model linear-in-composition is unlikely to successfully model VHT response. This means that significantly more data are required to develop nonlinear-in-composition models. Until sufficient data are available to accurately model VHT response as a function of composition, it is recommended that the second-order model reported by Vienna et al. (2001b) can be used as a gross indicator of VHT response but not used to limit waste loading or glass composition. The model of Lu et al. (2002) may also be used; however, the difficulty of specifying initial glass thickness that is required to obtain their model variable makes its application problematic.

7.3 Solubility of Troublesome Components

The solubilities of components in glass melts are generally strong functions of both temperature and composition. If solid phases precipitate when the concentration of a sparsely soluble component is higher than some critical value, the appropriate method for addressing this solubility is through T_L modeling. If a molten salt segregates when the concentration of a sparsely soluble component is higher than some critical value, then both solubility, as functions of temperature and composition, and segregation kinetics need to be considered. There are insufficient data and understanding of the temperature and composition effects on the maximum allowable concentration of many sparsely soluble components, e.g., S, P, Cr, …. We, therefore, cannot model these effects. However, we expect many of these to limit the loading of some Hanford wastes in glass. As an interim solution to this dilemma, we suggest using some single- and multi-component concentration constraints to give a rough assessment of the impacts of the concentrations of these sparsely soluble components. If during the evaluation of glass-volume estimates by Hanford Tank Waste Optimization Simulator (HTWOS) (or other exercises), it is determined that one or more of these component constraints is highly influential, then it is recommended that further study be performed to put their concentration limits on a sounder technical basis. The recommended single- and multi-component constraints are listed in Table 7-1.

Clearly, developing the appropriate data and models to predict the acceptable concentration of these components is critical to developing optimized glass compositions and more immediately to accurately estimate the volume of glass likely to be produced from Hanford's tank wastes.

Table 7-1. Single- and Multi-Component Concentration Constraints in Mass%

Constraint	Limit	Explanation
Cr_2O_3	≤ 1	***Eskolaite (Cr_2O_3) T_L and Spinel T_L*** At a concentration above its solubility, Cr_2O_3 will either crystallize as eskolaite or incorporate into spinel crystals. The effect of composition on T_L in the eskolaite primary phase field is unknown, and the model to predict the T_L in the spinel primary phase field is typically valid at < 1 wt% Cr_2O_3. Recent study on the Cr_2O_3 solubility in a HLW glass suggests that glass compositions in the eskolaite primary phase field and optimized for Cr_2O_3 solubility should be capable of achieving at least 1 mass%.
P_2O_5	≤ 2.5	***Immiscibility*** Jantzen et al. (2000) showed that generally, borosilicate waste-glass melts with higher than 2.6 mass% of P_2O_5 tended to separate into two or more immiscible liquid phases. Therefore, 2.5 mass% of P_2O_5 was adopted as a limit to help assure single-phase glass because the impact of the separated liquid phases on glass durability is not well known; e.g., if separate phases form, the durability may or may not be adequate, and the durability models will not be accurate.
F	≤ 2	***Immiscibility*** The solubility of fluoride, or the concentration of fluorine that a melt can contain without the formation of a fluorine-containing phase, such as CaF_2, at melt temperature or during cooling, can vary from roughly 2 to 8 mass%.

Table 7.1 (Contd)

Constraint	Limit	Explanation
		As most of the Hanford wastes are relatively low in fluorine, we adopt the conservative limit of 2 mass% fluorine. However, if this limit were found to influence the waste loading significantly, detailed studies would be required to determine temperature and composition effects on solubility.
ThO_2	≤ 4	***Solubility*** Glass is difficult to melt if ThO_2 > 4 mass%, especially when present together with ZrO_2. The 4 mass% limit from the current WTP contract (BNI 2001) should be used until more detailed information becomes available. If it is found that the ThO_2 limit is restricting the loading of a significant fraction of the Hanford HLW in glass, then additional data on ThO_2 solubility should be generated and modeled.
SO_3	≤ 0.8	***Salt Formation*** A number of studies found that immiscible salt phases form and segregate from melts with SO_3 concentrations higher than roughly 0.6 to 1.2 mass%. We adopt a limit of 0.8 mass% SO_3 to avoid salt segregation in the melter.
RuO_2+Rh_2O_3 Ag_2O	≤ 0.1 ≤ 0.25	***Accumulation in the Melter*** The combined concentrations of RuO_2 and Rh_2O_3 of 0.10 mass% limit is used to avoid noble metals accumulation in the melter. Other noble metals are either not expected to be a problem in the melter at the concentrations currently thought to be in Hanford wastes, e.g., Au_2O, or are not actively tracked in tank-waste inventories. It is well understood that Ag_2O concentrations in the melter can exceed those of RuO_2 and/or Rh_2O_3 without the detrimental effects that they pose. Therefore, the WTP contract limit of 0.25 mass% Ag_2O should be adopted until it is shown to either restrict loading of significant amounts of Hanford HLW in glass or be an insufficient limit to assure that processing-related problems do not occur.
$SiO_2/(SiO_2+Na_2O+Al_2O_3)$	≤ 0.62	***Nepheline Formation on Cooling - Durability*** This constraint is a composition rule designed to help avoid the formation of nepheline, $NaAlSiO_4$. Li et al. (1997) showed that alumino-borosilicate glasses with $Na_2O{\cdot}Al_2O_3{\cdot}SiO_2$ sub-mixtures within the nepheline primary phase field in that ternary mixture are susceptible to nepheline formation, which can significantly decrease the chemical durability of partly crystallized glasses. For practical purposes, glasses with $SiO_2/(SiO_2+Na_2O+Al_2O_3)$ ≥ 0.62 are less susceptible to nepheline formation.
$(Na_2O+Li_2O)/(Na_2O+Li_2O+B_2O_3+SiO_2)$	≥0.12	***Liquid-Liquid Phase Separation*** This constraint is a composition rule designed to help avoid a silica-rich immiscible melt on cooling of the glass. Glasses with $(Na_2O + Li_2O)/(Na_2O + Li_2O + B_2O_3 + SiO_2) \geq 0.12$ are less susceptible to silica-rich immiscible liquid formation (Peeler and Hrma 1998).

7.4 Electrical Conductivity

Although an important processing-related property, electrical conductivity (ε) has rarely been found to restrict the composition or waste loading of glasses melted in Joule-heated ceramic melters operating below 1250°C. Therefore, little effort was invested in updating ε models from those previously reported (Hrma et al. 1994). It is recommended that the ε model reported by Hrma et al. (1994) be used to estimate the conductivity of glasses, but not restrict their composition or waste loading.

Additional data, developed since the work of Hrma et al. (1994), are currently available for the development of an updated ε model. If it is determined that ε is a more important parameter for processing Hanford HLW glasses, then an updated model should be developed. In addition, if glasses with significant concentrations of K_2O or other ε influencing components, e.g., F, are used, then further data collection and model development would be required.

8.0 Model Applications

As mentioned in Section 1.2, waste glasses must meet property and composition constraints. The task is to determine, for a given waste stream, the composition, or composition region, of glass that has admissible properties and the minimum possible, or acceptably small, volume. Thus, we first need to solve the reverse problem to developing property-composition relationships. That is, we need to find the relationship $\mathbf{x} = F_{\mathbf{w}}[\mathbf{p}]$, where $\mathbf{p} \equiv [p_1, p_2, \ldots p_K]$ is the property vector, and the parameter **w** stands for waste composition. The next step is to identify the composition region, **G,** of glasses with acceptable properties, i.e., the region of glasses made from the given waste composition and meeting all acceptability and processability constraints. Finally, we need to find on **G** a glass $\mathbf{x_0} \in \mathbf{G}$ with maximum waste loading or a minimum allowable waste loading with maximum allowable variation in **w**.

Note that $\mathbf{x_0}$ is subject to Equation 1.2. Property constraints have a form $\pm p_\alpha \le c_\alpha$, where p_α is the α -th property, and c_α is a constant; the ± sign depends on whether the constraint is an upper or a lower limit. By Equation 1.4, a property constraint assumes the form(x)

$$\pm \sum_{i=1}^{N} b_{\alpha i} x_i - c_\alpha \ge 0 \tag{8.1}$$

for each $\alpha = 1,2,\ldots,K$.

Not all properties that limit glass acceptability and processability have models or other relationships as functions of glass composition. For example, insoluble noble metals, chromium, sulfates, fluorides, and phosphates, may negatively impact glass processing, or the crystallization of nepheline and cristobalite may negatively impact glass acceptability. These limitations are expressed as composition constraints, some of which are provisory and will be used until the nature of the constraining property is mathematically formulated, and the property is measured and evaluated as a function of glass composition. Composition constraints are of a general form

$$\sum_{i=1}^{N} Q_i x_i + Q_0 \ge 0 \tag{8.2}$$

Here the Q_j values may be 0 for some or most components. Lower and upper bounds on single waste-glass components, on linear combinations of waste-glass components, or on ratios of linear combinations of waste-glass components can all be represented in the form of Equation 8.2. Similarly, lower and upper bounds on waste-glass properties, implemented through property-composition models of the form (1.4), (1.7), (1.12), etc., can be represented in the form (8.1).

(x) Inequalities (8.1) and (8.2) follow the convention, common in many statistical software packages, that a nonnegative value means inside (pass) the constraint, while a negative value means outside (fail) the constraint. Thus, their form (in vector notation) is $\pm \mathbf{b.x} - \mathbf{c} \ge 0$.

The maximum waste-loading requirement can be expressed as

$$W = \max \text{ on } \mathbf{G} \tag{8.3}$$

where W is the waste loading.

The solution of the constrained optimization problem of finding $\mathbf{x_0} \in \mathbf{G}$ has been outlined several times in the past; see, for example, Hrma and Robertus (1993) and Hrma (1994). This approach to developing waste-glass formulations has been widely applied at Hanford and Idaho (Vienna et al. 2000). By making use of this approach, glasses are being formulated for experimental melter runs.

Of course, glass for costly melter runs, not to mention vitrification plants, cannot be formulated on computers and paper only. Because of uncertainties in measured data and the property-composition models, the real-property values associated with the "optimized" glass composition are subject to uncertainty and may differ from the model-predicted property values, depending on the accuracy and precision of the property-composition models. Consequently, experimental verification of the acceptability of mathematically optimized glass formulations is absolutely necessary. Models are then used again to assure that acceptable glass will be made from the full range of expected waste-composition variation.

To verify a mathematically optimized glass formulation, the glass is made in the laboratory, its properties are measured, and the measured and model-predicted property values are compared. If the measured and predicted property values differ beyond an acceptable tolerance, e.g., as determined by applicable statistical model-validation methods, the candidate glass formulation must be corrected. One correction approach is to start with the candidate formulation as a baseline. If the corrected glass composition is **x'**, the property value (p_α') of the corrected glass can be expressed as

$$g_\alpha(p'_\alpha) = g_\alpha(p_\alpha) + \sum_{i=1}^{N} b_{\alpha i}(x'_i - x_i) \tag{8.4}$$

where p_α is the measured property value of the baseline glass. Equation 8.4 is a consequence of Equation 1.4.

However, Equation 8.4 is insufficient to make the property-composition model appropriate for local sub-regions of glass composition space because local $b_{\alpha i}$ values may be different from the global ones, i.e., those determined for a large composition region. Therefore, we need to check the corrected glass and make as many corrections as needed. However, the process of checking and correcting may be unnecessary or shorter if local glass composition regions and models are the basis for the glass optimization.

Only a glass whose properties have been confirmed by property measurement can be used for a melter test run or waste-glass production. Such a run may reveal that laboratory testing did not exactly match the glass produced in the melter. For example, glass redox can have a different value because the glass from a laboratory crucible is close to redox equilibrium with the furnace atmosphere, whereas the redox state of glass from the melter is governed by the feed-melting reactions. A difference in the redox state might have an impact on some properties, such as T_L. Any such discrepancies must be resolved

before the glass is committed to large-scale production. Resolutions may include modifying property-composition models to account for redox effects so that such effects are accounted for in future efforts to optimize formulations with the mathematical approach.

Generating a large number of data within a sufficiently close neighborhood of the baseline composition will make the measurement-prediction iterative process described above more efficient. A local property-composition model developed from the data would adequately respond to small composition variations within a relatively small neighborhood of glass compositions, but could not be extrapolated beyond this close neighborhood.

Whether the "iterations" or "local response" approach is chosen depends on its effectiveness with respect to the intended application. For processing a large HLW batch of a known average composition with specified variations, a set of local property-composition models might be preferred. In this situation, the detailed knowledge of the local neighborhood is needed to show that the expected composition variations, which are unavoidable in the real process, will yield acceptable glasses. For a short-term medium-scale melter run, one or two composition iterations followed by calculations by making use of Equation 8.4 may be enough.

Additionally, fully radioactive glasses, made from tank sludge treated according to the appropriate flowsheet unit operations, should be fabricated and tested to confirm that the chemical simulation of the waste adequately represented the real waste from a key glass-property perspective.

There are several benefits to developing waste glasses by the process of 1) generating property-composition data to cover a waste-glass–composition region of interest, 2) developing property-composition models that adequately fit the data, 3) making use of mathematically constrained optimization methods to develop candidate optimized glass formulations, and 4) verifying or improving the candidate glass formulation, either via local property-composition models or measurement-calculation iterations:

- The process is much faster and cheaper than developing a glass from scratch for each new waste composition to be vitrified at Hanford or when a property constraint is changed.
- Step 4) of the process provides strong evidence that the resulting glass composition is optimal for given constraints. Stopping after Step 3) would always leave open to question whether a better solution had been missed. As has been repeatedly shown in practice (Musick et al. 2000; Peeler et al. 2001; Vienna et al. 2000), Step 4) does provide for obtaining improved glass formulations over the result after Step 3).
- Additional data are generated in Step 4) that can be used for validating and/or improving the existing property-composition models.

Planning Hanford's large-scale vitrification program will require considering a large number of parameters and alternatives. To help in making important decisions, optimization programs such as the HTWOS have been developed that allow working with compositions of all Hanford waste streams simultaneously. These programs can assess the effects of influential parameters on important global criteria, such as the total number of HLW glass canisters to be produced, and compare alternatives in equipment, schedules, pretreatments, etc.

A useful tool in trying to develop optimal glass formulations is to develop charts that plot glass volume, i.e., the number of canisters, or cleanup-cost estimates as functions of property constraints. The following hypothetical situations illustrate the usefulness of such investigations:

- Suppose a change in a certain property constraint (say, the lower limit for T_L) has a strong impact on the total number of canisters, and thus on the overall cost. This information would provide an incentive for either changing this constraint if the risk associated with it proves exaggerated or developing a technology that is not sensitive to the influential property.
- Suppose a certain constraint (say, the upper limit for viscosity) can be changed without a significant impact on the number of canisters, but a change in this constraint would substantially increase melter output, i.e., the production rate. In this case, large potential savings could be achieved by formulating glass with a revised constraint, e.g., lower viscosity.
- Suppose a more durable glass (when a less durable product is acceptable) can be produced at the expense of an insignificant increase of the total volume. A decision might be made to produce more durable glass. Such a decision would increase the safety margin for protection of the environment that might be much appreciated by the general public.

These and similar studies can be performed only when dependable property-composition models are available, and if these models are regularly updated to meet changing demands and changes in input data. Though data generation, development of property-composition models, and development of sophisticated optimization algorithms are complex endeavors, the output can be presented in a form that is easily comprehended and convincing. This would help in adopting unbiased views and informed decisions.

Models of glass durability are also required to assure the regulators and the public that Hanford LAW and HLW can be safely produced and disposed.

9.0 Discussion and Recommendations

The preceding sections of this report describe the utility and status of continued development of models for waste-glass properties in support of Hanford's tank waste immobilization efforts. It is recommended that the models described in this report be used to estimate the properties of Hanford waste glasses. Once adequate (and final) glass-property models are developed by the WTP, those models should be used for the initial few waste tanks and compositions similar to them, and the more global models developed in this study or their successors should be used in predicting glass properties for Hanford's balance-of-mission glasses.

The models described in this report were shown to more accurately represent the larger data set than our previously published models and provide reasonable estimates of various properties over the composition regions of overlap between expected Hanford waste glasses and available data. However, they are far from adequate for the purpose of predicting properties of glasses to be produced from all expected Hanford tank wastes with sufficient accuracy and precision. In that sense, this report represents a work in progress. Additional efforts should be focused on those areas that give the highest level of uncertainty in overall program cost and schedule. Some of these more important efforts, described in detail in the previous sections, are summarized below:

- Development of a T_L model in the eskolaite primary phase field – Initial calculations (Perez et al. 2001) suggest that the single most important factor in determining the volume of HLW glass to be produced at Hanford is chromium. There are many aspects to the Cr uncertainties. First, there is uncertainty in the quantity and distribution of Cr in the waste tanks. Second, there is high uncertainty in the amount of Cr that can be efficiently removed from HLW during pretreatment. Third, there is high uncertainty in the solubility of Cr in glass melts that are in the eskolaite primary phase field. Finally, there is uncertainty in the boundary between the eskolaite and spinel primary phase fields. Studies aimed at lowering these uncertainties would make considerable progress toward reducing the uncertainty in glass volumes to be produced from Hanford HLWs.
- Development of sub-space models or overlapping local models for T_L in the spinel primary phase field – Most HLW batches are currently expected to be within the spinel primary phase field. However, the T_L model presented in this report has validity over a limited composition region and has lower than acceptable precision. These problems can only be resolved by developing a non-linear model or developing linear models that are valid over smaller composition regions. An initial evaluation of these two options suggests that developing linear models that are valid over limited composition regions that overlap each other is likely to give prediction uncertainties as low as measurement uncertainty. This approach should allow T_L to be calculated over as broad a composition region as necessary to support the Hanford mission and one that is supported by the current database.
- Determination of acceptable sulfur content in LAW melter feed – The current WTP technical basis for LAW loading in glass is that the concentrations of Na_2O and SO_3 in mass% targeted in final glass must be below 5 when multiplied, e.g., the rule-of-five: $[Na_2O][SO_3] \leq 5$. Calculations suggest that this will double the amount of glass required to immobilize all of Hanford LAW as compared with the volume of glass that would be required if loading were 20 mass% Na_2O. Results from several tests, including some performed in support of the WTP, have suggested that $[SO_3]$ as high as 1 mass% in glass should be processable in joule-heated ceramic-melters without an undesirable segregated salt

layer accumulating. However, the salt layer often forms at [SO_3] below the solubility limit, and the acceptable [SO_3] is a complex function of a number of physical and chemical parameters. Initial studies suggest that the appropriate level should be between 0.6 and 1.0 mass% SO_3. However, more research is required to accurately assess the limit of [SO_3] in glass and the values of key chemical and physical parameters that are required to successfully process high sulfur wastes in the currently designed plant.

- Development of initial models for VHT and TCLP – Toxicity Characteristic Leach Procedure and VHT have both been used to show that there are composition and/or waste loading limits for Hanford waste glasses. The VSL has developed preliminary data sets and models for VHT and TCLP (Muller, Buechele, and Pegg 2001; Kot and Pegg 2001; Lu et al. 2002; Gan and Pegg 2002). However, those data sets and models are very preliminary and are not yet adequate for predicting TCLP and VHT responses. Additional VHT and TCLP data covering the glass-composition regions of interest to the WTP must be developed. These data should be used with existing data to develop, evaluate, and validate property-composition models.
- Improve estimates of Hanford waste glasses and then update models – Because of uncertainty about the compositions of wastes in Hanford tanks and further uncertainties about pretreatment and retrieval scenarios, the composition region of glasses expected to be produced from Hanford wastes changes *dramatically* at times. The models reported here should be applied to estimate glass-composition regions expected to be produced from future Hanford HLWs, which may require ignoring model validity ranges. Then, additional glass-property–composition data should be developed, and the models should be refit to acceptably predict glass properties within the appropriate composition region(s). This process should be performed iteratively until adequate glass-property models are available.
- Models should be developed for other key glass properties – Many properties, such as melt corrosivity (to glass-contact materials), melting rate, electrical conductivity, crystal formation on cooling, impact of slow cooling on durability, thermal conductivity, etc., are important for waste immobilization at Hanford. Data collection and model development for these properties should be performed to allow for the optimization of acceptable glass compositions and the determination of glass volumes to be produced at Hanford.

Performing these tasks is necessary for many purposes, including 1) accurate estimation of glass volumes to be produced at Hanford, 2) optimization of glass compositions for specific wastes, 3) detailed planning required to conduct the River Protection Program scope, 4) ability to estimate the impacts of different process or product changes on cleanup cost and schedule, 5) evaluation of the impacts of new technologies and strategies, and 6) a host of other tasks.

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INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
IG1-01	0.0552	0.0947	0.0007	0.0005		0.0425	0.0546	0.0000	0.1432		0.0703	0.4706	0.0649			0.0001			0.0000		0.0006
IG1-02	0.0656	0.1312	0.0007	0.0005		0.0874	0.0714	0.0000	0.0819		0.1312	0.4273	0.0000			0.0001			0.0000		0.0006
IG1-03	0.0000	0.0438	0.0007	0.0005		0.0875	0.0010	0.0000	0.2131		0.1312	0.3971	0.1224			0.0001			0.0000		0.0006
IG1-04	0.0000	0.0437	0.0007	0.0005		0.0000	0.0787	0.0000	0.0953		0.1310	0.5248	0.1225			0.0001			0.0000		0.0006
IG1-05	0.0657	0.1313	0.0007	0.0005		0.0000	0.0014	0.0000	0.2131		0.1310	0.4537	0.0000			0.0001			0.0000		0.0006
IG1-06	0.0000	0.1501	0.0008	0.0005		0.1000	0.0482	0.0000	0.0500		0.0000	0.5722	0.0751			0.0001			0.0000		0.0007
IG1-07	0.1501	0.1501	0.0008	0.0005		0.0000	0.0845	0.0000	0.0500		0.0000	0.5308	0.0301			0.0001			0.0000		0.0007
IG1-08	0.1312	0.0437	0.0007	0.0005		0.0875	0.0722	0.0000	0.0819		0.1312	0.4221	0.0262			0.0001			0.0000		0.0006
IG1-09	0.0360	0.1312	0.0007	0.0005		0.0000	0.0333	0.0000	0.2019		0.1312	0.3411	0.1215			0.0001			0.0000		0.0006
IG1-10	0.0000	0.0654	0.0008	0.0005		0.0000	0.0900	0.0000	0.1560		0.0000	0.5441	0.1401			0.0001			0.0000		0.0007
IG1-11	0.1464	0.0500	0.0008	0.0006		0.0000	0.0511	0.0000	0.2000		0.0000	0.5479	0.0000			0.0001			0.0000		0.0007
IG1-12	0.0317	0.1501	0.0008	0.0005		0.1001	0.0000	0.0000	0.1530		0.0000	0.4206	0.1401			0.0001			0.0000		0.0007
IG1-13	0.0759	0.0501	0.0008	0.0006		0.1001	0.0709	0.0000	0.1720		0.0000	0.5266	0.0000			0.0001			0.0000		0.0007
IG1-14	0.1087	0.0724	0.0007	0.0006		0.0242	0.0507	0.0000	0.1674		0.0362	0.5023	0.0338			0.0001			0.0000		0.0006
IG1-15	0.0644	0.0677	0.0007	0.0005		0.0677	0.0600	0.0000	0.1086		0.1016	0.4943	0.0316			0.0001			0.0000		0.0006
IG1-16	0.0725	0.0725	0.0007	0.0006		0.0242	0.0464	0.0000	0.1674		0.0362	0.4752	0.1014			0.0001			0.0000		0.0007
IG1-17	0.0677	0.0678	0.0007	0.0005		0.0226	0.0386	0.0000	0.1763		0.1016	0.4266	0.0948			0.0001			0.0000		0.0006
IG1-18	0.0684	0.1129	0.0007	0.0005		0.0226	0.0563	0.0000	0.1086		0.1016	0.4941	0.0316			0.0001			0.0000		0.0006
IG1-19	0.0683	0.1126	0.0007	0.0005		0.0226	0.0564	0.0000	0.1086		0.1016	0.4944	0.0316			0.0001			0.0000		0.0006
IG1-20	0.0449	0.1129	0.0007	0.0005		0.0226	0.0528	0.0000	0.1086		0.1016	0.4578	0.0948			0.0001			0.0000		0.0006
IG1-21	0.0890	0.1207	0.0007	0.0005		0.0724	0.0652	0.0000	0.0950		0.0362	0.4323	0.0848			0.0001			0.0000		0.0006
IG1-22	0.1013	0.1118	0.0007	0.0005		0.0226	0.0610	0.0000	0.1316		0.1017	0.4045	0.0615			0.0001			0.0000		0.0006
IG1-23	0.0979	0.0677	0.0007	0.0005		0.0663	0.0610	0.0000	0.1086		0.1016	0.4282	0.0647			0.0001			0.0000		0.0006
IG1-24	0.0863	0.1207	0.0007	0.0006		0.0724	0.0652	0.0000	0.0971		0.0362	0.4302	0.0876			0.0001			0.0000		0.0006
IG1-25	0.0724	0.0724	0.0007	0.0006		0.0724	0.0492	0.0000	0.1334		0.0362	0.4580	0.1014			0.0001			0.0000		0.0006
IG1-26	0.0552	0.0947	0.0007	0.0005		0.0425	0.0546	0.0000	0.1432		0.0703	0.4706	0.0649			0.0001			0.0000		0.0006
IG1-27	0.1312	0.0437	0.0007	0.0005		0.0875	0.0721	0.0000	0.0819		0.1312	0.4221	0.0263			0.0001			0.0000		0.0006
IG1-28	0.1312	0.0437	0.0007	0.0005		0.0875	0.0722	0.0000	0.0819		0.1312	0.4221	0.0263			0.0001			0.0000		0.0006
IG1-29	0.1400	0.0839	0.0000	0.0200		0.0000	0.0700	0.0000	0.1063	0.0011	0.0006	0.5700	0.0000			0.0013			0.0000		0.0003
IG1-30	0.0203	0.0607	0.0042	0.0051		0.0000	0.0707	0.0012	0.1833	0.0094	0.0049	0.4598	0.1112			0.0115			0.0000		0.0025
IG1-31	0.1500	0.1500	0.0009	0.0005		0.0000	0.0900	0.0000	0.1187	0.0000	0.0000	0.4565	0.0300			0.0000			0.0000		0.0007
IG1-32	0.1500	0.0500	0.0009	0.0005		0.1000	0.0836	0.0000	0.0500	0.0000	0.0500	0.5116	0.0000			0.0000			0.0000		0.0007
IG1-33	0.0000	0.0500	0.0009	0.0005		0.1000	0.0116	0.0000	0.2000	0.0000	0.0000	0.4936	0.1400			0.0000			0.0000		0.0007
IG1-34	0.0000	0.0701	0.0009	0.0005		0.0000	0.0900	0.0000	0.0500	0.0000	0.0500	0.5951	0.1400			0.0000			0.0000		0.0007
IG1-35	0.0750	0.1500	0.0009	0.0005		0.0000	0.0016	0.0000	0.2000	0.0000	0.0500	0.5186	0.0000			0.0000			0.0000		0.0007
IG1-36	0.0750	0.0500	0.0009	0.0005		0.1000	0.0900	0.0000	0.1174	0.0000	0.0000	0.5628	0.0000			0.0000			0.0000		0.0007
IG1-37	0.0762	0.1013	0.0009	0.0005		0.0497	0.0568	0.0000	0.1191	0.0000	0.0260	0.4902	0.0759			0.0000			0.0000		0.0007
IG1-38	0.0375	0.1250	0.0009	0.0005		0.0250	0.0631	0.0000	0.0875	0.0000	0.0125	0.5396	0.1050			0.0000			0.0000		0.0007
IG1-39	0.0751	0.1250	0.0009	0.0005		0.0750	0.0675	0.0000	0.0883	0.0000	0.0125	0.4469	0.1049			0.0000			0.0000		0.0007
IG1-40	0.0546	0.1022	0.0009	0.0005		0.0750	0.0559	0.0000	0.0875	0.0000	0.0375	0.5475	0.0350			0.0000			0.0000		0.0007
IG1-41	0.0513	0.0750	0.0009	0.0005		0.0750	0.0471	0.0000	0.1268	0.0000	0.0375	0.5475	0.0350			0.0000			0.0000		0.0007
IG1-42	0.1084	0.0750	0.0009	0.0005		0.0734	0.0675	0.0000	0.0875	0.0000	0.0375	0.4743	0.0716			0.0000			0.0000		0.0007
IG1-43	0.0704	0.1250	0.0009	0.0005		0.0250	0.0249	0.0000	0.1625	0.0000	0.0375	0.4449	0.1050			0.0000			0.0000		0.0007
IG1-44	0.0000	0.0701	0.0009	0.0005		0.0000	0.0900	0.0000	0.0500	0.0000	0.0500	0.5951	0.1400			0.0000			0.0000		0.0007

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
IG1-01	0.0000			0.0000	0.0006	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-02	0.0000			0.0000	0.0006	0.0006				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-03	0.0000			0.0000	0.0005	0.0006				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-04	0.0000			0.0000	0.0005	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-05	0.0000			0.0000	0.0005	0.0007				0.0006		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-06	0.0000			0.0000	0.0006	0.0007				0.0008		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-07	0.0000			0.0000	0.0006	0.0007				0.0008		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-08	0.0000			0.0000	0.0006	0.0006				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-09	0.0000			0.0000	0.0005	0.0006				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-10	0.0000			0.0000	0.0006	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-11	0.0000			0.0000	0.0006	0.0008				0.0008		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-12	0.0000			0.0000	0.0006	0.0007				0.0008		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-13	0.0000			0.0000	0.0006	0.0007				0.0008		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-14	0.0000			0.0000	0.0006	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-15	0.0000			0.0000	0.0005	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-16	0.0000			0.0000	0.0006	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-17	0.0000			0.0000	0.0005	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-18	0.0000			0.0000	0.0005	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-19	0.0000			0.0000	0.0005	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-20	0.0000			0.0000	0.0005	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-21	0.0000			0.0000	0.0006	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-22	0.0000			0.0000	0.0006	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-23	0.0000			0.0000	0.0006	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-24	0.0000			0.0000	0.0006	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-25	0.0000			0.0000	0.0006	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-26	0.0000			0.0000	0.0006	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-27	0.0000			0.0000	0.0006	0.0006				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-28	0.0000			0.0000	0.0006	0.0006				0.0007		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG1-29	0.0000			0.0003	0.0002	0.0003				0.0000		0.0000	0.0011	0.0000	0.0003		0.0005	0.0000	0.0022	0.0000	
IG1-30	0.0000			0.0021	0.0015	0.0025				0.0000		0.0000	0.0102	0.0000	0.0020		0.0049	0.0000	0.0190	0.0000	
IG1-31	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-32	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-33	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-34	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-35	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-36	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-37	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-38	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-39	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-40	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-41	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-42	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-43	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG1-44	0.0000			0.0000	0.0010	0.0007				0.0007		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
IG1-01	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-02	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-03	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-04	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-05	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-06	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-07	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-08	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-09	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-10	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-11	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-12	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-13	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-14	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-15	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-16	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-17	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-18	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-19	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-20	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-21	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-22	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-23	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-24	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-25	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-26	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-27	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-28	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0001		0.0000		
IG1-29	0.0001	0.0000	0.0002	0.0000		0.0001	0.0000		0.0003				0.0001		0.0000	0.0000	0.0007		0.0000		
IG1-30	0.0008	0.0000	0.0017	0.0000		0.0008	0.0000		0.0025				0.0008		0.0000	0.0000	0.0059		0.0000		
IG1-31	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-32	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-33	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-34	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-35	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-36	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-37	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-38	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-39	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-40	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-41	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-42	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-43	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		
IG1-44	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
IG1-01							0.0000			1.0000	0.0548	0.0857	0.0009			0.0440	0.0507		0.1436		0.0663
IG1-02							0.0000			1.0000											
IG1-03							0.0000			1.0000											
IG1-04							0.0000			1.0000	0.0013	0.0369	0.0009			0.0009	0.0693		0.0921		0.1170
IG1-05							0.0000			1.0000	0.0629	0.1265	0.0009			0.0009	0.0015		0.2187		0.1255
IG1-06							0.0000			1.0000	0.0008	0.1403	0.0009			0.0916	0.0458		0.0491		0.0007
IG1-07							0.0000			1.0000	0.1397	0.1410	0.0010			0.0009	0.0792		0.0498		0.0007
IG1-08							0.0000			1.0000	0.1269	0.0350	0.0009			0.0901	0.0669		0.0826		0.1237
IG1-09							0.0000			1.0000	0.0343	0.1278	0.0010			0.0009	0.0332		0.2100		0.1285
IG1-10							0.0000			1.0000	0.0011	0.0575	0.0009			0.0009	0.0805		0.1483		0.0007
IG1-11							0.0000			1.0000	0.1361	0.0473	0.0011			0.0009	0.0475		0.1897		0.0007
IG1-12							0.0000			1.0000	0.0307	0.1440	0.0009			0.1014	0.0001		0.1547		0.0007
IG1-13							0.0000			1.0000	0.0709	0.0443	0.0011			0.1028	0.0701		0.1786		0.0081
IG1-14							0.0000			1.0000	0.0989	0.0643	0.0010			0.0239	0.0454		0.1574		0.0320
IG1-15							0.0000			1.0000											
IG1-16							0.0000			1.0000	0.0686	0.0730	0.0009			0.0246	0.0438		0.1641		0.0357
IG1-17							0.0000			1.0000											
IG1-18							0.0000			1.0000	0.0644	0.1060	0.0010			0.0228	0.0536		0.1076		0.0981
IG1-19							0.0000			1.0000											
IG1-20							0.0000			1.0000	0.0435	0.1067	0.0009			0.0230	0.0497		0.1076		0.0979
IG1-21							0.0000			1.0000	0.0855	0.1131	0.0009			0.0734	0.0603		0.0944		0.0340
IG1-22							0.0000			1.0000											
IG1-23							0.0000			1.0000											
IG1-24							0.0000			1.0000	0.0798	0.1141	0.0009			0.0725	0.0594		0.0933		0.0324
IG1-25							0.0000			1.0000	0.0693	0.0689	0.0010			0.0696	0.0470		0.1290		0.0348
IG1-26							0.0000			1.0000	0.0538	0.0819	0.0009			0.0414	0.0521		0.1412		0.0687
IG1-27							0.0000			1.0000											
IG1-28							0.0000			1.0000											
IG1-29							0.0001			1.0000	0.1313	0.0814	0.0003			0.0009	0.0659		0.1053		0.0007
IG1-30							0.0008			1.0000	0.0208	0.0561	0.0040			0.0009	0.0664		0.1823		0.0050
IG1-31							0.0000			1.0000	0.1412	0.1367	0.0011			0.0008	0.0833		0.1145		0.0013
IG1-32							0.0000			1.0000	0.1413	0.0537	0.0011			0.0884	0.0789		0.0510		0.0476
IG1-33							0.0000			1.0000	0.0018	0.0340	0.0012			0.0765	0.0117		0.2099		0.0015
IG1-34							0.0000			1.0000	0.0026	0.0742	0.0011			0.0008	0.0848		0.0511		0.0476
IG1-35							0.0000			1.0000	0.0720	0.1496	0.0010			0.0005	0.0017		0.2013		0.0500
IG1-36							0.0000			1.0000	0.0727	0.0563	0.0011			0.0914	0.0867		0.1179		0.0014
IG1-37							0.0000			1.0000	0.0739	0.0963	0.0011			0.0445	0.0545		0.1202		0.0255
IG1-38							0.0000			1.0000	0.0371	0.1207	0.0011			0.0229	0.0601		0.0883		0.0129
IG1-39							0.0000			1.0000	0.0719	0.1110	0.0009			0.0645	0.0629		0.0884		0.0123
IG1-40							0.0000			1.0000	0.0532	0.1065	0.0010			0.0658	0.0544		0.0924		0.0390
IG1-41							0.0000			1.0000	0.0501	0.0670	0.0011			0.0669	0.0463		0.1313		0.0388
IG1-42							0.0000			1.0000	0.1038	0.0871	0.0011			0.0651	0.0658		0.0932		0.0388
IG1-43							0.0000			1.0000	0.0672	0.1164	0.0010			0.0227	0.0242		0.1654		0.0395
IG1-44							0.0000			1.0000	0.0025	0.0646	0.0010			0.0006	0.0868		0.0517		0.0501

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
IG1-01	0.4503	0.0667																			
IG1-02																					
IG1-03																					
IG1-04	0.4936	0.1116																			
IG1-05	0.4540	0.0001																			
IG1-06	0.5717	0.0724																			
IG1-07	0.5311	0.0290																			
IG1-08	0.3968	0.0271																			
IG1-09	0.3471	0.1133																			
IG1-10	0.5273	0.1405																			
IG1-11	0.5247	0.0004																			
IG1-12	0.3947	0.1348																			
IG1-13	0.5343	0.0074																			
IG1-14	0.4819	0.0305																			
IG1-15																					
IG1-16	0.4680	0.0981																			
IG1-17																					
IG1-18	0.4872	0.0297																			
IG1-19																					
IG1-20	0.4690	0.0952																			
IG1-21	0.4300	0.0847																			
IG1-22																					
IG1-23																					
IG1-24	0.4300	0.0855																			
IG1-25	0.4690	0.0967																			
IG1-26	0.4514	0.0633																			
IG1-27																					
IG1-28																					
IG1-29	0.5445	0.0002																			
IG1-30	0.4412	0.1046																			
IG1-31	0.4626	0.0293																			
IG1-32	0.5022	0.0002																			
IG1-33	0.5150	0.1393																			
IG1-34	0.5680	0.1353																			
IG1-35	0.4930	0.0003																			
IG1-36	0.5370	0.0002																			
IG1-37	0.4840	0.0747																			
IG1-38	0.5250	0.1022																			
IG1-39	0.4270	0.1024																			
IG1-40	0.5289	0.0367																			
IG1-41	0.5359	0.0345																			
IG1-42	0.4590	0.0723																			
IG1-43	0.4490	0.1079																			
IG1-44	0.5835	0.1384																			

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
IG1-01																					
IG1-02																					
IG1-03																					
IG1-04																					
IG1-05																					
IG1-06																					
IG1-07																					
IG1-08																					
IG1-09																					
IG1-10																					
IG1-11																					
IG1-12																					
IG1-13																					
IG1-14																					
IG1-15																					
IG1-16																					
IG1-17																					
IG1-18																					
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IG1-37																					
IG1-38																					
IG1-39																					
IG1-40																					
IG1-41																					
IG1-42																					
IG1-43																					
IG1-44																					

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
IG1-01																				0.9630
IG1-02																				
IG1-03																				
IG1-04																				0.9236
IG1-05																				0.9910
IG1-06																				0.9733
IG1-07																				0.9724
IG1-08																				0.9500
IG1-09																				0.9961
IG1-10																				0.9577
IG1-11																				0.9484
IG1-12																				0.9620
IG1-13																				1.0176
IG1-14																				0.9353
IG1-15																				
IG1-16																				0.9768
IG1-17																				
IG1-18																				0.9704
IG1-19																				
IG1-20																				0.9935
IG1-21																				0.9763
IG1-22																				
IG1-23																				
IG1-24																				0.9679
IG1-25																				0.9853
IG1-26																				0.9547
IG1-27																				
IG1-28																				
IG1-29																				0.9305
IG1-30																				0.8813
IG1-31																				0.9708
IG1-32																				0.9644
IG1-33																				0.9909
IG1-34																				0.9655
IG1-35																				0.9694
IG1-36																				0.9647
IG1-37																				0.9747
IG1-38																				0.9703
IG1-39																				0.9413
IG1-40																				0.9779
IG1-41																				0.9719
IG1-42																				0.9862
IG1-43																				0.9933
IG1-44																				0.9792

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
IG1-01	1150	897	902	Li3PO4	Homogeneous	Phase separated	Li3PO4	no
IG1-02	1150			Li3PO4	Phase Separated		Li3PO4	no
IG1-03	1150			Na3PO4	Phase Separated		Na3PO4	no
IG1-04	1150				Phase Separated	Phase Separated		no
IG1-05	1150				Phase Separated	Phase Separated		no
IG1-06	1150	883-855	887	SiO2, LiB2O4	Homogeneous		Amorphous	yes
IG1-07	1150	915-897	885	LiAlSi3O8	Homogeneous		Amorphous	yes
IG1-08	1150				Phase Separated	Phase Separated		no
IG1-09	1150		861	Na2Si3O7,	Homogeneous	Phase separated	Li2NaPO4	no
IG1-10	1150	985-965	981	Na2ZrSi2O7,	Homogeneous		Amorphous	yes
IG1-11	1150	848-743	827	NaAlSiO4, Li2SiO3	Homogeneous		Amorphous	yes
IG1-12	1150		1075	K2ZrSi3O9	Homogeneous	Homogeneous	Amorphous	yes
IG1-13	1150	775-770	765	Li2SiO3	Homogeneous	Homogeneous	Amorphous	yes
IG1-14	1150	850-840	862	Li3PO4	Homogeneous	Phase separated	Li3PO4	no
IG1-15	1150				Phase Separated			no
IG1-16	1150	908-882	917	Li3PO4, Zr2P2O7	Homogeneous	Homogeneous	Amorphous	yes
IG1-17	1150	930-925	928	(Li,Na)3PO4, Li2NaPO4	Homogeneous	Phase separated	Li2NaPO4	no
IG1-18	1150				Phase separated			no
IG1-19	1150				Phase separated			no
IG1-20	1150				Phase separated	Phase separated		no
IG1-21	1150	918-898	927	Li3PO4	Homogeneous	Phase separated	Li3PO4	no
IG1-22	1150				Phase separated			no
IG1-23	1150				Phase separated			no
IG1-24	1150	918	905	Li3PO4	Homogeneous	Phase separated	Li3PO4, Na2ZrSiO5	no
IG1-25	1150	990-980	991	K2ZrSi3O9, Li3PO4	Homogeneous	Questionable	Li3PO4	no
IG1-26	1150	888	875	Li3PO4	Homogeneous	Phase separated	Li3PO4	no
IG1-27	1150				Phase separated			no
IG1-28	1150				Phase separated			no
IG1-29	1150	1090-1080			Homogeneous			yes
IG1-30	1150	1135-1125			Homogeneous			yes
IG1-31	1150	785	791	Li2SiO3, ZrO2	Homogeneous		Li2SiO3, ZrO2	no
IG1-32	1150				Phase Separated		Li3PO4	no
IG1-33	1450		1310	Na2ZrSi2O7	Homogeneous		Amorphous	yes
IG1-34	1150		1142	LiNaZrSi6O15, Li3PO4	Homogeneous	Phase separated	Li3PO4	no
IG1-35	1150	863	850	Na3PO4	Homogeneous	Homogeneous	Amorphous	yes
IG1-36	1150	865	855	Li2SiO3	Homogeneous		Li2SiO3	no
IG1-37	1150	871	887	Li3PO4, ZrO2	Homogeneous	Homogeneous	Amorphous	yes
IG1-38	1150	900-885	922	LiNaZrSi6O15	Homogeneous	Homogeneous	Amorphous	yes
IG1-39	1150	875-840	855	K2ZrSi3O9	Homogeneous	Homogeneous	Amorphous	yes
IG1-40	1150	927	927	Li3PO4	Homogeneous	Homogeneous	Li3PO4	no
IG1-41	1150	835-827	847	Li3PO4	Homogeneous	Questionable	Li3PO4	no
IG1-42	1150	960-953	954	Li3PO4	Homogeneous	Phase separated	Li3PO4	no
IG1-43	1150	815	811	Li3PO4	Homogeneous	Homogeneous	Amorphous	yes
IG1-44	1150		1142	LiNaZrSi6O15, Li3PO4	Homogeneous	Phase separated	Li3PO4	no

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
IG1-01					
IG1-02					
IG1-03					
IG1-04					
IG1-05					
IG1-06					
IG1-07					
IG1-08					
IG1-09					
IG1-10					
IG1-11					
IG1-12					
IG1-13					
IG1-14	Phase separated		Li3PO4		
IG1-15					
IG1-16	homogenous		Li3PO4		
IG1-17					
IG1-18					
IG1-19					
IG1-20					
IG1-21					
IG1-22					
IG1-23					
IG1-24					
IG1-25					
IG1-26					
IG1-27					
IG1-28					
IG1-29					
IG1-30					
IG1-31					
IG1-32					
IG1-33					
IG1-34					
IG1-35	homogenous		Na3PO4		
IG1-36					
IG1-37	homogenous		Li3PO4		
IG1-38	homogenous		none		
IG1-39	homogenous		none		
IG1-40					
IG1-41	Phase separated		Li3PO4		
IG1-42					
IG1-43	homogenous		Li3PO4		
IG1-44					

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
IG1-01			-5.8791	6252.6	296.52	4.25	-11.624	18626.3	4.33				1160	3.8	1105.8
IG1-02			-3.5888	2400.8	584.24	1.92	-10.903	16498.7	2.00				1162.2	1.7	1109.3
IG1-03															
IG1-04															
IG1-05															
IG1-06			-5.9344	6419	337.53	7.14	-12.931	21236.6	7.33				1156.1	6.66	1105.9
IG1-07			-5.061	6470.2	264.42	9.44	-10.218	17762.1	9.62				1159.5	8.76	1106.6
IG1-08			-1.1538	1153.3	849.2	14.59	-13.273	22753.9	15.14				1159	13.18	1107.9
IG1-09			-7.0245	6030	353.72	1.73	-14.109	20894.0	1.78				1155.9	1.64	1105.5
IG1-10			-7.3343	7607.1	242.89	2.86	-12.854	19823.4	2.94				1159.1	2.68	1106.4
IG1-11			-4.8207	6807	216.48	11.83	-9.233	16682.8	12.07				1158.6	11.19	1105.4
IG1-12			-9.6209	10796	209.54	6.41	-16.359	25957.7	6.57				1158.7	5.67	1108
IG1-13			-5.5947	6261.9	183.91	2.43	-9.104	14234.8	2.46				1156	2.33	1105.1
IG1-14			-5.3455	6601.5	255.8	7.67	-10.419	17754.0	7.83				1157.6	7.18	1106.6
IG1-15															
IG1-16			-5.9717	6781.3	305.43	7.83	-12.405	20626.9	8.09				1162.1	7.05	1109
IG1-17			-6.0772	6626.8	338.08	8.04	-13.320	21964.5	8.29				1159.9	7.25	1107.4
IG1-18															
IG1-19			-5.4745	6233.2	325.58	8.05	-10.958	18584.3	8.18				1160.8	7.23	1108.5
IG1-20															
IG1-21			-6.1136	6360	285.07	3.45	-11.656	18383.0	3.53				1158	3.24	1105.8
IG1-22															
IG1-23			-5.8418	6380.9	337.04	7.44	-11.773	19632.8	7.57				1158	6.88	1107
IG1-24			-5.7323	5834.4	311.32	3.40	-11.364	17948.6	3.49				1162.4	3.06	1109.8
IG1-25			-6.1325	6734.2	307.96	6.46	-12.618	20654.5	6.67				1159.6	5.92	1107.2
IG1-26			-5.9698	6285.1	297.72	4.07	-11.742	18738.4	4.16				1158	3.78	1107
IG1-27			-1.2374	1166.9	848.61	13.93	-13.892	23590.1	14.67				1159.9	12.38	1109
IG1-28			-1.8747	1522.3	811.08	13.69	-14.667	24669.0	14.42				1158.1	12.17	1107
IG1-29			-4.6669	6594.3	238.87	13.07	-9.329	16959.1	13.31				1163.2	11.74	1110.3
IG1-30			-5.0111	4049.1	425.74	1.79	-11.533	17273.8	1.83				1155.3	1.71	1104.1
IG1-31			-5.816	6034.3	220.07	1.96	-9.786	14901.3	1.99				1157.3	1.87	1106.6
IG1-32			-4.9198	6656.4	273.09	14.45	-10.040	18112.8	14.71				1157.1	13.75	1106.1
IG1-33															
IG1-34			-5.8934	6799.9	373.14	17.46	-13.818	23769.5	17.92				1158	15.95	1106.9
IG1-35			-5.1402	5750.5	366.4	9.01	-12.244	20609.6	9.39				1158.5	8.25	1107.4
IG1-36			-5.5219	6460.8	189.34	3.33	-9.230	14871.2	3.39				1155.9	3.25	1106
IG1-37			-5.849	6571.6	286.65	5.83	-11.618	19076.5	5.98				1157.5	5.45	1106.8
IG1-38			-5.9294	6569.3	319.64	7.26	-12.583	20764.4	7.46				1157.5	6.74	1106.7
IG1-39			-6.3307	6346.2	288.7	2.82	-11.949	18514.0	2.89				1159.2	2.62	1107.7
IG1-40			-5.2199	6054.7	313.58	7.53	-11.169	18797.4	7.70				1157.9	6.92	1106.7
IG1-41			-5.3757	6490.9	274.82	7.70	-10.784	18279.6	7.86				1158	7.16	1106.9
IG1-42			-5.7084	6720.2	289.77	8.20	-11.691	19668.3	8.42				1158.6	7.6	1107.2
IG1-43			-6.0533	6513.7	343.86	7.59	-13.339	21906.5	7.81				1159.7	6.82	1107.2
IG1-44			-5.9383	6830.5	371.37	17.02	-13.833	23754.6	17.47				1158.9	15.43	1107.5

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
IG1-01	6.22	1055.1	10.32	1108	6.42	1158.7	3.99	1206.5	2.69	1255.2	1.87	1153.4	4.23	1005.5	19.2	956	36.53				
IG1-02	2.6	1058.4	4.23	1109.5	2.68	1158.7	1.85	1207.9	1.32	1255.9	0.96	1156.3	1.92	1008	8.1						
IG1-03																					
IG1-04																					
IG1-05																					
IG1-06	11.21	1056	20	1107.9	10.93	1157.5	6.6	1206.1	4.27	1255.3	2.89	1155.2	6.98	1006.7	39.19	957.2	83.12				
IG1-07	13.83	1055.6	22.59	1107.6	13.61	1158	8.86	1206.1	6.1	1254.9	4.31	1154.4	9.22	1005.9	39.25	955.9	72.99				
IG1-08	27.35	1158.6	12.48	1207.2	8.14	1256	5.31	1156.2	13.76												
IG1-09	2.7	1055.6	4.77	1105.9	2.71	1155.2	1.65	1204.1	1.06	1252.9	0.72	1154.6	1.69	1006	9.31	956.9	19.38				
IG1-10	4.47	1055.8	7.7	1107.3	4.38	1157	2.71	1206.1	1.75	1256	1.17	1155	2.77	1006.1	14.07	956.8	27.35				
IG1-11	17.35	1055.4	27.25	1107.2	16.99	1156.6	11.34	1205.8	7.83	1254.7	5.54	1154	11.8	1006.1	45.23	956.6	78.54				
IG1-12	10.8	1057.9	21.25	1109.5	10.59	1158.8	5.77	1207.6	3.29	1255.8	1.97	1156.2	6.58	1007.9	50.7	958.6	120.84				
IG1-13	3.35	1055	4.94	1105.3	3.36	1154.8	2.37	1204	1.72	1253.1	1.27	1154.1	2.42	1005.2	7.69	956.1	12.12				
IG1-14	11.3	1056.3	18.29	1106.7	11.3	1156.2	7.34	1205.2	4.99	1254.2	3.49	1155.4	7.51	1006.4	31.97	957	57.77				
IG1-15																					
IG1-16	12.03	1058.4	21.33	1109.5	11.97	1158.8	7.28	1207.7	4.67	1256.4	3.14	1156.6	7.48	1008.1	40.4	958.9	80.74				
IG1-17	12.77	1056.5	23.31	1107.6	12.61	1157.1	7.63	1206.2	4.75	1255.2	3.1	1155.4	7.76	1006.5	47.37	957.2	100.39				
IG1-18																					
IG1-19	11.95	1057.6	21.06	1108.9	11.94	1158.3	7.42	1207.1	4.93	1255.8	3.43	1156.1	7.74								
IG1-20																					
IG1-21	5.2	1055.4	8.62	1107.9	5.06	1157.3	3.26	1206.1	2.2	1255	1.54	1154.8	3.37	1005.9	15.16	956.7	28.39				
IG1-22																					
IG1-23	11.53	1056.8	20.36	1107.2	11.55	1156.5	7.01	1205.5	4.52	1254.4	3	1155.7	7.19								
IG1-24	4.78	1059	7.79	1110.2	4.76	1159.5	3.14	1208.3	2.17	1256.9	1.57	1157.3	3.29	1008.7	14.23	959.6	26.37				
IG1-25	10.09	1056.5	17.8	1107.9	10	1157.4	6.12	1206.3	3.92	1255.1	2.6	1155.3	6.33	1006.5	34.28	957.3	68.32				
IG1-26	6.03	1057.1	10.01	1107.1	6.06	1156.9	3.86	1206	2.59	1255	1.79	1156.2	3.94	1007	18.25	957.6	34.67				
IG1-27	25.34	1158.5	12.54	1107.6	27	1158.8	11.91	1207.5	7.6	1256.2	5.11	1156.3	13.36								
IG1-28	26.29	1106.2	27.59	1156.4	12.02	1205.4	7.27	1254.3	4.92	1155.5	12.76										
IG1-29	18.22	1059.5	29.02	1110.9	18.24	1160	12.13	1208.9	8.38	1258	6.02	1158.1	12.45	1009.4	49.44	960.2	86.88				
IG1-30	2.55	1055.8	4.05	1107.4	2.53	1157	1.72	1206.1	1.2	1255.2	0.87	1155.6	1.73	1006.9	7.25	957.1	13.49				
IG1-31	2.7	1056.2	4.05	1106.7	2.71	1156.1	1.89	1205.4	1.36	1254.2	1	1155.4	1.9	1006.2	6.43	956.9	10.65				
IG1-32	21.69	1055.9	35.77	1106.4	21.65	1155.8	13.83	1204.8	9.23	1253.8	6.35	1155	14.05	1006.1	63.75						
IG1-33																					
IG1-34	29.34	1056.5	57.34	1106.7	29.46	1156.1	16.34	1205.1	9.7	1254.1	6.06	1155.2	16.67	1006.1	124.1						
IG1-35	13.59	1057.1	23.86	1107.4	13.66	1156.9	8.54	1205.8	5.66	1254.7	3.94	1155.8	8.86	1006.8	48.16	957.5	101.63				
IG1-36	4.66	1056.1	6.98	1106.7	4.64	1156.1	3.23	1205.3	2.31	1254.2	1.68	1155.4	3.27	1006.4	10.99	957.1	17.74				
IG1-37	8.81	1056.7	14.75	1107	8.8	1156.5	5.58	1205.5	3.68	1254.4	2.51	1155.6	5.7	1006.7	26.9	957.6	51.17				
IG1-38	11.31	1056.4	20.03	1106.6	11.34	1156.1	6.89	1205.2	4.42	1254.2	2.96	1155.3	7.03	1006.3	38.39	956.9	78.91				
IG1-39	4.17	1057.1	6.92	1107.4	4.2	1156.7	2.7	1205.6	1.81	1254.4	1.25	1155.5	2.73	1006.6	12.48	957.3	23.35				
IG1-40	11.09	1056.5	18.48	1107	11.12	1156.5	7.17	1205.5	4.83	1254.4	3.36	1155.6	7.31	1006.8	34.26	957.4	65.23				
IG1-41	11.32	1056.5	18.64	1106.9	11.39	1156.2	7.34	1205.3	4.95	1254.1	3.45	1155.2	7.57	1006.3	33.42	956.9	62.31				
IG1-42	12.51	1056.7	21.47	1107.2	12.57	1156.6	7.8	1205.5	5.11	1254.5	3.45	1155.5	7.97	1006.7	39.82	957.5	76.91				
IG1-43	11.98	1057.1	21.86	1107.8	11.89	1157.7	7.08	1206.2	4.47	1255.2	2.94	1155.5	7.39	1006.3	43.86	958.8	92.76				
IG1-44	28.44	1057	55.43	1107.3	28.61	1156.6	15.92	1205.5	9.42	1254.4	5.88	1155.5	16.16	1006.5	119.96						

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
IG1-01					2.790	1.636	2.279	0.670								
IG1-02					3.546	0.877	2.984	0.4225								
IG1-03					21.404	6.168	16.491	2.569								
IG1-04					0.384	1.686	0.599	0.200								
IG1-05					4.061	0.129	2.330	0.401								
IG1-06					9.634	9.516	8.923	1.583								
IG1-07					0.282	0.362	0.063	0.2575								
IG1-08					0.183	0.283	0.339	0.1265								
IG1-09					2.865	1.115	2.292	0.2495								
IG1-10					14.658	10.665	9.512	5.6345								
IG1-11					0.291	0.380	0.938	0.2825								
IG1-12					4.605		3.999	0.155								
IG1-13					30.051	23.368	29.596	20.071								
IG1-14					0.498	0.285	0.650	0.1945								
IG1-15					0.493	0.395	0.584	0.203								
IG1-16					0.353	0.216	0.594	0.1565								
IG1-17					0.202	0.066	0.335	0.1185								
IG1-18					0.318	0.290	0.353	0.1355								
IG1-19					0.279	0.251	0.323	0.1245								
IG1-20					0.254	0.219	0.282	0.1095								
IG1-21					0.905	0.736	0.738	0.1295								
IG1-22					0.396	0.223	0.396	0.1285								
IG1-23					0.176	0.207	0.328	0.112								
IG1-24					1.042	0.725	0.750	0.133								
IG1-25					0.450	0.401	0.632	0.1445								
IG1-26					3.143	1.812	2.495	0.7185								
IG1-27					0.151	0.293	0.336	0.118								
IG1-28					0.181	0.315	0.357	0.1295								
IG1-29					0.227	0.357	0.175	0.205								
IG1-30					12.142	8.152	8.975	3.4275								
IG1-31					1.512	1.270	0.783	0.2645								
IG1-32					0.194	0.289	0.268	0.150								
IG1-33					5.822	9.658	10.615	4.285								
IG1-34					0.543	0.541	0.119	0.257								
IG1-35					0.440	18.427	0.358	0.1515								
IG1-36					8.858	8.973	8.924	4.634								
IG1-37					7.792	0.057	6.358	0.4835								
IG1-38					1.225	1.108	0.737	0.3145								
IG1-39					1.694	1.396	1.080	0.1695								
IG1-40					4.115	2.835	3.623	1.0755								
IG1-41					20.179	8.174	16.802	6.3355								
IG1-42					0.202	0.264	0.307	0.126								
IG1-43					0.725	0.355	0.552	0.1195								
IG1-44					0.580	0.573	0.125	0.2745								

INEEL CVS Phase 1 (Staples et al. 1999)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
IG1-01												
IG1-02												
IG1-03												
IG1-04												
IG1-05												
IG1-06												
IG1-07												
IG1-08												
IG1-09												
IG1-10												
IG1-11												
IG1-12												
IG1-13												
IG1-14												
IG1-15												
IG1-16												
IG1-17												
IG1-18												
IG1-19												
IG1-20												
IG1-21												
IG1-22												
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IG1-26												
IG1-27												
IG1-28												
IG1-29												
IG1-30												
IG1-31												
IG1-32												
IG1-33												
IG1-34												
IG1-35												
IG1-36												
IG1-37												
IG1-38												
IG1-39												
IG1-40												
IG1-41												
IG1-42												
IG1-43												
IG1-44												

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
IG2-01	0.1986	0.0496	0.0000	0.0000		0.0000	0.0000	0.0021	0.1986	0.0149	0.0000	0.4715	0.0000			0.0000			0.0000		0.0000
IG2-02	0.1986	0.1787	0.1191	0.0000		0.0000	0.0000	0.0021	0.0496	0.0000	0.0298	0.4170	0.0000			0.0000			0.0000		0.0000
IG2-03	0.0348	0.1790	0.0000	0.0796		0.0000	0.0000	0.0021	0.0497	0.0149	0.0000	0.5969	0.0000			0.0000			0.0000		0.0001
IG2-04	0.1986	0.1787	0.0000	0.0000		0.0993	0.0894	0.0021	0.0496	0.0149	0.0000	0.3474	0.0149			0.0000			0.0000		0.0000
IG2-05	0.0347	0.0496	0.1191	0.0794		0.0099	0.0000	0.0021	0.1986	0.0149	0.0000	0.3476	0.1390			0.0000			0.0000		0.0000
IG2-06	0.0645	0.1787	0.0000	0.0794		0.0000	0.0894	0.0021	0.0496	0.0149	0.0298	0.3475	0.1390			0.0000			0.0000		0.0000
IG2-07	0.0794	0.0496	0.1191	0.0000		0.0993	0.0000	0.0021	0.0496	0.0149	0.0298	0.3525	0.1390			0.0000			0.0000		0.0000
IG2-08	0.0347	0.1787	0.1191	0.0000		0.0993	0.0000	0.0021	0.1268	0.0000	0.0000	0.4342	0.0000			0.0000			0.0000		0.0000
IG2-09	0.1986	0.0496	0.1191	0.0794		0.0000	0.0736	0.0021	0.0496	0.0000	0.0000	0.3633	0.0000			0.0000			0.0000		0.0000
IG2-10	0.0347	0.0496	0.0000	0.0794		0.0993	0.0834	0.0021	0.0496	0.0000	0.0298	0.5074	0.0000			0.0000			0.0000		0.0000
IG2-11	0.0347	0.0496	0.0746	0.0000		0.0000	0.0894	0.0021	0.1588	0.0149	0.0298	0.5410	0.0000			0.0000			0.0000		0.0000
IG2-12	0.0347	0.1787	0.0000	0.0000		0.0000	0.0052	0.0021	0.1986	0.0000	0.0000	0.4044	0.1116			0.0000			0.0000		0.0000
IG2-13	0.0485	0.0706	0.0000	0.0000		0.0000	0.0894	0.0021	0.0496	0.0000	0.0000	0.5957	0.1390			0.0000			0.0000		0.0000
IG2-14	0.1986	0.0613	0.0000	0.0794		0.0993	0.0000	0.0021	0.1489	0.0000	0.0298	0.3556	0.0199			0.0000			0.0000		0.0000
IG2-15	0.0794	0.0596	0.0397	0.0050		0.0298	0.0596	0.0021	0.1489	0.0050	0.0199	0.4963	0.0397			0.0000			0.0000		0.0000
IG2-16	0.1092	0.1191	0.0397	0.0050		0.0298	0.0298	0.0021	0.1489	0.0050	0.0199	0.3971	0.0794			0.0000			0.0000		0.0000
IG2-17	0.0794	0.0596	0.0794	0.0050		0.0298	0.0298	0.0021	0.0993	0.0050	0.0199	0.4814	0.0794			0.0000			0.0000		0.0000
IG2-18	0.1191	0.0596	0.0397	0.0298		0.0596	0.0298	0.0021	0.1489	0.0050	0.0099	0.4021	0.0794			0.0000			0.0000		0.0000
IG2-19	0.0794	0.0596	0.0397	0.0050		0.0298	0.0596	0.0021	0.1489	0.0099	0.0199	0.4914	0.0397			0.0000			0.0000		0.0000
IG2-20	0.0794	0.0596	0.0397	0.0050		0.0596	0.0298	0.0021	0.1489	0.0099	0.0199	0.4914	0.0397			0.0000			0.0000		0.0000
IG2-21	0.0794	0.0596	0.0794	0.0199		0.0596	0.0298	0.0021	0.0993	0.0099	0.0099	0.4964	0.0397			0.0000			0.0000		0.0000
IG2-22	0.1134	0.0651	0.0375	0.0048		0.2098	0.0611	0.0021	0.0140	0.0043	0.0168	0.3825	0.0747			0.0000			0.0000		0.0000
IG2-23	0.1050	0.1191	0.0397	0.0050		0.0298	0.0298	0.0021	0.1489	0.0050	0.0199	0.3971	0.0794			0.0000			0.0000		0.0000
IG2-24	0.1191	0.0596	0.0794	0.0050		0.0596	0.0564	0.0021	0.0993	0.0099	0.0099	0.4053	0.0794			0.0000			0.0000		0.0000
IG2-25	0.1191	0.0596	0.0794	0.0050		0.0596	0.0576	0.0021	0.0993	0.0050	0.0099	0.4090	0.0794			0.0000			0.0000		0.0000
IG2-26	0.0817	0.0611	0.0257	0.0051		0.0611	0.0505	0.0022	0.1018	0.0051	0.0102	0.5088	0.0814			0.0000			0.0000		0.0001
IG2-27	0.0981	0.0596	0.0794	0.0050		0.0298	0.0310	0.0021	0.0993	0.0099	0.0199	0.4963	0.0397			0.0000			0.0000		0.0000
IG2-28	0.0794	0.0596	0.0735	0.0298		0.0596	0.0298	0.0021	0.0993	0.0099	0.0099	0.4924	0.0397			0.0000			0.0000		0.0000
IG2-29	0.0987	0.0915	0.0489	0.0256		0.0440	0.0392	0.0000	0.1154	0.0074	0.0144	0.4361	0.0579			0.0000			0.0000		0.0000
IG2-30	0.1503	0.1503	0.0008	0.0005		0.0000	0.0846	0.0000	0.0501	0.0000	0.0000	0.5314	0.0301			0.0000			0.0000		0.0006
IG2-31	0.0376	0.1252	0.0009	0.0005		0.0250	0.0632	0.0000	0.0876	0.0000	0.0125	0.5403	0.1051			0.0000			0.0000		0.0007
IG2-32	0.0980	0.0908	0.0485	0.0254		0.0437	0.0389	0.0021	0.1146	0.0073	0.0143	0.4331	0.0575			0.0000			0.0000		0.0000
IG2-33	0.0980	0.0908	0.0485	0.0254		0.0437	0.0389	0.0021	0.1146	0.0073	0.0143	0.4331	0.0575			0.0000			0.0000		0.0000
IG2-34	0.0960	0.0890	0.0476	0.0249		0.0428	0.0381	0.0021	0.1123	0.0072	0.0140	0.4243	0.0563			0.0000			0.0000		0.0000
IG2-35	0.0975	0.0904	0.0483	0.0252		0.0435	0.0387	0.0022	0.1139	0.0073	0.0142	0.4304	0.0572			0.0000			0.0000		0.0001
IG2-36	0.0960	0.0890	0.0476	0.0249		0.0428	0.0381	0.0021	0.1123	0.0072	0.0140	0.4243	0.0563			0.0000			0.0000		0.0000
IG2-37	0.0940	0.0872	0.0466	0.0244		0.0419	0.0373	0.0021	0.1100	0.0071	0.0137	0.4155	0.0552			0.0000			0.0000		0.0000

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01	0.0850	0.0925	0.0487	0.0228		0.0088	0.0396	0.0024	0.1246	0.0073	0.0107	0.4207	0.0622			0.0000				0.0001	
IG3-02b	0.0450	0.1625	0.1057	0.0046		0.0018	0.0079	0.0024	0.0652	0.0015	0.0021	0.5158	0.0124			0.0000				0.0001	
IG3-03	0.0400	0.0500	0.0000	0.0000		0.0200	0.0078	0.0024	0.2000	0.0150	0.0250	0.4272	0.1400			0.0000				0.0001	
IG3-04	0.0350	0.1800	0.0000	0.0300		0.0000	0.0268	0.0024	0.0500	0.0150	0.0250	0.5432	0.0000			0.0000				0.0001	

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
IG2-01	0.0003			0.0006	0.0000	0.0000		0.0596		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-02	0.0003			0.0006	0.0000	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-03	0.0003			0.0007	0.0000	0.0000		0.0378		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-04	0.0003			0.0006	0.0000	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-05	0.0003			0.0006	0.0000	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-06	0.0003			0.0006	0.0000	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-07	0.0003			0.0006	0.0000	0.0000		0.0596		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-08	0.0003			0.0006	0.0000	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-09	0.0003			0.0006	0.0000	0.0000		0.0596		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-10	0.0003			0.0006	0.0000	0.0000		0.0596		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-11	0.0003			0.0006	0.0000	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-12	0.0003			0.0006	0.0000	0.0000		0.0596		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-13	0.0003			0.0006	0.0000	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-14	0.0003			0.0006	0.0000	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-15	0.0003			0.0006	0.0000	0.0000		0.0099		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-16	0.0003			0.0006	0.0000	0.0000		0.0099		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-17	0.0003			0.0006	0.0000	0.0000		0.0248		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-18	0.0003			0.0006	0.0000	0.0000		0.0099		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-19	0.0003			0.0006	0.0000	0.0000		0.0099		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-20	0.0003			0.0006	0.0000	0.0000		0.0099		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-21	0.0003			0.0006	0.0000	0.0000		0.0099		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-22	0.0003			0.0006	0.0000	0.0000		0.0091		0.0000		0.0000	0.0000	0.0000	0.0001		0.0000	0.0002	0.0001	0.0000	
IG2-23	0.0003			0.0006	0.0000	0.0000		0.0141		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-24	0.0003			0.0006	0.0000	0.0000		0.0099		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-25	0.0003			0.0006	0.0000	0.0000		0.0099		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-26	0.0003			0.0007	0.0000	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-27	0.0003			0.0006	0.0000	0.0000		0.0248		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-28	0.0003			0.0006	0.0000	0.0000		0.0099		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-29	0.0000			0.0000	0.0000	0.0000		0.0209		0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	
IG2-30	0.0000			0.0000	0.0009	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG2-31	0.0000			0.0000	0.0010	0.0000		0.0000		0.0000		0.0000	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000	0.0000	
IG2-32	0.0003			0.0006	0.0000	0.0000		0.0207		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-33	0.0003			0.0006	0.0000	0.0000		0.0207		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-34	0.0003			0.0006	0.0000	0.0000		0.0203		0.0000		0.0000	0.0000	0.0000	0.0001		0.0201	0.0002	0.0001	0.0000	
IG2-35	0.0003			0.0007	0.0000	0.0000		0.0206		0.0000		0.0000	0.0000	0.0000	0.0001		0.0053	0.0002	0.0001	0.0000	
IG2-36	0.0003			0.0006	0.0000	0.0000		0.0203		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	
IG2-37	0.0003			0.0006	0.0000	0.0000		0.0199		0.0000		0.0000	0.0000	0.0000	0.0001		0.0001	0.0002	0.0001	0.0000	

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01	0.0003			0.0007	0.0000			0.0217				0.0000	0.0226		0.0001		0.0073	0.0002	0.0001	0.0000	
IG3-02b	0.0003			0.0007	0.0000			0.0044				0.0000	0.0445		0.0001		0.0135	0.0002	0.0001	0.0000	
IG3-03	0.0003			0.0007	0.0000			0.0000				0.0000	0.0500		0.0001		0.0150	0.0002	0.0001	0.0000	
IG3-04	0.0003			0.0007	0.0000			0.0000				0.0000	0.0500		0.0001		0.0000	0.0002	0.0001	0.0000	

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
IG2-01	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-02	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-03	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0006		0.0000		0.0000
IG2-04	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-05	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-06	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-07	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-08	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-09	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-10	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-11	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-12	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-13	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-14	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-15	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-16	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-17	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-18	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-19	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-20	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-21	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-22	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0003		0.0000		0.0000
IG2-23	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-24	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-25	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-26	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0006		0.0000		0.0000
IG2-27	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-28	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-29	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0000		0.0000		0.0000
IG2-30	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		0.0000
IG2-31	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0000	0.0000	0.0002		0.0000		0.0000
IG2-32	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-33	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-34	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0005		0.0000		0.0000
IG2-35	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0023	0.0006		0.0000		0.0000
IG2-36	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0206		0.0000		0.0000
IG2-37	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000				0.0000		0.0005	0.0022	0.0405		0.0000		0.0000

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0021	0.0184		0.0000		
IG3-02b		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0044	0.0037		0.0000		
IG3-03		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0050	0.0000		0.0000		
IG3-04		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0000	0.0400		0.0000		

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
IG2-01							0.0000			1.0000	0.2070	0.0522	0.0004	0.0002		0.0000	0.0000		0.2000	0.0155	0.0000
IG2-02							0.0000			1.0000	0.1990	0.1900	0.1130	0.0003		0.0000	0.0000		0.0541	0.0000	0.0286
IG2-03							0.0000			1.0000	0.0364	0.1810	0.0004	0.0820		0.0000	0.0000		0.0508	0.0153	0.0005
IG2-04							0.0000			1.0000	0.1990	0.2010	0.0002	0.0003		0.1300	0.0931		0.0563	0.0148	0.0000
IG2-05							0.0000			1.0000	0.0368	0.0549	0.1170	0.0781		0.0118	0.0000		0.1990	0.0148	0.0000
IG2-06							0.0000			1.0000	0.0649	0.2040	0.0003	0.0766		0.0000	0.1067		0.0512	0.0142	0.0288
IG2-07							0.0000			1.0000	0.0848	0.0573	0.1040	0.0002		0.1190	0.0000		0.0523	0.0146	0.0280
IG2-08							0.0000			1.0000	0.0356	0.1880	0.1150	0.0002		0.1110	0.0000		0.1470	0.0000	0.0000
IG2-09							0.0000			1.0000	0.2000	0.0543	0.1140	0.0756		0.0000	0.0756		0.0581	0.0000	0.0000
IG2-10							0.0000			1.0000	0.0379	0.0661	0.0006	0.0701		0.0868	0.0921		0.0669	0.0000	0.0306
IG2-11							0.0000			1.0000	0.0379	0.0543	0.0729	0.0002		0.0000	0.0911		0.1790	0.0145	0.0281
IG2-12							0.0000			1.0000	0.0385	0.2007	0.0002	0.0002		0.0000	0.0060		0.2240	0.0000	0.0000
IG2-13							0.0000			1.0000	0.0494	0.0784	0.0007	0.0004		0.0000	0.0964		0.0554	0.0000	0.0000
IG2-14							0.0000			1.0000	0.1940	0.0659	0.0003	0.0761		0.1090	0.0000		0.1570	0.0000	0.0275
IG2-15							0.0000			1.0000	0.0802	0.0833	0.0400	0.0050		0.0325	0.0579		0.1590	0.0047	0.0181
IG2-16							0.0000			1.0000	0.1070	0.1270	0.0389	0.0050		0.0313	0.0294		0.1420	0.0046	0.0192
IG2-17							0.0000			1.0000	0.0721	0.0641	0.0675	0.0047		0.0320	0.0306		0.1040	0.0049	0.0176
IG2-18							0.0000			1.0000	0.1150	0.0630	0.0397	0.0277		0.0607	0.0309		0.1660	0.0046	0.0093
IG2-19							0.0000			1.0000	0.0768	0.0647	0.0383	0.0051		0.0311	0.0631		0.1660	0.0092	0.0172
IG2-20							0.0000			1.0000	0.0793	0.0620	0.0396	0.0048		0.0612	0.0290		0.1700	0.0093	0.0181
IG2-21							0.0000			1.0000	0.0791	0.0605	0.0759	0.0166		0.0697	0.0326		0.0980	0.0093	0.0087
IG2-22							0.0000			1.0000	0.1130	0.0648	0.0374	0.0048		0.2090	0.0609		0.0139	0.0043	0.0167
IG2-23							0.0000			1.0000	0.1010	0.1180	0.0382	0.0047		0.0359	0.0299		0.1600	0.0047	0.0187
IG2-24							0.0000			1.0000	0.1050	0.0582	0.0662	0.0059		0.0662	0.0589		0.0975	0.0094	0.0090
IG2-25							0.0000			1.0000	0.1060	0.0573	0.0640	0.0051		0.0616	0.0536		0.0951	0.0046	0.0086
IG2-26							0.0000			1.0000	0.0772	0.0538	0.0251	0.0224		0.0609	0.0554		0.1050	0.0046	0.0089
IG2-27							0.0000			1.0000	0.0992	0.0557	0.0765	0.0048		0.0327	0.0338		0.0969	0.0092	0.0173
IG2-28							0.0000			1.0000	0.0761	0.0564	0.0700	0.0268		0.0696	0.0273		0.1060	0.0090	0.0089
IG2-29							0.0000			1.0000	0.0962	0.1070	0.0466	0.0261		0.0480	0.0390		0.1280	0.0070	0.0132
IG2-30							0.0000			1.0000	0.1480	0.1470	0.0012	0.0014		0.0000	0.0970		0.0513	0.0000	0.0000
IG2-31							0.0000			1.0000	0.0415	0.1300	0.0022	0.0000		0.0262	0.0599		0.0877	0.0000	0.0123
IG2-32							0.0000			1.0000	0.1000	0.0966	0.0476	0.0259		0.0466	0.0425		0.1120	0.0071	0.0143
IG2-33							0.0000			1.0000	0.0968	0.0924	0.0489	0.0251		0.0439	0.0424		0.1150	0.0074	0.0139
IG2-34							0.0000			1.0000	0.0992	0.0992	0.0481	0.0248		0.0431	0.0370		0.1080	0.0070	0.0137
IG2-35							0.0000			1.0000	0.1000	0.0970	0.0485	0.0253		0.0489	0.0360		0.1220	0.0074	0.0142
IG2-36							0.0000			1.0000	0.0980	0.0909	0.0486	0.0244		0.0447	0.0367		0.1100	0.0073	0.0140
IG2-37							0.0000			1.0000	0.0970	0.0829	0.0478	0.0244		0.0461	0.0357		0.1020	0.0073	0.0130

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01							0.0000			1.0000	0.0867	0.0939	0.0538	0.0226		0.0096	0.0396	0.0019	0.1243	0.0068	0.0060
IG3-02b							0.0000			1.0000	0.0452	0.1601	0.1060	0.0045		0.0018	0.0080	0.0020	0.0703	0.0013	0.0016
IG3-03							0.0000			1.0000	0.0411	0.0504	0.0003	0.0001		0.0205	0.0081	0.0026	0.2056	0.0137	0.0208
IG3-04							0.0000			1.0000	0.0361	0.1793	0.0005	0.0297		0.0000	0.0265	0.0002	0.0527	0.0136	0.0228

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
IG2-01	0.4780	0.0000																0.0607			
IG2-02	0.4250	0.0000																0.0000			
IG2-03	0.5930	0.0000																0.0138			
IG2-04	0.3410	0.0147																0.0000			
IG2-05	0.3650	0.1410																0.0000			
IG2-06	0.3630	0.1340																0.0000			
IG2-07	0.3780	0.1280																0.0548			
IG2-08	0.4450	0.0000																0.0000			
IG2-09	0.3840	0.0000																0.0591			
IG2-10	0.4910	0.0000																0.0565			
IG2-11	0.5450	0.0000																0.0000			
IG2-12	0.3940	0.1160																0.0581			
IG2-13	0.5970	0.1360																0.0000			
IG2-14	0.3450	0.0195																0.0000			
IG2-15	0.5050	0.0385																0.0095			
IG2-16	0.3910	0.0799																0.0095			
IG2-17	0.4880	0.0768																0.0209			
IG2-18	0.4220	0.0791																0.0083			
IG2-19	0.5130	0.0399																0.0089			
IG2-20	0.4820	0.0382																0.0084			
IG2-21	0.4890	0.0380																0.0091			
IG2-22	0.3810	0.0744																0.0091			
IG2-23	0.3800	0.0777																0.0132			
IG2-24	0.4080	0.0779																0.0091			
IG2-25	0.3950	0.0740																0.0092			
IG2-26	0.4730	0.0778																0.0000			
IG2-27	0.4840	0.0391																0.0231			
IG2-28	0.4820	0.0382																0.0097			
IG2-29	0.4250	0.0556																0.0203			
IG2-30	0.4960	0.0294																0.0000			
IG2-31	0.5230	0.1060																0.0000			
IG2-32	0.4490	0.0573																0.0195			
IG2-33	0.4430	0.0557																0.0193			
IG2-34	0.4510	0.0543																0.0177			
IG2-35	0.4330	0.0546																0.0199			
IG2-36	0.3900	0.0554																0.0195			
IG2-37	0.3970	0.0526																0.0195			

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01	0.4252	0.0535			0.0000				0.0000		0.0003			0.0006	0.0000			0.0172			
IG3-02b	0.5263	0.0118			0.0000				0.0000		0.0003			0.0006	0.0000			0.0033			
IG3-03	0.4257	0.1195			0.0001				0.0001		0.0003			0.0008	0.0000			0.0005			
IG3-04	0.5412	0.0000			0.0000				0.0000		0.0000			0.0001	0.0000			0.0005			

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
IG2-01						0.0000															
IG2-02						0.0000															
IG2-03						0.0000															
IG2-04						0.0000															
IG2-05						0.0000															
IG2-06						0.0000															
IG2-07						0.0000															
IG2-08						0.0000															
IG2-09						0.0000															
IG2-10						0.0000															
IG2-11						0.0000															
IG2-12						0.0000															
IG2-13						0.0000															
IG2-14						0.0000															
IG2-15						0.0000															
IG2-16						0.0000															
IG2-17						0.0000															
IG2-18						0.0000															
IG2-19						0.0000															
IG2-20						0.0000															
IG2-21						0.0000															
IG2-22						0.0000															
IG2-23						0.0000															
IG2-24						0.0000															
IG2-25						0.0000															
IG2-26						0.0000															
IG2-27						0.0000															
IG2-28						0.0000															
IG2-29						0.0000															
IG2-30						0.0000															
IG2-31						0.0000															
IG2-32						0.0000															
IG2-33						0.0000															
IG2-34						0.0191															
IG2-35						0.0050															
IG2-36						0.0000															
IG2-37						0.0000															

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01	0.0000	0.0211		0.0001		0.0069	0.0002	0.0001	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-02b	0.0000	0.0410		0.0001		0.0130	0.0002	0.0001	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-03	0.0000	0.0462		0.0001		0.0142	0.0002	0.0001	0.0000			0.0000		0.0000		0.0001	0.0000		0.0000		
IG3-04	0.0000	0.0447		0.0000		0.0002	0.0000	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
IG2-01						0.0003														1.0143
IG2-02						0.0003														1.0103
IG2-03						0.0004														0.9736
IG2-04						0.0003														1.0507
IG2-05						0.0004														1.0188
IG2-06						0.0003														1.0440
IG2-07						0.0003														1.0213
IG2-08						0.0004														1.0422
IG2-09						0.0002														1.0209
IG2-10						0.0003														0.9989
IG2-11						0.0004														1.0234
IG2-12						0.0003														1.0380
IG2-13						0.0003														1.0140
IG2-14						0.0003														0.9946
IG2-15						0.0003														1.0340
IG2-16						0.0004														0.9852
IG2-17						0.0003														0.9835
IG2-18						0.0003														1.0266
IG2-19						0.0003														1.0336
IG2-20						0.0003														1.0022
IG2-21						0.0003														0.9868
IG2-22						0.0003														0.9896
IG2-23						0.0003														0.9823
IG2-24						0.0003														0.9716
IG2-25						0.0003														0.9344
IG2-26						0.0003														0.9644
IG2-27						0.0003														0.9726
IG2-28						0.0003														0.9803
IG2-29						0.0000														1.0120
IG2-30						0.0000														0.9713
IG2-31						0.0000														0.9888
IG2-32						0.0003														1.0187
IG2-33						0.0003														1.0041
IG2-34						0.0003														1.0225
IG2-35						0.0003														1.0121
IG2-36						0.0148														0.9543
IG2-37						0.0300														0.9553

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01		0.0000		0.0005	0.0039	0.0183		0.0000									0.0000			0.9932
IG3-02b		0.0000		0.0005	0.0040	0.0036		0.0000									0.0000			1.0057
IG3-03		0.0000		0.0006	0.0052	0.0000		0.0000									0.0000			0.9771
IG3-04		0.0000		0.0000	0.0004	0.0348		0.0000									0.0000			0.9836

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
IG2-01	1250				Inhomogeneous		Na3AlF6	no
IG2-02	1250		1133	Ca5(PO4)3(OH)	Homogeneous		Amorphous	yes
IG2-03	1550				Inhomogeneous		Fe2O3, NaAlO2	no
IG2-04	1150		913	NiO, Na2ZrO3	Homogeneous		Amorphous	yes
IG2-05	1250				Inhomogeneous		ZrO2	no
IG2-06	1250				Inhomogeneous		ZrSiO4, ZrO2	no
IG2-07	1250				Inhomogeneous		ZrO2, CaF2	no
IG2-08	1150		861	CaSiO3	Homogeneous		Amorphous	yes
IG2-09	1150				Inhomogeneous		Amorphous	no
IG2-10	1150				Inhomogeneous		Unidentified Phase	no
IG2-11	1150		773	Li2SiO3	Homogeneous		Amorphous	yes
IG2-12	1150		823	unknown phase	Homogeneous		Amorphous	yes
IG2-13	1250		1223	ZrSiO4	Homogeneous		Amorphous	yes
IG2-14	1250		1133	NaAlSiO4	Homogeneous		Amorphous	yes
IG2-15	1150		823	Ca5(PO4)3OH	Homogeneous		Amorphous	yes
IG2-16	1150		948	Ca5(PO4)3F	Homogeneous		Amorphous	yes
IG2-17	1250				Homogeneous		Ca5(PO4)3F	no
IG2-18	1250		1407	ZrO2	Homogeneous		ZrO2	no
IG2-19	1150		841	Li2SiO3,	Homogeneous		Amorphous	yes
IG2-20	1150		843	Ca5(PO4)3F	Homogeneous		Amorphous	yes
IG2-21	1150		961	Ca5(PO4)3F	Homogeneous		Amorphous	yes
IG2-22	1250				Homogeneous		SiO2, SiP2O7, AlPO4	no
IG2-23	1150		923	Ca5(PO4)3F	Homogeneous		Amorphous	yes
IG2-24	1250		1382	ZrO2	Homogeneous		Amorphous	yes
IG2-25	1250		1362	ZrO2	Homogeneous		Amorphous	yes
IG2-26	1150		966	Li2SiO3	Homogeneous		Amorphous	yes
IG2-27	1250				Inhomogeneous		Ca5(PO4)3F	no
IG2-28	1150		938	Ca5(PO4)3F	Homogeneous		Amorphous	yes
IG2-29	1150		923	Ca5(PO4)3F	Homogeneous		Amorphous	yes
IG2-30	1150		948	LiAlSi3O8	Homogeneous		Amorphous	yes
IG2-31	1150		883	LiNaZrSi6O15, LiPO4	Homogeneous		Amorphous	yes
IG2-32	1150		933	Ca5(PO4)3F	Homogeneous		Amorphous	yes
IG2-33	1150		913	Ca5(PO4)3F	Homogeneous		Amorphous	yes
IG2-34	1250				Inhomogeneous		Ca5(PO4)3F, KAlSiO4	no
IG2-35	1150		931	Ca5(PO4)3F	Homogeneous		Amorphous	yes
IG2-36	1150		923	Ca5(PO4)3F	Homogeneous		Amorphous	yes
IG2-37	1150		938	Ca5(PO4)3F	Homogeneous		Amorphous	yes

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01	1150		873	Ca10(SiO4)3(SO4)3F 2	single-phase		amorphous	yes
IG3-02b	1250		963	CaMoO4	single-phase		amorphous	yes
IG3-03	1350				multi-phase		Na2MoO4, Na(AlSi3O8)	no
IG3-04	1250				multi-phase		LaPO4, Na5P3O10, SiP2O7	no

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
IG2-01					
IG2-02					
IG2-03					
IG2-04					
IG2-05					
IG2-06					
IG2-07					
IG2-08					
IG2-09	Inhomogenous		LiAlSiO4 and NaAlSiO4		
IG2-10	Inhomogenous		Li3PO4 and LiF		
IG2-11	homogenous		Amorphous		
IG2-12	Inhomogenous		NaF, LiAlOCl2, and NaAl2Si2O9		
IG2-13					
IG2-14					
IG2-15	homogenous		Amorphous		
IG2-16					
IG2-17					
IG2-18					
IG2-19	homogenous		Amorphous		
IG2-20	homogenous		Amorphous		
IG2-21					
IG2-22					
IG2-23	Inhomogenous		Ca5(PO4)3F		
IG2-24					
IG2-25					
IG2-26	homogenous		Amorphous		
IG2-27					
IG2-28	homogenous		Amorphous		
IG2-29	Inhomogenous		Ca5(PO4)3F		
IG2-30					
IG2-31					
IG2-32					
IG2-33	Inhomogenous		Ca5(PO4)3F		
IG2-34					
IG2-35	Inhomogenous		Ca5(PO4)3F		
IG2-36	Inhomogenous		Ca5(PO4)3F		
IG2-37					

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01	brown colored glass is multi-phase and transparent with a small fraction of large clear crystal clusters throughout		amorphous		
IG3-02b	opaque colored glass is multi-phase and devitrified with large clear crystals		amorphous		
IG3-03	dark reddish brown glass is multi-phase with very small clear granular crystals making the glass appear cloudy		La2Mo2O9 and KAlP2O7		
IG3-04	opaque-brown glass with a lighter brown surface is multi-phased and devitrified with fern type crystals		La(PO4) and La2(MoO4)3		

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
IG2-01		2.49	-3.6815	6380.2	259.2	32.49	-8.170	16656.0	34.29	1606		1317	1156.7	29.94	1105.7
IG2-02		2.45	-4.6429	5769.9	516.35	86.74	-14.185	26612.9	91.56	1516		1341	1254.9	23.36	1205
IG2-03		2.34													
IG2-04		2.45	-5.7656	5989.6	201.68	1.73	-9.374	14141.8	1.76	1132		938	1157.1	1.64	1106.2
IG2-05		2.94	-16.402	27111	-385.51	3.50	-15.192	23401.5	3.50	1200		1065	1256.3	1.17	1205.8
IG2-06		2.73	-10.533	13589	-144.05	0.97	-11.671	16572.6	0.98	1067		913	1007.7	3.84	958
IG2-07		2.78	-33.64	63084	-501.3	95.84	(-28.623)	47202.154	(94.43')	1337		1253	1107.2	338.1	1057.2
IG2-08		2.56	-5.4958	4279.5	422.59	1.47	-12.232	18004.0	1.52	1120		966	1157.8	1.37	1107.4
IG2-09		2.66	-5.2587	3936.8	454.74	1.50	-12.400	18270.4	1.55	1122		970	1159.4	1.34	1108.1
IG2-10		2.45	-5.5952	5698.8	301.94	3.08	-11.321	17729.3	3.12	1203		1028	1059.1	6.92	1007.7
IG2-11		2.55	-5.8924	5992.5	206.39	1.58	-10.113	15046.1	1.58	1119		939	1059.4	3.05	1007.4
IG2-12		2.63	-6.4399	5817.5	336	2.03	-13.871	20743.0	2.03	1151		1010	1061.8	4.34	957.6
IG2-13		2.59	-5.8504	7017.6	364.12	21.74	-12.412	22087.8	22.42	1413		1228	1254.8	7.54	1204.7
IG2-14		2.29	-27.698	96203	-1806.8	126.24	-12.483	24733.0	134.01	1604		1400	1255.5	44.31	1204.9
IG2-15		2.56	-5.5756	6249.9	256.64	4.14	-10.366	16800.0	4.22	1246		1053	1157.1	3.86	1106.4
IG2-16		2.61	-5.9936	6386.2	302.7	4.68	-11.982	19284.0	4.80	1248		1077	1156.1	4.37	1105.3
IG2-17		2.65	-5.7477	6537.2	363.42	12.98	-12.163	20998.0	13.37	1360		1178	1254.3	4.74	1204.1
IG2-18		2.67	-7.1023	8434.5	222.83	7.35	-12.183	20260.0	7.80	1300		1125	1254.9	2.86	1205.1
IG2-19		2.58	-5.7004	6278.3	258.55	3.83	-10.540	16939.0	3.91	1235		1046	1156.1	3.57	1105.6
IG2-20		2.58	-5.6886	6772.7	267.91	7.31	-11.146	18736.0	7.54	1309		1120	1158.7	6.65	1107.3
IG2-21		2.61	-5.5949	6870.3	297.01	11.70	-11.831	20386.0	12.12	1355		1169	1158.7	10.79	1108
IG2-22		2.59	-7.2824	8396	234.93	6.64	-13.137	21426.0	6.82	1276		1115	1158.1	6	1116.7
IG2-23		2.62	-6.2059	6387.6	303.18	3.81	-12.176	19270.0	3.92	1224		1058	1158.4	3.51	1107.5
IG2-24		2.66	-7.5443	8590.7	183.59	3.84	-12.327	19490.0	3.93	1224		1059	1159.2	3.56	1108.9
IG2-25		2.66	-7.4458	8626.8	174.48	4.05	-12.059	19182.0	4.14	1231		1062	1158.9	3.73	1108.3
IG2-26		2.6	-5.5274	6772.5	302.42	11.74	-11.848	20409.0	12.11	1354		1169	1156.7	11	1106.6
IG2-27		2.59	-5.4888	6358.8	369.17	14.22	-12.222	21200.0	14.53	1368		1186	1157.2	12.94	1106.8
IG2-28		2.62	-5.7848	6668.3	299.18	7.79	-11.922	19929.0	8.03	1307		1128	1158.5	7.38	1107.5
IG2-29		2.62	-5.8416	6430.1	274.81	4.51	-11.180	18085.0	4.61	1250		1068	1158.5	4.11	1107.2
IG2-30		2.41	-5.0017	6565.9	261.49	10.89	-10.119	17829.0	11.14	1376		1162	1157.7	10.22	1107.7
IG2-31		2.56	-5.7592	6542.4	320.54	8.40	-12.345	20636.0	8.64	1310		1136	1158.3	7.75	1107.1
IG2-32		2.61	-5.8462	6466.9	283.55	5.04	-11.396	18555.0	5.17	1262		1081	1160.2	4.54	1108.7
IG2-33		2.62	-6.0101	6340	288.38	3.85	-11.584	18437.0	3.94	1229		1055	1157.6	3.53	1106.4
IG2-34		2.63	-5.8429	6386.1	292.35	4.97	-11.549	18751.0	5.09	1259		1081	1157.3	4.58	1106.8
IG2-35		2.61	-5.8817	6398.6	282.21	4.44	-11.353	18313.0	4.56	1247		1068	1156.7	4.16	1106.7
IG2-36		2.64	-5.7538	6211.9	289.88	4.34	-11.228	18100.0	4.44	1245		1065	1158.4	3.94	1107.4
IG2-37		2.67	-5.8505	6358.3	287.47	4.58	-11.400	18422.0	4.69	1250		1071	1157.1	4.25	1107.3

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01		2.71					-11.688	18047.0	2.70	1184		1017	1156.2	2.47	1106
IG3-02b		2.60					-12.092	21014.0	14.52	1370		1187	1255.4	5.07	1205.2
IG3-03		2.83					-14.454	24640.0	17.49	1354		1197	1354.2	1.92	1304.2
IG3-04		2.56					-11.676	21039.0	22.40	1428		1232	1255.4	7.61	1205.5

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
IG2-01	46.49	1055.4	76.18	1006.5	130.91	956.6	237.94	1155.6	31.02	1204.6	21.84	1254.5	15.76	1303.8	11.31	1353.8	8.56				
IG2-02	42.21	1155.5	81	1105.8	170.14	1056.1	415.42	1156.6	84.56	1205.9	42.01	1255	23.46	1304.5	13.93	1354.7	9.39	1405.5	6.62	1255.6	22.74
IG2-03																					
IG2-04	2.35	1056.1	3.47	1006.4	5.35	956.8	8.64	1156.5	1.66	1205.6	1.22	1255.7	0.91	1156.9	1.7						
IG2-05	1.98	1156.1	3.24	1106.7	5.83	1254.7	1.02	1304.2	0.71	1254.6	1.15										
IG2-06	5.77	1157.4	0.85	1206.7	0.63	1256.1	0.45	1157.1	0.92												
IG2-07	749.13	1157.4	99.78	1206.4	29.18	1255.2	7.22	1304.5	2.94	1354	1.91	1255.8	8.86								
IG2-08	2.11	1057.3	3.46	1007.5	6.21	957.7	12.36	1058.7	3.41	1157.9	1.39	1206.7	0.97	1255.6	0.7	1156.8	1.43				
IG2-09	2.1	1057.7	3.4	1007.9	5.97	958.3	13.25	1059.1	3.93	1158.2	1.42	1207.4	0.98	1256.6	0.7	1157.6	1.46				
IG2-10	11.73	956.8	21.69	906.8	46.76	1057.3	7.28	1106.8	4.25	1156.2	2.86	1205.5	2.04	1254.8	1.45	1155.7	3.04	1056.3	7.13	1156.7	3.02
IG2-11	4.88	956.9	8.06	906.9	14.19	857.1	27.45	957.5	8.02	1057.1	3.17	1106.7	2.15	1156.3	1.53	1205.7	1.1	1255.2	0.82	1156	1.54
IG2-12	18.06	907.3	42	857.3	112.57	958.1	18.82	1007.3	9.33	1057.4	4.82	1106.9	2.85	1156.3	1.84	1205.5	1.25	1254.8	0.88	1155.7	2.06
IG2-13	12.19	1155.2	20.65	1105.6	36.93	1055.7	71.19	1156.1	20.72	1205.5	12.36	1254.9	7.7	1304.4	4.96	1354.3	3.37	1255.1	7.7		
IG2-14	68.02	1155.4	120.9	1205.1	66.89	1254.3	39.05	1303.8	24.58	1403	9.21	1452.9	6.09	1353.7	15.54	1254.7	44.17	1353.8	15.97	1452.8	6.31
IG2-15	5.9	1056.1	9.48	956.4	28.44	1057.4	9.44	1156.6	3.93	1205.7	2.76	1254.9	1.97	1155.6	4.01						
IG2-16	7.14	1054.8	12.25	1004.9	22.29	955.2	44.05	1055.7	12.2	1155.3	4.45	1204.7	2.95	1254.2	2.03	1155.4	4.64				
IG2-17	7.51	1154.4	12.4	1104.7	21.58	1054.8	40.11	1155.2	12.55	1204.5	7.61	1253.9	4.89	1303.5	3.33	1253.9	5.07				
IG2-18	4.42	1155.6	7.1	1106.1	11.88	1056.3	20.72	1006.6	39	956.9	79.49	1057.8	20.41	1157	6.89	1255.1	2.89	1304.4	1.99	1354	1.42
IG2-19	5.52	1055.5	8.84	1007	14.81	957.3	26.43	1058.2	8.72	1157.3	3.64	1206.5	2.53	1255.7	1.79	1156.6	3.74				
IG2-20	10.93	1056.9	18.44	1006.9	32.56	957.2	62	1058.2	18.51	1157.6	6.96	1206.6	4.64	1255.8	3.14	1156.6	7.27				
IG2-21	17.95	1057.7	31.62	1007.5	59.57	957.6	120.82	1058.8	31.53	1158.1	11.11	1207.1	7.17	1256.1	4.69						
IG2-22	9.29	1058.4	18.49	1007.6	35.81	957.9	75.12	1059.3	19.21	1158.4	6.4	1207.2	3.83	1256.2	2.52	1157	6.3				
IG2-23	5.68	1057.2	9.75	1007.4	17.65	957.7	34.49	1058.8	9.73	1157.9	3.56	1206.9	2.37	1256	1.63	1156.8	3.64				
IG2-24	5.85	1058.7	9.95	1008.9	17.85	959.3	33.4	1060.1	9.7	1158.5	3.59	1207.1	2.33	1256.2	1.56	1157	3.66				
IG2-25	6.15	1058.2	10.46	1008.3	18.65	958.6	34.14	1059.7	10.04	1158.8	3.79	1207.8	2.46	1256.6	1.65	1157.3	3.87				
IG2-26	18.27	1056.6	32.31	1006.8	60.42	957.1	121.48	1057.9	31.7	1157.3	10.98	1206.5	7.16	1255.7	4.79	1156.3	11.15				
IG2-27	22.34	1056.7	43.41	1157.2	13.54	1206.3	8.33	1255.4	5.37	1156.2	13.23										
IG2-28	12.07	1056.7	20.88	1006.8	38.38	957	76.51	1057.7	20.63	1157	7.16	1206.2	4.72	1255.3	3.29	1156.2	7.42				
IG2-29	6.56	1056.3	11.04	1006.4	19.21	956.5	35.85	1057.4	10.91	1156.6	4.3	1205.6	2.9	1254.8	2.03	1155.7	4.48				
IG2-30	15.8	1057.6	25.8	1007.9	44.42	958.2	82.84	1059.3	25.46	1158.4	10.26	1207	6.96	1255.9	4.89	1156.8	10.45				
IG2-31	12.9	1056.9	22.8	1008.2	43.08	958.5	88.52	1059.6	22.54	1156.9	7.89	1205.7	5.1	1254.5	3.45	1155.5	8.08				
IG2-32	7.31	1058	12.29	1008	21.89	958.2	41.66	1059.3	12.37	1158.4	4.72	1207.2	3.18	1256.3	2.19	1157.1	4.94				
IG2-33	5.69	1056.1	9.54	1006.3	16.86	956.6	32.02	1057.4	9.59	1156.9	3.62	1206	2.46	1255.2	1.72	1155.8	3.79				
IG2-34	7.38	1056.6	12.47	1006.7	22.31	956.9	42.8	1057.8	12.26	1157.1	4.67	1206.1	3.14	1255.3	2.18	1156	4.9				
IG2-35	6.56	1056.8	10.91	1006.9	19.21	957.2	36.18	1058.3	10.69	1157.5	4.19	1206.6	2.83	1255.7	1.96	1156.4	4.35				
IG2-36	6.26	1057.1	10.41	1007.2	18.35	957.4	34.72	1058.3	10.35	1157.6	4.1	1206.7	2.78	1256	1.95	1156.8	4.26				
IG2-37	6.69	1057.4	11.19	1007.6	19.76	957.8	37.61	1058.8	11.03	1158	4.29	1207.3	2.88	1256.5	2.01	1157.4	4.49				

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01	3.86	1056	6.41	1006.2	11.19	956.6	21.46	1057.3	6.28	1156.4	2.5	1205.5	1.71	1254.6	1.21	1155.7	2.59				
IG3-02b	7.95	1155.6	13.09	1106	23.23	1056.1	44.77	1156.4	13.09	1254.7	5.16	1304	3.49	1353.9	2.46	1254.5	5.28				
IG3-03	3.02	1254.7	5.04	1205.3	8.7	1156	16.38	1106.6	33.58	1255.5	5.04	1354.2	1.97	1403.8	1.32	1453.4	0.93				
IG3-04	12.49	1156	20.97	1106.5	36.26	1056.6	66.17	1156.9	20.59	1255.7	7.77	1305	5.19	1355.8	3.88	1256.7	7.71				

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
IG2-01					0.226		0.213	0.131	8.50							
IG2-02					0.090		0.107	0.041	7.68							
IG2-03					12.404		5.449	0.214	6.79							
IG2-04					2.884	2.601	1.597	0.250	10.88							
IG2-05					0.490		1.429	0.163	11.27							
IG2-06					2.067	1.661	0.525	0.184	9.50							
IG2-07					0.307		0.351	0.072	9.34							
IG2-08					0.440		0.694	0.208	10.11							
IG2-09					0.100	0.223	0.087	0.059	9.67							
IG2-10					1.397	1.377	1.427	0.246	10.44							
IG2-11	1056.3	3.28	1156.6	1.53	1.981	2.506	2.606	1.376	11.72							
IG2-12	1056.2	5.96	1156.7	2.08	11.673	10.471	7.379	0.123	8.60							
IG2-13					0.289	0.533	0.023	0.210	10.19							
IG2-14					0.425		0.593	0.185	10.44							
IG2-15					0.739	1.016	1.139	0.269	11.12							
IG2-16					0.766	0.639	0.546	0.086	10.01							
IG2-17					0.213	0.378	0.335	0.086	9.90							
IG2-18	1255	3.04			0.391	0.478	0.783	0.156	10.78							
IG2-19					0.729	0.959	1.102	0.261	11.23							
IG2-20					0.622	0.846	0.946	0.233	11.13							
IG2-21					0.253	0.526	0.428	0.103	10.26							
IG2-22					0.542	1.161	0.756	0.186	11.30							
IG2-23					0.911	0.735	0.786	0.115	10.23							
IG2-24					0.379	0.702	0.563	0.095	10.68							
IG2-25					0.431	0.816	0.619	0.050	10.83							
IG2-26					0.303	0.533	0.481	0.144	10.54							
IG2-27					0.287	0.500	0.371	0.106	10.05							
IG2-28					0.380	0.730	0.727	0.110	10.54							
IG2-29					0.481	0.503	0.549	0.121	10.27							
IG2-30					0.558	0.647	0.040	0.360	9.23							
IG2-31					1.617	1.506	0.942	0.320	9.99							
IG2-32					0.566	0.681	0.653	0.136	10.11							
IG2-33					0.501	0.547	0.581	0.131	10.26							
IG2-34					0.536	0.667	0.574	0.135	10.22							
IG2-35					0.408	0.470	0.493	0.122	10.13							
IG2-36					0.378	0.461	0.466	0.119	10.14							
IG2-37					0.449	0.590	0.473	0.125	10.18							

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01					0.542	0.572	0.683	0.142	10.34							
IG3-02b					0.593	0.696	0.090	0.162	8.76							
IG3-03					0.994	0.337	1.630	0.268	11.31							
IG3-04					4.491	3.929	2.991	0.349	8.82							

INEEL CVS Phase 2 (Staples et al. 2000)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
IG2-01												
IG2-02												
IG2-03												
IG2-04												
IG2-05												
IG2-06												
IG2-07												
IG2-08												
IG2-09												
IG2-10												
IG2-11												
IG2-12												
IG2-13												
IG2-14												
IG2-15												
IG2-16												
IG2-17												
IG2-18												
IG2-19												
IG2-20												
IG2-21												
IG2-22												
IG2-23												
IG2-24												
IG2-25												
IG2-26												
IG2-27												
IG2-28												
IG2-29												
IG2-30												
IG2-31												
IG2-32												
IG2-33												
IG2-34												
IG2-35												
IG2-36												
IG2-37												

INEEL CVS Phase 3 (Scholes et al. 2000)

IG3-01												
IG3-02b												
IG3-03												
IG3-04												

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
IG3-05	0.0350	0.0500	0.1200	0.0000		0.0200	0.0000	0.0024	0.1201	0.0150	0.0000	0.5332	0.0000			0.0000				0.0001	
IG3-06	0.0400	0.0500	0.1200	0.0000		0.0200	0.0302	0.0024	0.0500	0.0150	0.0250	0.4214	0.1400			0.0000				0.0001	
IG3-07	0.1690	0.1800	0.0000	0.0800		0.0000	0.0000	0.0024	0.1860	0.0150	0.0000	0.3500	0.0000			0.0000				0.0001	
IG3-08b	0.0535	0.1538	0.0146	0.0628		0.0026	0.0119	0.0024	0.1190	0.0127	0.0032	0.4086	0.1167			0.0000				0.0001	
IG3-09	0.0350	0.0500	0.0000	0.0800		0.0200	0.0900	0.0024	0.0568	0.0000	0.0250	0.5626	0.0000			0.0000				0.0001	
IG3-10b	0.0490	0.1625	0.0097	0.0457		0.0178	0.0390	0.0024	0.0649	0.0135	0.0021	0.3641	0.1244			0.0000				0.0001	
IG3-11	0.1205	0.0500	0.1200	0.0800		0.0000	0.0146	0.0024	0.2000	0.0000	0.0000	0.3649	0.0000			0.0000				0.0001	
IG3-12	0.0350	0.1800	0.0899	0.0300		0.0000	0.0000	0.0024	0.1151	0.0000	0.0000	0.3500	0.1000			0.0000				0.0001	
IG3-13	0.0400	0.0754	0.0000	0.0800		0.0000	0.0467	0.0024	0.1335	0.0150	0.0144	0.3500	0.1400			0.0000				0.0001	
IG3-14	0.0800	0.0600	0.0400	0.0300		0.0100	0.0600	0.0024	0.1000	0.0050	0.0150	0.4925	0.0400			0.0000				0.0001	
IG3-15	0.1000	0.0600	0.0800	0.0050		0.0100	0.0425	0.0024	0.1000	0.0100	0.0050	0.4000	0.0800			0.0000				0.0001	
IG3-16	0.0989	0.0751	0.0800	0.0050		0.0100	0.0600	0.0024	0.1000	0.0050	0.0150	0.4000	0.0800			0.0000				0.0001	
IG3-17	0.0893	0.0600	0.0800	0.0300		0.0097	0.0600	0.0024	0.1000	0.0050	0.0150	0.4000	0.0800			0.0000				0.0001	
IG3-18	0.1200	0.0600	0.0400	0.0050		0.0100	0.0580	0.0024	0.1500	0.0100	0.0145	0.4000	0.0600			0.0000				0.0001	
IG3-19	0.1200	0.0600	0.0800	0.0150		0.0100	0.0600	0.0024	0.1051	0.0050	0.0150	0.4000	0.0439			0.0000				0.0001	
IG3-20	0.0800	0.1200	0.0800	0.0300		0.0050	0.0305	0.0024	0.1000	0.0050	0.0050	0.4120	0.0400			0.0000				0.0001	
IG3-21	0.1000	0.1115	0.0400	0.0150		0.0050	0.0600	0.0024	0.1000	0.0050	0.0050	0.4075	0.0800			0.0000				0.0001	
IG3-22	0.1000	0.0600	0.0400	0.0300		0.0050	0.0538	0.0024	0.1500	0.0050	0.0050	0.4000	0.0800			0.0000				0.0001	

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
IG3-05	0.0003			0.0007	0.0000			0.0467				0.0000	0.0000		0.0001		0.0150	0.0002	0.0001	0.0000	
IG3-06	0.0003			0.0007	0.0000			0.0334				0.0000	0.0500		0.0001		0.0000	0.0002	0.0001	0.0000	
IG3-07	0.0003			0.0007	0.0000			0.0000				0.0000	0.0000		0.0001		0.0150	0.0002	0.0001	0.0000	
IG3-08b	0.0003			0.0007	0.0000			0.0065				0.0000	0.0068		0.0001		0.0127	0.0002	0.0001	0.0000	
IG3-09	0.0003			0.0007	0.0000			0.0556				0.0000	0.0000		0.0001		0.0150	0.0002	0.0001	0.0000	
IG3-10b	0.0003			0.0007	0.0000			0.0333				0.0000	0.0274		0.0001		0.0015	0.0002	0.0001	0.0000	
IG3-11	0.0003			0.0007	0.0000			0.0000				0.0000	0.0000		0.0001		0.0000	0.0002	0.0001	0.0000	
IG3-12	0.0003			0.0007	0.0000			0.0000				0.0000	0.0500		0.0001		0.0000	0.0002	0.0001	0.0000	
IG3-13	0.0003			0.0007	0.0000			0.0600				0.0000	0.0000		0.0001		0.0000	0.0002	0.0001	0.0000	
IG3-14	0.0003			0.0007	0.0000			0.0250				0.0000	0.0150		0.0001		0.0100	0.0002	0.0001	0.0000	
IG3-15	0.0003			0.0007	0.0000			0.0250				0.0000	0.0350		0.0001		0.0100	0.0002	0.0001	0.0000	
IG3-16	0.0003			0.0007	0.0000			0.0100				0.0000	0.0150		0.0001		0.0100	0.0002	0.0001	0.0000	
IG3-17	0.0003			0.0007	0.0000			0.0100				0.0000	0.0150		0.0001		0.0100	0.0002	0.0001	0.0000	
IG3-18	0.0003			0.0007	0.0000			0.0100				0.0000	0.0150		0.0001		0.0100	0.0002	0.0001	0.0000	
IG3-19	0.0003			0.0007	0.0000			0.0250				0.0000	0.0350		0.0001		0.0100	0.0002	0.0001	0.0000	
IG3-20	0.0003			0.0007	0.0000			0.0250				0.0000	0.0200		0.0001		0.0100	0.0002	0.0001	0.0000	
IG3-21	0.0003			0.0007	0.0000			0.0100				0.0000	0.0350		0.0001		0.0100	0.0002	0.0001	0.0000	
IG3-22	0.0003			0.0007	0.0000			0.0100				0.0000	0.0200		0.0001		0.0050	0.0002	0.0001	0.0000	

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
IG3-05		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0000	0.0400		0.0000		
IG3-06		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0000	0.0000		0.0000		
IG3-07		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0000	0.0000		0.0000		
IG3-08b		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0041	0.0055		0.0000		
IG3-09		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0050	0.0000		0.0000		
IG3-10b		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0044	0.0357		0.0000		
IG3-11		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0050	0.0400		0.0000		
IG3-12		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0050	0.0400		0.0000		
IG3-13		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0000	0.0400		0.0000		
IG3-14		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0025	0.0100		0.0000		
IG3-15		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0025	0.0300		0.0000		
IG3-16		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0010	0.0300		0.0000		
IG3-17		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0010	0.0300		0.0000		
IG3-18		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0025	0.0300		0.0000		
IG3-19		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0010	0.0100		0.0000		
IG3-20		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0025	0.0300		0.0000		
IG3-21		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0010	0.0100		0.0000		
IG3-22		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0025	0.0287		0.0000		

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
IG3-05							0.0000			1.0000	0.0366	0.0506	0.1200	0.0001		0.0204	0.0007	0.0002	0.1245	0.0142	0.0002
IG3-06							0.0000			1.0000	0.0420	0.0499	0.1210	0.0006		0.0211	0.0295	0.0005	0.0508	0.0135	0.0093
IG3-07							0.0000			1.0000	0.1687	0.1790	0.0001	0.0805		0.0000	0.0008	0.0004	0.1894	0.0137	0.0002
IG3-08b							0.0000			1.0000	0.0555	0.1569	0.0173	0.0650		0.0027	0.0122	0.0002	0.1432	0.0116	0.0021
IG3-09							0.0000			1.0000	0.0268	0.0522	0.0001	0.0821		0.0225	0.0930	0.0025	0.0650	0.0001	0.0246
IG3-10b							0.0000			1.0000	0.0404	0.1685	0.0122	0.0471		0.0190	0.0404	0.0023	0.0683	0.0127	0.0013
IG3-11							0.0000			1.0000	0.1195	0.0503	0.1199	0.0796		0.0000	0.0141	0.0042	0.2032	0.0001	0.0002
IG3-12							0.0000			1.0000	0.0371	0.1793	0.0908	0.0295		0.0000	0.0010	0.0025	0.1139	0.0001	0.0002
IG3-13							0.0000			1.0000	0.0418	0.0767	0.0007	0.0795		0.0000	0.0471	0.0003	0.1422	0.0143	0.0054
IG3-14							0.0000			1.0000	0.0805	0.0602	0.0434	0.0298		0.0110	0.0595	0.0015	0.1058	0.0046	0.0075
IG3-15							0.0000			1.0000	0.1028	0.0623	0.0842	0.0051		0.0111	0.0439	0.0025	0.1042	0.0025	0.0041
IG3-16							0.0000			1.0000	0.0970	0.0745	0.0828	0.0049		0.0089	0.0583	0.0007	0.1031	0.0050	0.0062
IG3-17							0.0000			1.0000	0.0886	0.0597	0.0833	0.0300		0.0108	0.0588	0.0009	0.1049	0.0045	0.0092
IG3-18							0.0000			1.0000	0.1206	0.0616	0.0440	0.0047		0.0091	0.0582	0.0015	0.1510	0.0049	0.0081
IG3-19							0.0000			1.0000	0.1227	0.0640	0.0857	0.0153		0.0112	0.0616	0.0007	0.1067	0.0046	0.0059
IG3-20							0.0000			1.0000	0.0823	0.1218	0.0821	0.0310		0.0042	0.0321	0.0014	0.1032	0.0045	0.0041
IG3-21							0.0000			1.0000	0.0996	0.1137	0.0438	0.0151		0.0056	0.0597	0.0008	0.1021	0.0044	0.0028
IG3-22							0.0000			1.0000	0.1006	0.0622	0.0445	0.0333		0.0056	0.0544	0.0017	0.1591	0.0044	0.0028

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
IG3-05	0.5348	0.0003			0.0000				0.0000		0.0000			0.0001	0.0000			0.0368			
IG3-06	0.4295	0.1061			0.0000				0.0000		0.0001			0.0001	0.0000			0.0261			
IG3-07	0.3530	0.0002			0.0000				0.0000		0.0001			0.0001	0.0000			0.0005			
IG3-08b	0.4156	0.1025			0.0000				0.0000		0.0000			0.0001	0.0000			0.0005			
IG3-09	0.6001	0.0000			0.0001				0.0001		0.0003			0.0008	0.0000			0.0347			
IG3-10b	0.3904	0.1146			0.0000				0.0001		0.0003			0.0007	0.0000			0.0145			
IG3-11	0.3674	0.0000			0.0001				0.0001		0.0006			0.0013	0.0001			0.0005			
IG3-12	0.3562	0.0905			0.0000				0.0001		0.0003			0.0007	0.0000			0.0005			
IG3-13	0.3658	0.1224			0.0000				0.0000		0.0000			0.0001	0.0000			0.0426			
IG3-14	0.5081	0.0325			0.0000				0.0000		0.0002			0.0004	0.0000			0.0213			
IG3-15	0.4134	0.0742			0.0000				0.0001		0.0003			0.0007	0.0000			0.0193			
IG3-16	0.4027	0.0630			0.0000				0.0000		0.0001			0.0002	0.0000			0.0073			
IG3-17	0.4001	0.0659			0.0000				0.0000		0.0001			0.0003	0.0000			0.0076			
IG3-18	0.4022	0.0482			0.0000				0.0000		0.0002			0.0005	0.0000			0.0075			
IG3-19	0.4161	0.0347			0.0000				0.0000		0.0001			0.0002	0.0000			0.0198			
IG3-20	0.4140	0.0376			0.0000				0.0000		0.0002			0.0004	0.0000			0.0193			
IG3-21	0.4193	0.0708			0.0000				0.0000		0.0001			0.0003	0.0000			0.0077			
IG3-22	0.4209	0.0715			0.0000				0.0000		0.0002			0.0005	0.0000			0.0080			

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
IG3-05	0.0000	0.0001		0.0000		0.0149	0.0000	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-06	0.0000	0.0473		0.0000		0.0002	0.0000	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-07	0.0000	0.0001		0.0000		0.0145	0.0000	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-08b	0.0000	0.0064		0.0000		0.0121	0.0000	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-09	0.0000	0.0001		0.0001		0.0149	0.0002	0.0001	0.0000			0.0000		0.0000		0.0001	0.0000		0.0000		
IG3-10b	0.0000	0.0272		0.0001		0.0013	0.0002	0.0001	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-11	0.0000	0.0001		0.0002		0.0002	0.0004	0.0002	0.0000			0.0000		0.0000		0.0001	0.0000		0.0001		
IG3-12	0.0000	0.0462		0.0001		0.0002	0.0002	0.0001	0.0000			0.0000		0.0000		0.0001	0.0000		0.0000		
IG3-13	0.0000	0.0001		0.0000		0.0002	0.0000	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-14	0.0000	0.0142		0.0001		0.0097	0.0001	0.0001	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-15	0.0000	0.0326		0.0001		0.0096	0.0002	0.0001	0.0000			0.0000		0.0000		0.0001	0.0000		0.0000		
IG3-16	0.0000	0.0141		0.0000		0.0097	0.0001	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-17	0.0000	0.0139		0.0000		0.0094	0.0001	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-18	0.0000	0.0138		0.0001		0.0093	0.0001	0.0001	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-19	0.0000	0.0325		0.0000		0.0096	0.0001	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-20	0.0000	0.0184		0.0001		0.0094	0.0001	0.0001	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-21	0.0000	0.0322		0.0000		0.0095	0.0001	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-22	0.0000	0.0187		0.0001		0.0047	0.0002	0.0001	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
IG3-05		0.0000		0.0000	0.0004	0.0359		0.0000									0.0000			0.9910
IG3-06		0.0000		0.0001	0.0010	0.0000		0.0000									0.0000			0.9486
IG3-07		0.0000		0.0001	0.0008	0.0000		0.0000									0.0000			1.0023
IG3-08b		0.0000		0.0000	0.0004	0.0056		0.0000									0.0000			1.0098
IG3-09		0.0000		0.0006	0.0052	0.0000		0.0000									0.0000			1.0265
IG3-10b		0.0000		0.0006	0.0048	0.0333		0.0000									0.0000			1.0009
IG3-11		0.0001		0.0010	0.0087	0.0343		0.0000									0.0000			1.0067
IG3-12		0.0000		0.0006	0.0051	0.0353		0.0000									0.0000			0.9907
IG3-13		0.0000		0.0001	0.0006	0.0365		0.0000									0.0000			0.9767
IG3-14		0.0000		0.0004	0.0030	0.0103		0.0000									0.0000			1.0043
IG3-15		0.0000		0.0006	0.0050	0.0284		0.0000									0.0000			1.0077
IG3-16		0.0000		0.0002	0.0014	0.0278		0.0000									0.0000			0.9680
IG3-17		0.0000		0.0002	0.0018	0.0274		0.0000									0.0000			0.9775
IG3-18		0.0000		0.0004	0.0031	0.0279		0.0000									0.0000			0.9773
IG3-19		0.0000		0.0002	0.0014	0.0101		0.0000									0.0000			1.0033
IG3-20		0.0000		0.0003	0.0029	0.0277		0.0000									0.0000			0.9972
IG3-21		0.0000		0.0002	0.0017	0.0103		0.0000									0.0000			0.9999
IG3-22		0.0000		0.0004	0.0034	0.0271		0.0000									0.0000			1.0246

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
IG3-05	1150				multi-phase		amorphous	no
IG3-06	1350		>1500	ZrO2	single-phase		amorphous	yes
IG3-07	1250				multi-phase		amorphous	no
IG3-08b	1275		>1350	ZrO2	single-phase		amorphous	yes
IG3-09	1150				multi-phase		LiF, Li3PO4, LiFeO2, Fe7S8	no
IG3-10b	1250		>1500	ZrO2	single-phase		amorphous	yes
IG3-11	1150		1013	Na7Al6Si6O24S3	single-phase		amorphous	yes
IG3-12	1150		973	CaAl2(SiO4)2	single-phase		amorphous	yes
IG3-13	1150				multi-phase		LiF, Fe2O3, ZrO2, Na17Al5O16	no
IG3-14	1150		943	(Ca9Sr)(PO4)6F2	single-phase		amorphous	yes
IG3-15	1200		1203	ZrO2	single-phase		amorphous	yes
IG3-16	1150		1133	ZrO2	single-phase		amorphous	yes
IG3-17	1150		1173	ZrO2	single-phase		amorphous	yes
IG3-18	1150		1023	Na6Ca2(Al6Si6O24)(SO4)2	single-phase		amorphous	yes
IG3-19	1150		893	La2NiO4	single-phase		amorphous	yes
IG3-20	1150		893	Ca10(SiO4)3(SO4)3F2	single-phase		amorphous	yes
IG3-21	1150		1013	ZrO2	single-phase		amorphous	yes
IG3-22	1200		1163	ZrO2	single-phase		amorphous	yes

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
IG3-05	brown colored glass is multiphase and devitrified with large clear crystals throughout, the top surface is semi-transparent, but with a rough scale like appearance		CaF2, FeO, and LiAlSi2O6		
IG3-06	dark brown colored glass is multi-phase and translucent, not devitrified		Ca8La2(PO4)5O2 and (CaLa)Si2		
IG3-07	dark reddish brown colored glass completely devitrified with dark snowflake type crystals throughout the glass		(FeNi2)o2(BO3)		
IG3-08b	separated into regions of either transparent glass or opaque phase-separated glass with well-defined boundaries, but no signs of devitrification		amorphous		
IG3-09	green-opaque colored glass appears to be completely devitrified with very small clear granular crystals throughout with some red colored ones at the top and outer surfaces		LiF, Li3PO4, Li2SiO3, LiKSO4, and AlPS4		
IG3-10b	brown colored glass is single-phase and transparent, not devitrified		amorphous		
IG3-11	dark brown colored glass appears crumbly and about half is transparent with the rest devitrified with solid brown groups of crystals		Na4Ca4(Si6O18)NaAlSiO4, and CaSrO		
IG3-12	dark green colored glass is single-phase and transparent with lots of small air bubbles		amorphous		
IG3-13	solid reddish brown colored glass is multi-phase with very small reddish granular crystals throughout the glass and on top are clear granular crystals with reddish star-type crystals		Sr9NaBO2(PO4)6, LiF, Li2NiF4, and Fe2O3		
IG3-14	brownish green colored glass is multi-phase and devitrified with clear clusters of crystals throughout		CaF2, LiAlSi2O6, Sr2FeO4, and La2O2S		
IG3-15	green colored glass appears to be single-phase and transparent		amorphous		
IG3-16	dark green colored glass is mostly translucent with lots of small air bubbles, very small percent of clear cubic crystals are present throughout the glass		amorphous		
IG3-17	brown colored glass is multi-phase and transparent, but devitrified with small white-flaky and rod-type crystals throughout the glass		amorphous		
IG3-18	dark brown glass is multi-phased with areas of opaque green near the bottom and devitrified with a small percent of snowflake type crystals throughout		amorphous		
IG3-19	brown colored glass is transparent, but devitrified with white fern-like crystals forming on the bottom and sides		La2NiO4		
IG3-20	dark brown colored glass appears to be transparent with lots of small air bubbles, but contains a small percent of clear crystal clusters thoughout		amorphous		
IG3-21	brown colored glass is single-phase and transparent, not devitrified		amorphous		
IG3-22	reddish brown colored glass is single-phase and transparent with some air bubbles, not devitrified		amorphous		

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
IG3-05		2.65					-12.817	20915.0	6.56	1275		1110	1158.7	5.66	1107.6
IG3-06		2.91					-15.390	24906.0	8.27	1275		1135	1256.2	2.34	1206.3
IG3-07		2.53					-10.088	17358.0	8.25	1337		1128	1256.8	3.46	1206.4
IG3-08b		2.71					-12.949	21483.0	8.57	1302		1135	1256.3	2.86	1206.4
IG3-09		2.50					-10.851	17520.0	4.31	1245		1059	1158	3.86	1106.8
IG3-10b		2.81					-13.478	20120.0	1.94	1147		1002	1159	1.79	1107.7
IG3-11		2.74					-11.935	18283.0	2.49	1175		1011	1158.8	2.24	1107.6
IG3-12		2.87					-16.362	24601.0	2.52	1169		1045	1158.8	2.17	1107.8
IG3-13		2.87					-12.111	17109.0	0.92	1063		914	1160.1	0.82	1108.8
IG3-14		2.63					-11.133	17804.0	3.97	1232		1052	1158.5	3.59	1107.3
IG3-15		2.79					-12.660	19591.0	3.03	1194		1036	1158.6	2.68	1107.5
IG3-16		2.74					-12.427	18809.0	2.21	1160		1004	1159	1.98	1107.7
IG3-17		2.77					-12.267	18380.0	1.91	1145		988	1157.1	1.76	1106.2
IG3-18		2.69					-11.520	17694.0	2.50	1176		1007	1157	2.29	1106.2
IG3-19		2.71					-11.594	17476.0	1.99	1149		984	1160.8	1.76	1108.9
IG3-20		2.72					-11.911	18117.0	2.27	1164		1001	1160.4	1.99	1108.9
IG3-21		2.71					-11.878	18053.0	2.24	1163		1000	1159.5	2.02	1107.6
IG3-22		2.75					-12.222	18589.0	2.32	1166		1007	1156.2	2.12	1106.1

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
IG3-05	9.71	1057	17.5	1007.1	33.83	957.5	71.8	1058.3	17.33	1157.6	5.76	1206.5	3.8	1256	2.63	1157	6.28				
IG3-06	3.91	1156.8	8.07	1157.8	7.79	1256	2.27	1305.5	1.49	1354.8	0.97	1255.4	2.55								
IG3-07	5.07	1156.7	7.67	1107.1	11.98	1057.2	19.88	1157.6	7.66	1256	3.53	1305.3	2.51	1354.8	1.82	1255.7	3.56				
IG3-08b	4.53	1156.9	7.66	1107.3	13.7	1057.2	26.1	1157.7	7.87	1256.3	2.98	1305.5	1.97	1354.8	1.38	1255.5	2.97				
IG3-09	5.99	1056.4	9.68	1006.3	16.81	956.4	32.59	1156.9	4.02	1205.9	2.78	1255.1	1.98	1155.7	4.11						
IG3-10b	2.94	1057	5.22	1006.9	9.58	957.1	18.7	1057.9	4.75	1157	1.72	1206.1	1.13	1255.4	0.78	1156	1.78				
IG3-11	3.52	1056.9	5.9	1006.9	10.5	957.1	20.22	1058	5.86	1157.2	2.27	1206.2	1.54	1255.5	1.13	1156.3	2.3				
IG3-12	3.93	1057.5	7.7	1007.5	17.16	957.8	44.46	1058.5	7.57	1157.7	2.2	1206.7	1.36	1255.9	0.89	1156.4	2.26				
IG3-13	1.3	1058.2	2.11	1008.2	3.47	958.6	5.93	1059.1	2.06	1158.2	0.86	1207.3	0.58	1256.3	0.4	1157	0.88				
IG3-14	5.67	1056.9	9.33	1007.2	16	957.6	29.38	1058.5	9.21	1157.8	3.6	1206.8	2.47	1255.9	1.77	1156.6	3.76				
IG3-15	4.46	1057.1	7.73	1007.1	14.06	957.3	27.74	1057.9	7.54	1157	2.78	1206.2	1.82	1255.4	1.24	1155.9	2.9				
IG3-16	3.16	1057	5.35	1006.8	9.64	957	18.79	1057.8	5.35	1157.2	2.05	1206.3	1.36	1255.4	0.94	1156	2.07				
IG3-17	2.79	1055.7	4.69	1005.8	8.26	956.1	15.4	1056.4	4.57	1155.8	1.79	1205.3	1.19	1255.1	0.82	1155.6	1.83				
IG3-18	3.56	1055.7	5.85	1005.8	10.16	956	18.75	1056.4	5.81	1155.9	2.34	1205.3	1.6	1254.7	1.12	1155.2	2.39				
IG3-19	2.73	1058.1	4.49	1008.2	7.71	958.3	14.39	1059.5	4.42	1158.6	1.82	1207.4	1.26	1256.5	0.9	1157.1	1.87				
IG3-20	3.13	1058.1	5.23	1008.1	9.36	958.3	17.79	1059.5	5.21	1158.6	2.07	1207.5	1.42	1256.6	1	1157.1	2.14				
IG3-21	3.18	1056.8	5.27	1006.8	9.29	957	17.5	1058	5.23	1157.1	2.08	1206.1	1.41	1255.2	0.99	1155.7	2.11				
IG3-22	3.36	1056.1	5.67	1006.2	10.07	956.5	19.13	1057.7	5.62	1157	2.18	1205.8	1.44	1254.9	1	1155.5	2.18				

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
IG3-05					0.200		0.568	0.135	10.23							
IG3-06					0.194	0.386	0.270	0.055	9.87							
IG3-07					4.859		2.617	0.104	9.00							
IG3-08b					0.792	0.801	0.545	0.103	8.83							
IG3-09					0.681	0.965	0.684	0.346	9.88							
IG3-10b					1.581	1.451	1.124	0.097	8.96							
IG3-11					0.313	0.985	1.825	0.171	11.56							
IG3-12					0.581		0.699	0.073	9.16							
IG3-13					0.410	0.458	0.658	0.099	10.11							
IG3-14					0.401	0.540	0.513	0.175	10.44							
IG3-15					0.227	0.428	0.448	0.083	10.68							
IG3-16					0.444	0.709	0.713	0.161	11.13							
IG3-17					0.493	0.727	0.736	0.163	11.09							
IG3-18					0.642	0.735	1.214	0.243	11.33							
IG3-19					0.377	0.583	0.641	0.150	11.01							
IG3-20					0.315	0.424	0.421	0.083	9.95							
IG3-21					0.498	0.606	0.517	0.143	10.66							
IG3-22					0.553	0.613	1.006	0.185	11.34							

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
IG3-05												
IG3-06												
IG3-07												
IG3-08b												
IG3-09												
IG3-10b												
IG3-11												
IG3-12												
IG3-13												
IG3-14												
IG3-15												
IG3-16												
IG3-17												
IG3-18												
IG3-19												
IG3-20												
IG3-21												
IG3-22												

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
IG3-23	0.1200	0.0600	0.0400	0.0050		0.0050	0.0300	0.0024	0.1497	0.0100	0.0050	0.4478	0.0400			0.0000				0.0001	
IG3-24	0.1200	0.0600	0.0400	0.0050		0.0050	0.0319	0.0024	0.1500	0.0100	0.0050	0.4506	0.0400			0.0000				0.0001	
IG3-25	0.1200	0.0600	0.0400	0.0050		0.0050	0.0300	0.0024	0.1441	0.0050	0.0050	0.4434	0.0400			0.0000				0.0001	
IG3-26	0.1200	0.0843	0.0800	0.0150		0.0050	0.0300	0.0024	0.1000	0.0050	0.0150	0.4147	0.0600			0.0000				0.0001	
IG3-27	0.0843	0.0917	0.0483	0.0226		0.0087	0.0393	0.0024	0.1237	0.0072	0.0106	0.4173	0.0617			0.0000				0.0001	
IG3-28	0.0850	0.0925	0.0487	0.0228		0.0088	0.0396	0.0024	0.1246	0.0073	0.0107	0.4207	0.0622			0.0000				0.0001	
IG3-29	0.1501	0.1501	0.0008	0.0005		0.0000	0.0845	0.0014	0.0500	0.0000	0.0000	0.5308	0.0301			0.0000				0.0000	
IG3-30	0.0375	0.1250	0.0009	0.0005		0.0250	0.0631	0.0016	0.0875	0.0000	0.0125	0.5396	0.1050			0.0000				0.0000	

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1	0.0636	0.1142	0.0275	0.0568		0.0000	0.0376	0.0363	0.1003	0.0042	0.0007	0.4802	0.0429	0.0000		0.0007	0.0000		0.0055		0.0011
CVS1-2	0.1500	0.0500	0.1000	0.0200		0.0000	0.0700	0.0000	0.0500	0.0010	0.0002	0.5500	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-3	0.1400	0.2000	0.0000	0.0200		0.0000	0.0700	0.0800	0.0500	0.0010	0.0002	0.4200	0.0100	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-4	0.0000	0.2000	0.0200	0.0200		0.0000	0.0100	0.0800	0.0900	0.0010	0.0002	0.5700	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-5	0.0800	0.0500	0.0000	0.1500		0.0000	0.0700	0.0000	0.0700	0.0010	0.0002	0.5700	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-6	0.0000	0.2001	0.0000	0.0200		0.0000	0.0700	0.0000	0.0500	0.0103	0.0018	0.4402	0.1200	0.0000		0.0018	0.0000		0.0134		0.0027
CVS1-7	0.0000	0.0500	0.1000	0.0336		0.0000	0.0100	0.0000	0.0964	0.0010	0.0002	0.5700	0.1300	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-8	0.0000	0.0500	0.0000	0.1500		0.0000	0.0100	0.0800	0.0837	0.0010	0.0002	0.5363	0.0800	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-9	0.0000	0.1963	0.0000	0.1401		0.0000	0.0100	0.0800	0.0538	0.0103	0.0018	0.4202	0.0000	0.0000		0.0018	0.0000		0.0134		0.0027
CVS1-10	0.1201	0.0851	0.0000	0.0200		0.0000	0.0100	0.0000	0.0949	0.0103	0.0018	0.5703	0.0000	0.0000		0.0018	0.0000		0.0134		0.0027
CVS1-11	0.1401	0.1550	0.1000	0.0200		0.0000	0.0100	0.0000	0.0751	0.0082	0.0014	0.4202	0.0000	0.0000		0.0014	0.0000		0.0107		0.0022
CVS1-12	0.0000	0.1764	0.1000	0.1500		0.0000	0.0700	0.0000	0.0736	0.0010	0.0002	0.4200	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-13	0.0038	0.2000	0.0000	0.0200		0.0000	0.0100	0.0000	0.1862	0.0010	0.0002	0.5700	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-14	0.0238	0.2000	0.0000	0.0200		0.0000	0.0100	0.0000	0.1862	0.0010	0.0002	0.4200	0.1300	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-15	0.0000	0.0500	0.0000	0.0200		0.0000	0.0700	0.0800	0.1212	0.0103	0.0018	0.5592	0.0000	0.0000		0.0018	0.0000		0.0134		0.0027

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
IG3-23	0.0003			0.0007	0.0000			0.0250				0.0000	0.0150		0.0001		0.0100	0.0002	0.0001	0.0000	
IG3-24	0.0003			0.0007	0.0000			0.0250				0.0000	0.0350		0.0001		0.0050	0.0002	0.0001	0.0000	
IG3-25	0.0003			0.0007	0.0000			0.0250				0.0000	0.0350		0.0001		0.0050	0.0002	0.0001	0.0000	
IG3-26	0.0003			0.0007	0.0000			0.0100				0.0000	0.0350		0.0001		0.0100	0.0002	0.0001	0.0000	
IG3-27	0.0003			0.0007	0.0000			0.0216				0.0000	0.0225		0.0001		0.0072	0.0002	0.0001	0.0000	
IG3-28	0.0003			0.0007	0.0000			0.0217				0.0000	0.0226		0.0001		0.0073	0.0002	0.0001	0.0000	
IG3-29	0.0002			0.0004	0.0000			0.0000				0.0000	0.0000		0.0001		0.0001	0.0001	0.0001	0.0000	
IG3-30	0.0002			0.0005	0.0000			0.0000				0.0000	0.0000		0.0001		0.0000	0.0002	0.0001	0.0000	

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1			0.0000	0.0009	0.0011	0.0011		0.0022					0.0046	0.0009			0.0022		0.0090	0.0000	
CVS1-2			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-3			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-4			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-5			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-6			0.0000	0.0022	0.0027	0.0027		0.0054					0.0112	0.0022			0.0054		0.0221	0.0000	
CVS1-7			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-8			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-9			0.0000	0.0022	0.0027	0.0027		0.0054					0.0112	0.0022			0.0054		0.0221	0.0000	
CVS1-10			0.0000	0.0022	0.0027	0.0027		0.0054					0.0112	0.0022			0.0054		0.0221	0.0000	
CVS1-11			0.0000	0.0018	0.0022	0.0022		0.0043					0.0090	0.0018			0.0043		0.0177	0.0000	
CVS1-12			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-13			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-14			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-15			0.0000	0.0022	0.0027	0.0027		0.0054					0.0112	0.0022			0.0054		0.0221	0.0000	

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
IG3-23		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0025	0.0300		0.0000		
IG3-24		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0025	0.0100		0.0000		
IG3-25		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0025	0.0300		0.0000		
IG3-26		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0010	0.0100		0.0000		
IG3-27		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0100	0.0183		0.0000		
IG3-28		0.0000		0.0000		0.0001	0.0000		0.0000				0.0000		0.0006	0.0021	0.0184		0.0000		
IG3-29		0.0000		0.0000		0.0000	0.0000		0.0000				0.0000		0.0003	0.0000	0.0001		0.0000		
IG3-30		0.0000		0.0000		0.0000	0.0000		0.0000				0.0000		0.0004	0.0000	0.0002		0.0000		

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1	0.0004		0.0007	0.0004			0.0004		0.0011				0.0004			0.0020	0.0007		0.0000		0.0000
CVS1-2	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-3	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-4	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-5	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-6	0.0009		0.0018	0.0009			0.0009		0.0027				0.0009			0.0049	0.0018		0.0000		0.0000
CVS1-7	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-8	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-9	0.0009		0.0018	0.0009			0.0009		0.0027				0.0009			0.0049	0.0018		0.0000		0.0000
CVS1-10	0.0009		0.0018	0.0009			0.0009		0.0027				0.0009			0.0049	0.0018		0.0000		0.0000
CVS1-11	0.0007		0.0014	0.0007			0.0007		0.0022				0.0007			0.0039	0.0014		0.0000		0.0000
CVS1-12	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-13	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-14	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-15	0.0009		0.0018	0.0009			0.0009		0.0027				0.0009			0.0049	0.0018		0.0000		0.0000

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
IG3-23							0.0000			1.0000	0.1225	0.0617	0.0442	0.0055		0.0047	0.0308	0.0016	0.1513	0.0088	0.0041
IG3-24							0.0000			1.0000	0.1204	0.0605	0.0441	0.0050		0.0054	0.0314	0.0014	0.1557	0.0093	0.0044
IG3-25							0.0000			1.0000	0.1241	0.0626	0.0448	0.0049		0.0046	0.0316	0.0017	0.1496	0.0046	0.0046
IG3-26							0.0000			1.0000	0.1222	0.0866	0.0819	0.0145		0.0045	0.0312	0.0006	0.1017	0.0045	0.0074
IG3-27							0.0000			1.0000	0.0862	0.0961	0.0542	0.0231		0.0081	0.0402	0.0054	0.1302	0.0001	0.0055
IG3-28							0.0000			1.0000	0.0874	0.0963	0.0510	0.0248		0.0097	0.0409	0.0013	0.1289	0.0068	0.0081
IG3-29							0.0000			1.0000	0.1213	0.0872	0.0834	0.0148		0.0045	0.0308	0.0007	0.0999	0.0043	0.0087
IG3-30							0.0000			1.0000	0.0384	0.1257	0.0016	0.0001		0.0258	0.0634	0.0002	0.0888	0.0001	0.0097

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1		0.0000				0.0000	0.0004	0.0000		0.9999	0.0642	0.1160	0.0277	0.0566		0.0080	0.0340	0.0359	0.0891	0.0044	0.0007
CVS1-2		0.0000				0.0000	0.0001	0.0000		1.0000	0.1500	0.0511	0.1020	0.0203		0.0040	0.0615	0.0000	0.0504	0.0013	0.0002
CVS1-3		0.0000				0.0000	0.0001	0.0000		1.0000	0.1380	0.2010	0.0004	0.0202		0.0090	0.0601	0.0776	0.0511	0.0014	0.0002
CVS1-4		0.0000				0.0000	0.0001	0.0000		1.0000	0.0000	0.2000	0.0204	0.0210		0.0050	0.0086	0.0791	0.0893	0.0014	0.0002
CVS1-5		0.0000				0.0000	0.0001	0.0000		1.0000	0.0803	0.0517	0.0001	0.1490		0.0090	0.0620	0.0000	0.0641	0.0014	0.0002
CVS1-6		0.0000				0.0000	0.0009	0.0000		0.9999	0.0009	0.1920	0.0012	0.0190		0.0070	0.0616	0.0000	0.0537	0.0094	0.0018
CVS1-7		0.0000				0.0000	0.0001	0.0000		1.0000	0.0010	0.0507	0.1000	0.0334		0.0070	0.0087	0.0000	0.0946	0.0014	0.0002
CVS1-8		0.0000				0.0000	0.0001	0.0000		1.0000	0.0009	0.0527	0.0003	0.1520		0.0060	0.0092	0.0807	0.0780	0.0015	0.0002
CVS1-9		0.0000				0.0000	0.0009	0.0000		1.0000	0.0000	0.2020	0.0004	0.1400		0.0000	0.0091	0.0816	0.0562	0.0106	0.0018
CVS1-10		0.0000				0.0000	0.0009	0.0000		1.0000	0.1210	0.0848	0.0005	0.0206		0.0050	0.0087	0.0000	0.0924	0.0105	0.0018
CVS1-11		0.0000				0.0000	0.0007	0.0000		1.0001	0.1450	0.1600	0.1030	0.0206		0.0000	0.0098	0.0000	0.0730	0.0084	0.0014
CVS1-12		0.0000				0.0000	0.0001	0.0000		1.0000	0.0000	0.1810	0.1020	0.1490		0.0000	0.0703	0.0000	0.0761	0.0014	0.0002
CVS1-13		0.0000				0.0000	0.0001	0.0000		1.0000	0.0043	0.2030	0.0003	0.0205		0.0000	0.0086	0.0000	0.1740	0.0013	0.0002
CVS1-14		0.0000				0.0000	0.0001	0.0000		1.0000	0.0240	0.1960	0.0002	0.0194		0.0060	0.0093	0.0000	0.1850	0.0013	0.0002
CVS1-15		0.0000				0.0000	0.0009	0.0000		1.0000	0.0000	0.0507	0.0005	0.0201		0.0100	0.0568	0.0760	0.1120	0.0101	0.0018

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
IG3-23	0.4658	0.0373			0.0000				0.0000		0.0002			0.0005	0.0000			0.0209			
IG3-24	0.4573	0.0382			0.0000				0.0000		0.0002			0.0004	0.0000			0.0205			
IG3-25	0.4482	0.0384			0.0000				0.0000		0.0002			0.0005	0.0000			0.0202			
IG3-26	0.4241	0.0471			0.0000				0.0000		0.0001			0.0002	0.0000			0.0072			
IG3-27	0.4268	0.0532			0.0001				0.0001		0.0007			0.0016	0.0001			0.0182			
IG3-28	0.4236	0.0559			0.0000				0.0000		0.0002			0.0004	0.0000			0.0180			
IG3-29	0.4156	0.0487			0.0000				0.0000		0.0001			0.0002	0.0000			0.0074			
IG3-30	0.5477	0.0910			0.0000				0.0000		0.0000			0.0001	0.0000			0.0005			

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1	0.4770	0.0418			0.0007			0.0055		0.0012				0.0010	0.0010	0.0011		0.0022			
CVS1-2	0.5200	0.0090			0.0002			0.0014		0.0003				0.0002	0.0003	0.0003		0.0005			
CVS1-3	0.4110	0.0090			0.0002			0.0014		0.0007				0.0003	0.0002	0.0003		0.0005			
CVS1-4	0.5460	0.0005			0.0002			0.0014		0.0003				0.0003	0.0003	0.0003		0.0005			
CVS1-5	0.5630	0.0002			0.0002			0.0013		0.0003				0.0000	0.0002	0.0003		0.0005			
CVS1-6	0.4150	0.1160			0.0016			0.0130		0.0027				0.0022	0.0025	0.0025		0.0054			
CVS1-7	0.5550	0.1220			0.0002			0.0014		0.0003				0.0002	0.0003	0.0003		0.0005			
CVS1-8	0.5450	0.0696			0.0002			0.0014		0.0003				0.0003	0.0003	0.0003		0.0005			
CVS1-9	0.4140	0.0002			0.0018			0.0141		0.0030				0.0022	0.0025	0.0027		0.0054			
CVS1-10	0.5650	0.0002			0.0018			0.0118		0.0030				0.0024	0.0024	0.0027		0.0054			
CVS1-11	0.4180	0.0002			0.0014			0.0110		0.0023				0.0019	0.0020	0.0023		0.0043			
CVS1-12	0.4170	0.0001			0.0002			0.0014		0.0003				0.0003	0.0002	0.0003		0.0005			
CVS1-13	0.5510	0.0006			0.0002			0.0014		0.0003				0.0002	0.0003	0.0003		0.0005			
CVS1-14	0.4040	0.1230			0.0002			0.0013		0.0003				0.0002	0.0002	0.0003		0.0005			
CVS1-15	0.5380	0.0002			0.0017			0.0136		0.0033				0.0023	0.0026	0.0025		0.0054			

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
IG3-23	0.0000	0.0140		0.0001		0.0095	0.0002	0.0001	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-24	0.0000	0.0326		0.0001		0.0048	0.0001	0.0001	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-25	0.0000	0.0328		0.0001		0.0048	0.0002	0.0001	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-26	0.0000	0.0325		0.0000		0.0097	0.0001	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-27	0.0001	0.0213		0.0003		0.0069	0.0005	0.0002	0.0000			0.0001		0.0001		0.0001	0.0001		0.0001		
IG3-28	0.0000	0.0212		0.0001		0.0070	0.0001	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-29	0.0000	0.0315		0.0000		0.0094	0.0001	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		
IG3-30	0.0000	0.0001		0.0000		0.0002	0.0000	0.0000	0.0000			0.0000		0.0000		0.0000	0.0000		0.0000		

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1		0.0044	0.0012			0.0022		0.0083			0.0004		0.0007	0.0004			0.0004		0.0011		
CVS1-2		0.0012	0.0003			0.0005		0.0021			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-3		0.0012	0.0003			0.0005		0.0022			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-4		0.0012	0.0004			0.0006		0.0021			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-5		0.0011	0.0004			0.0006		0.0021			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-6		0.0100	0.0027			0.0050		0.0188			0.0009		0.0018	0.0009			0.0009		0.0025		
CVS1-7		0.0012	0.0003			0.0005		0.0021			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-8		0.0011	0.0004			0.0006		0.0021			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-9		0.0111	0.0029			0.0055		0.0201			0.0009		0.0018	0.0009			0.0009		0.0024		
CVS1-10		0.0112	0.0028			0.0051		0.0201			0.0009		0.0018	0.0009			0.0009		0.0020		
CVS1-11		0.0090	0.0023			0.0043		0.0163			0.0007		0.0014	0.0007			0.0007		0.0021		
CVS1-12		0.0012	0.0004			0.0005		0.0020			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-13		0.0011	0.0003			0.0006		0.0020			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-14		0.0011	0.0003			0.0005		0.0020			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-15		0.0105	0.0028			0.0053		0.0131			0.0009		0.0018	0.0009			0.0009		0.0021		

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
IG3-23		0.0000		0.0004	0.0033	0.0278		0.0000									0.0000			1.0154
IG3-24		0.0000		0.0004	0.0030	0.0102		0.0000									0.0000			1.0057
IG3-25		0.0000		0.0004	0.0034	0.0284		0.0000									0.0000			1.0110
IG3-26		0.0000		0.0002	0.0013	0.0104		0.0000									0.0000			0.9881
IG3-27		0.0001		0.0013	0.0111	0.0180		0.0000									0.0000			1.0102
IG3-28		0.0000		0.0003	0.0026	0.0179		0.0000									0.0000			1.0027
IG3-29		0.0000		0.0002	0.0015	0.0101		0.0000									0.0000			0.9804
IG3-30		0.0000		0.0000	0.0004	0.0000		0.0000									0.0000			0.9939

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1		0.0004			0.0020	0.0008				0.0002							0.0004			0.9910
CVS1-2		0.0001			0.0005	0.0002				0.0000							0.0001			0.9787
CVS1-3		0.0001			0.0005	0.0002				0.0001							0.0001			0.9885
CVS1-4		0.0001			0.0005	0.0002				0.0000							0.0001			0.9806
CVS1-5		0.0001			0.0005	0.0002				0.0001							0.0001			0.9897
CVS1-6		0.0009			0.0049	0.0017				0.0003							0.0009			0.9598
CVS1-7		0.0001			0.0005	0.0002				0.0003							0.0001			0.9833
CVS1-8		0.0001			0.0005	0.0002				0.0002							0.0001			1.0056
CVS1-9		0.0009			0.0049	0.0018				0.0000							0.0010			1.0025
CVS1-10		0.0009			0.0049	0.0018				0.0001							0.0010			0.9944
CVS1-11		0.0007			0.0039	0.0015				0.0000							0.0008			1.0091
CVS1-12		0.0001			0.0005	0.0003				0.0000							0.0001			1.0064
CVS1-13		0.0001			0.0005	0.0002				0.0000							0.0001			0.9726
CVS1-14		0.0001			0.0005	0.0002				0.0003							0.0001			0.9771
CVS1-15		0.0009			0.0049	0.0017				0.0001							0.0009			0.9544

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
IG3-23	1150		903	Na6Ca2(Al6Si6O24)(SO4)2	single-phase		amorphous	yes
IG3-24	1150		883	La8(SiO4)6O2	single-phase		amorphous	yes
IG3-25	1150		903	La2NiO4	single-phase		amorphous	yes
IG3-26	1150		1063	Ca10(SiO4)3(SO4)3F2	single-phase		amorphous	yes
IG3-27	1150		953	Ca10(SiO4)3(SO4)3F2	single-phase		amorphous	yes
IG3-28	1150		873	Ca10(SiO4)3(SO4)3F2	single-phase		amorphous	yes
IG3-29	1150		873	LiAlSi3O8	single-phase		amorphous	yes
IG3-30	1150		883	NaLiZrSi6O15	single-phase		amorphous	yes

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1		987		zircon				
CVS1-2		942		Ca asilicate				
CVS1-3		942		olivine				
CVS1-4		957		SiO2				
CVS1-5		1035		spinel				
CVS1-6		1118		zircon				
CVS1-7		1187		zircon				
CVS1-8		1118		zircon				
CVS1-9		>1118		spinel				
CVS1-10		>1118		spinel				
CVS1-11		1035		spinel				
CVS1-12		841		orthopyroxene				
CVS1-13								
CVS1-14								
CVS1-15		880		olivine				

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
IG3-23	brown colored glass is multi-phased with very small granular crystals and lots of small air bubbles making the glass appear translucent. The top surface has a thin layer of transparent glass with some small white flaky crystals just forming		SiF4		
IG3-24	brown colored glass is multi-phased with very small chain forming granular or long flaky crystals making the glass appear translucent, the top surface has a thin layer of transparent glass		amorphous		
IG3-25	green colored glass is multi-phase with very small chain-forming granular or long flaky crystals and small air bubbles making the glass appear translucent		amorphous		
IG3-26	brown colored glass is completely devitrified with lighter green round or rectangular snowflake-type crystals		(Ca,Na)5(SiO4,PO4)3F		
IG3-27	green colored glass is multi-phased with very small clear granular crystals and thin sheet-type crystals on the surface		SiF4 and CaSrSi4		
IG3-28	brown colored glass is multi-phased and transparent, with a small fraction of large clear crystal clusters throughout		amorphous		
IG3-29					
IG3-30					

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1	clinopyroxene, spinel	(Ca,Fe,Mg,Si; Zr), (Fe,Cr,Ni)	6-8 vol% clinopyroxene, spinel		
CVS1-2	none		<1 vol% unidentified		
CVS1-3	olivine	(Mg,Fe,Si; Ni,Zr)	2-3 vol% olivine (mg,Fe)2SiO4		
CVS1-4	none	none	<1 vol% unidentified		
CVS1-5	spinel, Li2SiO3, (Fe,Si) phase growing from spinel, hematite	(Si), (Fe,Si)	3-5 vol% spinel, 1 vol% Li2SiO3, <1 vol% unidentified		
CVS1-6	zircon + RuO2 settled, ZrO2, high-Ni spinel (?)	(Zr,Si), (Zr), (Ni,Fe,Cr)	8-10 vol% zircon ZrSiO4, <1 vol% ZrO2		
CVS1-7	Ca2ZrSi4O12, zircon	(Ca,Zr,Si)	3-5 vol% Ca2ZrSi4O12		
CVS1-8	zircon, spinel, hematite	(Zr,Si)	10-12 vol% zircon ZrSiO4, 2-4 vol% orthopyroxene (Mg,Fe)SiO3, 3-5 vol% clinopyroxene		
CVS1-9	large, long crystals	(Fe; Mg,Ni,Cr), (Si)	5-7 vol% unidentified, <1 vol% cristobalite SiO2, <1 vol% spinel		
CVS1-10	spinel	(Fe,Ni,Cr)	1-2 vol% spinel		
CVS1-11	high-Ni spinel(?)	(Ni,Fe,Cr)	none		
CVS1-12	hematite, unidentified, spinel, RuO2 needles		1-2 vol% hematite a-Fe2O3, 2-3 vol% unidentified		
CVS1-13	RuO2 needles	none	none		
CVS1-14	RuO2 needles	none	none		
CVS1-15	Li2SiO3, olivine, clinopyroxene	(Si), (Mg,Fe,Ni,Si)	2-3 vol% Li2SiO3, <1 vol% olivine (Mg,Fe)2SiO4, <2 vol% clinopyroxene		

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
IG3-23		2.67					-11.539	19014.0	6.19	1281		1101	1159	5.52	1107.8
IG3-24		2.66					-11.534	19016.0	6.23	1282		1101	1158.7	5.56	1107.5
IG3-25		2.69					-11.723	19251.0	6.08	1277		1099	1160.3	5.3	1109.1
IG3-26		2.72					-13.543	22053.0	7.06	1276		1119	1160.6	6.07	1109.1
IG3-27		2.70					-11.712	18175.0	2.89	1192		1024	1159	2.58	1107.9
IG3-28		2.69					-11.761	18154.0	2.71	1185		1018	1160.1	2.41	1108.7
IG3-29		2.43					-10.103	17535.0	9.20	1351		1140	1160	8.3	1108.7
IG3-30		2.58					-12.223	20261.0	7.50	1296		1122	1159.3	6.79	1108.1

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1		2.6839	-5.31	5390.83	387.05	5.78	-12.744	20714.4	6.13				1250	2.54	1150
CVS1-2		2.5501	-5.14	6367.00	326.47	13.29	-11.854	20617.5	13.94				1248	5.81	1149
CVS1-3		2.5131	-6.47	6286.50	294.28	2.39	-12.805	19435.3	2.35				1149	2.39	1050
CVS1-4		2.4818	-7.11	7998.68	287.57	8.70	-15.012	24398.4	8.45				1149	8.79	1051
CVS1-5		2.6185	-5.72	7937.47	194.09	13.24	-10.031	18036.5	14.07				1348	3.19	1250
CVS1-6		2.7439	-6.30	5392.86	379.94	2.01							1052	5.59	952
CVS1-7		2.7826	-6.86	8127.95	420.63	72.88	-15.257	27789.3	71.64				1348	6.75	1248
CVS1-8		2.7973	-5.67	7000.00	375.91	29.26							1350	4.57	1252
CVS1-9		2.7447	-7.18	7000.00	333.99	4.06							1251	1.58	1152
CVS1-10		2.5425	-2.56	4100.51	563.65	83.83	-10.189	20778.3	82.50				(1449)	(7.98)	1350
CVS1-11		2.6253											1251	5.68	1152
CVS1-12		2.7537	-5.18	2995.90	454.08	0.42	-11.558	15162.3	0.41				1148	0.42	1049
CVS1-13		2.541	-4.48	3586.72	518.39	3.31	-13.672	21274.1	3.59				1247	1.55	1148
CVS1-14		2.6836	-5.99	5055.15	449.86	3.42	-15.257	23573.7	3.70				1249	1.41	1150
CVS1-15		2.6913	-5.47	5493.19	293.09	2.55	-10.472	16285.9	2.65				1251	1.3	1151

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
IG3-23	8.87	1057.4	15.3	1007.3	27.24	957.5	52.48	1058.6	15.56	1157.6	5.62	1206.3	3.74	1255.3	2.62	1156	5.9				
IG3-24	8.99	1056.7	15.26	1006.7	27.46	956.9	54.17	1058	15.54	1157.1	5.68	1205.8	3.8	1254.9	2.65	1155.6	6.01				
IG3-25	8.66	1058.6	14.75	1008.6	26.87	958.9	52.51	1059.8	15.23	1158.8	5.44	1207.5	3.62	1256.5	2.53	1157.3	5.78				
IG3-26	10.56	1058.3	19.53	1008.3	38.58	958.6	84.87	1059.7	20.06	1158.7	6.32	1207.3	3.94	1256	2.61	1156.9	6.44				
IG3-27	4.07	1057.6	6.76	1007.6	11.97	958	22.42	1058.8	6.76	1157.7	2.66	1206.6	1.81	1255.5	1.27	1156.3	2.72				
IG3-28	3.77	1058	6.31	1007.9	11.08	958.1	21.37	1059.1	6.22	1158.1	2.48	1207	1.69	1256	1.19	1156.9	2.56				
IG3-29	12.88	1058.1	20.89	1008.1	35.81	958.4	65.94	1059.5	20.78	1158.3	8.45	1207	5.8	1255.6	4.11	1156.6	8.67				
IG3-30	11.14	1057.8	19.33	1008	36.12	958.4	73.65	1059.4	19.09	1158.3	6.76	1207	4.39	1255.7	2.97	1156.5	6.99				

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1	5.81	1050	16.69	949	72.38																
CVS1-2	13.58	1050	38.32	951	156.46																
CVS1-3	6.48	951	21.78	(852)	(121.81)																
CVS1-4	28.95	951	140.45																		
CVS1-5	6.02	1150	13.18	1050	35.11	950	118.89														
CVS1-6	22.73	(851)	(171.56)																		
CVS1-7	19.47	1148	75.15																		
CVS1-8	10.21	(1152)	(36.16)																		
CVS1-9	3.98	(1052)	(36.16)																		
CVS1-10	13.83	1250	30.8	1150	83.47																
CVS1-11	14.48	(1052)	(153.94)	(952)	(277.82)																
CVS1-12	0.88	952	2.31	(852)	(10.47)	(752)	(131.67)														
CVS1-13	3.36	1049	9.83	949	46.75																
CVS1-14	3.37	1051	11.38	950	61.29																
CVS1-15	2.53	1051	5.88	951	17.8	(851)	(79.16)														

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
IG3-23					0.261	0.291	0.492	0.116	10.78							
IG3-24					0.300	0.325	0.565	0.135	10.78							
IG3-25					0.256	0.321	0.539	0.114	10.73							
IG3-26					0.164	0.333	0.288	0.067	10.42							
IG3-27					0.396	0.453	0.507	0.117	10.61							
IG3-28					0.433	0.460	0.542	0.126	10.62							
IG3-29					0.607	0.676	0.065	0.394	9.59							
IG3-30					2.129	1.779	1.154	0.378	10.29							

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1					0.521	0.529	0.403	0.167	10.92	0.386	0.498	0.358	0.149	10.20		
CVS1-2					0.066	0.154	0.064	0.054	11.42	1.500	1.304	0.546	0.2295	11.56		
CVS1-3					0.864	0.791	0.580	0.172	9.85	0.732	0.817	0.540	0.19	9.76		
CVS1-4					20.639	16.935	17.034	0.54	9.67	14.791	18.495	18.269	0.699	9.32		
CVS1-5					0.355	0.462	0.191	0.318	11.22	0.878	1.859	0.496	0.956	11.50		
CVS1-6					6.113	4.892	3.046	0.312	10.07	5.036	3.902	2.796	0.2855	9.58		
CVS1-7					0.287	0.331	0.339	0.114	10.91	0.312	0.280	0.326	0.142	10.29		
CVS1-8					1.238	0.744	0.805	0.265	10.42	4.180	2.151	1.658	0.438	9.59		
CVS1-9					10.993	8.602	7.897	0.345	8.69	31.138	37.850	37.262	0.3025	9.06		
CVS1-10					0.127	0.386	0.095	0.104	9.76	0.119	0.301	0.092	0.097	9.14		
CVS1-11					0.099	0.187	0.099	0.041	9.99	0.197	0.280	0.126	0.043	9.55		
CVS1-12					4.662	4.171	4.395	0.825	11.12	2.989	3.948	4.083	0.906	11.19		
CVS1-13					14.072	12.903	12.413	0.786	10.37	12.379	12.796	12.485	2.062	10.32		
CVS1-14					9.847	8.011	5.790	0.149	9.63	8.601	6.774	5.067	0.137	9.71		
CVS1-15					18.778	11.198	13.995	0.967	13.03	19.614	8.571	14.022	0.65	11.99		

INEEL CVS Phase 3 (Scholes et al. 2000)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
IG3-23												
IG3-24												
IG3-25												
IG3-26												
IG3-27												
IG3-28												
IG3-29												
IG3-30												

Hanford CVS 1 (Hrma et al. 1994)

CVS1-1												
CVS1-2												
CVS1-3												
CVS1-4												
CVS1-5												
CVS1-6												
CVS1-7												
CVS1-8												
CVS1-9												
CVS1-10												
CVS1-11												
CVS1-12												
CVS1-13												
CVS1-14												
CVS1-15												

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
CVS1-16	0.1442	0.0500	0.0000	0.0858		0.0000	0.0100	0.0800	0.1873	0.0010	0.0002	0.4327	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-17	0.0000	0.0500	0.1000	0.1401		0.0000	0.0100	0.0000	0.1456	0.0103	0.0018	0.4547	0.0000	0.0000		0.0018	0.0000		0.0134		0.0027
CVS1-18	0.0000	0.0500	0.0200	0.0200		0.0000	0.0700	0.0800	0.1186	0.0093	0.0016	0.4216	0.1301	0.0000		0.0016	0.0000		0.0121		0.0024
CVS1-19	0.0636	0.1142	0.0275	0.0568		0.0000	0.0376	0.0363	0.1003	0.0042	0.0007	0.4802	0.0429	0.0000		0.0007	0.0000		0.0055		0.0011
CVS1-20	0.0636	0.1142	0.0275	0.0568		0.0000	0.0376	0.0363	0.1003	0.0042	0.0007	0.4802	0.0429	0.0000		0.0007	0.0000		0.0055		0.0011
CVS1-21	0.0000	0.2000	0.0200	0.0200		0.0000	0.0100	0.0800	0.0900	0.0010	0.0002	0.5700	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-22	0.0000	0.0500	0.0000	0.1500		0.0000	0.0100	0.0800	0.0837	0.0010	0.0002	0.5363	0.0800	0.0000		0.0002	0.0000		0.0013		0.0003
CVS1-23	0.0456	0.0956	0.0289	0.1179		0.0000	0.0375	0.0084	0.1052	0.0040	0.0007	0.5154	0.0063	0.0000		0.0007	0.0000		0.0053		0.0011

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1	0.0800	0.0874	0.0000	0.0400		0.0000	0.0600	0.0500	0.0700	0.0082	0.0014	0.5228	0.0100	0.0000		0.0014	0.0000		0.0107		0.0022
CVS2-2	0.1100	0.0700	0.0700	0.0450		0.0000	0.0600	0.0000	0.0883	0.0026	0.0004	0.5018	0.0300	0.0000		0.0004	0.0000		0.0034		0.0007
CVS2-3	0.1032	0.1320	0.0700	0.0450		0.0000	0.0435	0.0100	0.0700	0.0026	0.0004	0.4645	0.0368	0.0000		0.0004	0.0000		0.0034		0.0007
CVS2-4	0.0619	0.1095	0.0700	0.0400		0.0000	0.0536	0.0000	0.0700	0.0026	0.0004	0.5600	0.0100	0.0000		0.0004	0.0000		0.0034		0.0007
CVS2-5	0.0800	0.1591	0.0348	0.0400		0.0000	0.0200	0.0000	0.1010	0.0082	0.0014	0.4752	0.0100	0.0000		0.0014	0.0000		0.0107		0.0022
CVS2-6	0.0159	0.0700	0.0700	0.1200		0.0000	0.0382	0.0046	0.0700	0.0066	0.0011	0.5374	0.0100	0.0000		0.0011	0.0000		0.0086		0.0017
CVS2-7	0.0953	0.1701	0.0094	0.0400		0.0000	0.0591	0.0000	0.0700	0.0067	0.0012	0.4815	0.0100	0.0000		0.0012	0.0000		0.0087		0.0017
CVS2-8	0.0610	0.0700	0.0000	0.1140		0.0000	0.0600	0.0500	0.0985	0.0026	0.0004	0.5116	0.0100	0.0000		0.0004	0.0000		0.0034		0.0007
CVS2-9	0.0138	0.0944	0.0000	0.0712		0.0000	0.0600	0.0000	0.0924	0.0026	0.0004	0.5432	0.1000	0.0000		0.0004	0.0000		0.0034		0.0007
CVS2-10	0.1043	0.1700	0.0000	0.0669		0.0000	0.0200	0.0000	0.1306	0.0030	0.0005	0.4695	0.0100	0.0000		0.0005	0.0000		0.0039		0.0008
CVS2-11	0.0100	0.0751	0.0700	0.0400		0.0000	0.0600	0.0100	0.0833	0.0069	0.0012	0.4918	0.0935	0.0000		0.0012	0.0000		0.0089		0.0018
CVS2-12	0.0901	0.1700	0.0700	0.0400		0.0000	0.0466	0.0100	0.0700	0.0026	0.0004	0.4684	0.0100	0.0000		0.0004	0.0000		0.0034		0.0007
CVS2-13	0.0896	0.0700	0.0300	0.0400		0.0000	0.0225	0.0500	0.1692	0.0026	0.0004	0.4937	0.0100	0.0000		0.0004	0.0000		0.0034		0.0007
CVS2-14	0.0243	0.1312	0.0500	0.0400		0.0000	0.0486	0.0200	0.0802	0.0047	0.0008	0.4601	0.1000	0.0000		0.0008	0.0000		0.0061		0.0012
CVS2-15	0.0756	0.0700	0.0601	0.0400		0.0000	0.0214	0.0000	0.1701	0.0082	0.0014	0.4731	0.0100	0.0000		0.0014	0.0000		0.0107		0.0022
CVS2-16	0.0231	0.1053	0.0083	0.0719		0.0000	0.0375	0.0084	0.1125	0.0061	0.0011	0.5354	0.0385	0.0000		0.0011	0.0000		0.0080		0.0016
CVS2-17	0.0636	0.1142	0.0275	0.0568		0.0000	0.0376	0.0363	0.1003	0.0042	0.0007	0.4802	0.0429	0.0000		0.0007	0.0000		0.0055		0.0011
CVS2-18	0.0231	0.1053	0.0083	0.0719		0.0000	0.0375	0.0084	0.1125	0.0061	0.0011	0.5354	0.0385	0.0000		0.0011	0.0000		0.0080		0.0016
CVS2-19	0.0235	0.1048	0.0082	0.0733		0.0000	0.0373	0.0084	0.1129	0.0060	0.0010	0.5330	0.0392	0.0000		0.0010	0.0000		0.0065		0.0002
CVS2-20	0.0100	0.0500	0.0000	0.0600		0.0000	0.0669	0.0000	0.1031	0.0010	0.0002	0.5700	0.1300	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-21	0.0686	0.1314	0.0000	0.0200		0.0000	0.0700	0.0800	0.0500	0.0010	0.0002	0.5700	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-22	0.0365	0.0500	0.0000	0.0200		0.0000	0.0700	0.0800	0.0735	0.0103	0.0018	0.5703	0.0000	0.0000		0.0018	0.0000		0.0134		0.0027
CVS2-23	0.0578	0.0522	0.0800	0.0200		0.0000	0.0100	0.0000	0.2000	0.0010	0.0002	0.5700	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-24	0.0961	0.2001	0.0000	0.0200		0.0000	0.0700	0.0000	0.0736	0.0097	0.0017	0.4466	0.0000	0.0000		0.0017	0.0000		0.0126		0.0025
CVS2-25	0.0033	0.0500	0.0800	0.1500		0.0000	0.0700	0.0000	0.0841	0.0058	0.0010	0.5060	0.0000	0.0000		0.0010	0.0000		0.0076		0.0015
CVS2-26	0.0257	0.2000	0.0800	0.0200		0.0000	0.0700	0.0000	0.0512	0.0010	0.0002	0.4431	0.1000	0.0000		0.0002	0.0000		0.0013		0.0003

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
CVS1-16			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-17			0.0000	0.0022	0.0027	0.0027		0.0054					0.0112	0.0022			0.0054		0.0221	0.0000	
CVS1-18			0.0000	0.0020	0.0024	0.0024		0.0048					0.0101	0.0020			0.0048		0.0199	0.0000	
CVS1-19			0.0000	0.0009	0.0011	0.0011		0.0022					0.0046	0.0009			0.0022		0.0090	0.0000	
CVS1-20			0.0000	0.0009	0.0011	0.0011		0.0022					0.0046	0.0009			0.0022		0.0090	0.0000	
CVS1-21			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-22			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS1-23			0.0000	0.0009	0.0011	0.0011		0.0021					0.0044	0.0009			0.0021		0.0087	0.0000	

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1			0.0000	0.0018	0.0022	0.0022		0.0043					0.0090	0.0018			0.0043		0.0177	0.0000	
CVS2-2			0.0000	0.0006	0.0007	0.0007		0.0013					0.0028	0.0005			0.0013		0.0055	0.0000	
CVS2-3			0.0000	0.0006	0.0007	0.0007		0.0013					0.0028	0.0005			0.0013		0.0055	0.0000	
CVS2-4			0.0000	0.0006	0.0007	0.0007		0.0013					0.0028	0.0005			0.0013		0.0055	0.0000	
CVS2-5			0.0000	0.0018	0.0022	0.0022		0.0043					0.0090	0.0018			0.0043		0.0177	0.0000	
CVS2-6			0.0000	0.0014	0.0017	0.0017		0.0034					0.0072	0.0014			0.0034		0.0142	0.0000	
CVS2-7			0.0000	0.0015	0.0017	0.0017		0.0035					0.0073	0.0014			0.0035		0.0143	0.0000	
CVS2-8			0.0000	0.0006	0.0007	0.0007		0.0013					0.0028	0.0005			0.0013		0.0055	0.0000	
CVS2-9			0.0000	0.0006	0.0007	0.0007		0.0013					0.0028	0.0005			0.0013		0.0055	0.0000	
CVS2-10			0.0000	0.0006	0.0008	0.0008		0.0015					0.0032	0.0006			0.0015		0.0064	0.0000	
CVS2-11			0.0000	0.0015	0.0018	0.0018		0.0036					0.0074	0.0015			0.0036		0.0147	0.0000	
CVS2-12			0.0000	0.0006	0.0007	0.0007		0.0013					0.0028	0.0005			0.0013		0.0055	0.0000	
CVS2-13			0.0000	0.0006	0.0007	0.0007		0.0013					0.0028	0.0005			0.0013		0.0055	0.0000	
CVS2-14			0.0000	0.0010	0.0012	0.0012		0.0025					0.0051	0.0010			0.0025		0.0101	0.0000	
CVS2-15			0.0000	0.0018	0.0022	0.0022		0.0043					0.0090	0.0018			0.0043		0.0177	0.0000	
CVS2-16			0.0000	0.0013	0.0016	0.0016		0.0032					0.0066	0.0013			0.0032		0.0131	0.0000	
CVS2-17			0.0000	0.0009	0.0011	0.0011		0.0022					0.0046	0.0009			0.0022		0.0090	0.0000	
CVS2-18			0.0000	0.0013	0.0016	0.0016		0.0032					0.0066	0.0013			0.0032		0.0131	0.0000	
CVS2-19			0.0000	0.0013	0.0015	0.0016		0.0019					0.0155	0.0013			0.0031		0.0057	0.0000	
CVS2-20			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-21			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-22			0.0000	0.0022	0.0027	0.0027		0.0054					0.0112	0.0022			0.0054		0.0221	0.0000	
CVS2-23			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-24			0.0000	0.0021	0.0025	0.0025		0.0050					0.0105	0.0021			0.0050		0.0208	0.0000	
CVS2-25			0.0000	0.0013	0.0015	0.0015		0.0030					0.0063	0.0012			0.0030		0.0125	0.0000	
CVS2-26			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
CVS1-16	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-17	0.0009		0.0018	0.0009			0.0009		0.0027				0.0009			0.0049	0.0018		0.0000		0.0000
CVS1-18	0.0008		0.0016	0.0008			0.0008		0.0024				0.0008			0.0044	0.0016		0.0000		0.0000
CVS1-19	0.0004		0.0007	0.0004			0.0004		0.0011				0.0004			0.0020	0.0007		0.0000		0.0000
CVS1-20	0.0004		0.0007	0.0004			0.0004		0.0011				0.0004			0.0020	0.0007		0.0000		0.0000
CVS1-21	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-22	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS1-23	0.0004		0.0007	0.0004			0.0004		0.0011				0.0004			0.0019	0.0007		0.0000		0.0000

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1	0.0007		0.0014	0.0007			0.0007		0.0022				0.0007			0.0039	0.0014		0.0000		0.0000
CVS2-2	0.0002		0.0004	0.0002			0.0002		0.0007				0.0002			0.0012	0.0004		0.0000		0.0000
CVS2-3	0.0002		0.0004	0.0002			0.0002		0.0007				0.0002			0.0012	0.0004		0.0000		0.0000
CVS2-4	0.0002		0.0004	0.0002			0.0002		0.0007				0.0002			0.0012	0.0004		0.0000		0.0000
CVS2-5	0.0007		0.0014	0.0007			0.0007		0.0022				0.0007			0.0039	0.0014		0.0000		0.0000
CVS2-6	0.0006		0.0011	0.0006			0.0006		0.0017				0.0006			0.0032	0.0011		0.0000		0.0000
CVS2-7	0.0006		0.0012	0.0006			0.0006		0.0017				0.0006			0.0032	0.0012		0.0000		0.0000
CVS2-8	0.0002		0.0004	0.0002			0.0002		0.0007				0.0002			0.0012	0.0004		0.0000		0.0000
CVS2-9	0.0002		0.0004	0.0002			0.0002		0.0007				0.0002			0.0012	0.0004		0.0000		0.0000
CVS2-10	0.0003		0.0005	0.0003			0.0003		0.0008				0.0003			0.0014	0.0005		0.0000		0.0000
CVS2-11	0.0006		0.0012	0.0006			0.0006		0.0018				0.0006			0.0033	0.0012		0.0000		0.0000
CVS2-12	0.0002		0.0004	0.0002			0.0002		0.0007				0.0002			0.0012	0.0004		0.0000		0.0000
CVS2-13	0.0002		0.0004	0.0002			0.0002		0.0007				0.0002			0.0012	0.0004		0.0000		0.0000
CVS2-14	0.0004		0.0008	0.0004			0.0004		0.0012				0.0004			0.0023	0.0008		0.0000		0.0000
CVS2-15	0.0007		0.0014	0.0007			0.0007		0.0022				0.0007			0.0039	0.0014		0.0000		0.0000
CVS2-16	0.0005		0.0011	0.0005			0.0005		0.0016				0.0005			0.0029	0.0011		0.0000		0.0000
CVS2-17	0.0004		0.0007	0.0004			0.0004		0.0011				0.0004			0.0020	0.0007		0.0000		0.0000
CVS2-18	0.0005		0.0011	0.0005			0.0005		0.0016				0.0005			0.0029	0.0011		0.0000		0.0000
CVS2-19	0.0000		0.0019	0.0000			0.0000		0.0015				0.0000			0.0044	0.0000		0.0000		0.0000
CVS2-20	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-21	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-22	0.0009		0.0018	0.0009			0.0009		0.0027				0.0009			0.0049	0.0018		0.0000		0.0000
CVS2-23	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-24	0.0008		0.0017	0.0008			0.0008		0.0025				0.0008			0.0046	0.0017		0.0000		0.0000
CVS2-25	0.0005		0.0010	0.0005			0.0005		0.0015				0.0005			0.0028	0.0010		0.0000		0.0000
CVS2-26	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
CVS1-16		0.0000				0.0000	0.0001	0.0000		1.0000	0.1430	0.0509	0.0004	0.0851		0.0070	0.0085	0.0771	0.1740	0.0014	0.0002
CVS1-17		0.0000				0.0000	0.0009	0.0000		1.0000	0.0000	0.0513	0.0995	0.1370		0.0040	0.0091	0.0000	0.1540	0.0104	0.0018
CVS1-18		0.0000				0.0000	0.0008	0.0000		0.9999	0.0009	0.0516	0.0220	0.0202		0.0130	0.0616	0.0754	0.1150	0.0093	0.0016
CVS1-19		0.0000				0.0000	0.0004	0.0000		0.9999	0.0636	0.1150	0.0289	0.0559		0.0080	0.0345	0.0355	0.0964	0.0043	0.0007
CVS1-20		0.0000				0.0000	0.0004	0.0000		0.9999	0.0637	0.1160	0.0270	0.0555		0.0140	0.0350	0.0344	0.1100	0.0044	0.0007
CVS1-21		0.0000				0.0000	0.0001	0.0000		1.0000	0.0074	0.2010	0.0214	0.0207		0.0000	0.0086	0.0795	0.0855	0.0014	0.0002
CVS1-22		0.0000				0.0000	0.0001	0.0000		1.0000	0.0008	0.0512	0.0009	0.1480		0.0070	0.0096	0.0754	0.0836	0.0018	0.0002
CVS1-23		0.0000				0.0000	0.0004	0.0000		0.9999	0.0434	0.0945	0.0294	0.1140		0.0090	0.0296	0.0078	0.0943	0.0040	0.0007

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1		0.0000				0.0000	0.0007	0.0000		0.9998	0.0795	0.0880	0.0008	0.0400		0.0330	0.0580	0.0465	0.0700	0.0088	0.0014
CVS2-2		0.0000				0.0000	0.0002	0.0000		1.0000	0.1065	0.0705	0.0690	0.0425		0.0150	0.0530	0.0000	0.0780	0.0031	0.0005
CVS2-3		0.0000				0.0000	0.0002	0.0000		0.9999	0.0995	0.1305	0.0690	0.0435		0.0340	0.0405	0.0097	0.0650	0.0033	0.0005
CVS2-4		0.0000				0.0000	0.0002	0.0000		0.9999	0.0595	0.1090	0.0700	0.0385		0.0067	0.0465	0.0000	0.0630	0.0030	0.0005
CVS2-5		0.0000				0.0000	0.0007	0.0000		0.9997	0.0690	0.1545	0.0260	0.0345		0.0170	0.0170	0.0000	0.0890	0.0083	0.0014
CVS2-6		0.0000				0.0000	0.0006	0.0000		0.9999	0.0155	0.0690	0.0680	0.1125		0.0100	0.0350	0.0047	0.0630	0.0068	0.0012
CVS2-7		0.0000				0.0000	0.0006	0.0000		0.9999	0.0895	0.1570	0.0170	0.0385		0.0083	0.0495	0.0000	0.0770	0.0066	0.0012
CVS2-8		0.0000				0.0000	0.0002	0.0000		1.0000	0.0580	0.0695	0.0014	0.1065		0.0190	0.0540	0.0445	0.0900	0.0078	0.0005
CVS2-9		0.0000				0.0000	0.0002	0.0000		0.9999	0.0140	0.0950	0.0006	0.0700		0.0150	0.0545	0.0000	0.0860	0.0030	0.0005
CVS2-10		0.0000				0.0000	0.0003	0.0000		1.0000	0.1005	0.1690	0.0013	0.0635		0.0110	0.0019	0.0000	0.1180	0.0033	0.0005
CVS2-11		0.0000				0.0000	0.0006	0.0000		1.0000	0.0104	0.0745	0.0680	0.0395		0.0045	0.0550	0.0111	0.0910	0.0069	0.0012
CVS2-12		0.0000				0.0000	0.0002	0.0000		1.0000	0.0900	0.1745	0.0760	0.0400		0.0130	0.0450	0.0100	0.0690	0.0030	0.0005
CVS2-13		0.0000				0.0000	0.0002	0.0000		0.9999	0.0895	0.0710	0.0320	0.0405		0.0370	0.0215	0.0480	0.1620	0.0031	0.0005
CVS2-14		0.0000				0.0000	0.0004	0.0000		0.9999	0.0245	0.1320	0.0310	0.0395		0.0170	0.0340	0.0450	0.0700	0.0050	0.0008
CVS2-15		0.0000				0.0000	0.0007	0.0000		0.9999	0.0745	0.0775	0.0550	0.0380		0.0079	0.0205	0.0000	0.1440	0.0082	0.0014
CVS2-16		0.0000				0.0000	0.0005	0.0000		0.9998	0.0230	0.1040	0.0092	0.0700		0.0310	0.0360	0.0086	0.1050	0.0065	0.0011
CVS2-17		0.0000				0.0000	0.0004	0.0000		0.9999	0.0615	0.1135	0.0300	0.0550		0.0180	0.0330	0.0330	0.0890	0.0045	0.0007
CVS2-18		0.0000				0.0000	0.0005	0.0000		0.9998	0.0235	0.1060	0.0093	0.0705		0.0280	0.0365	0.0086	0.1090	0.0066	0.0011
CVS2-19		0.0000				0.0000	0.0000	0.0049		0.9999	0.0300	0.1010	0.0108	0.0610		0.0000	0.0344	0.0809	0.1160	0.0063	0.0010
CVS2-20		0.0000				0.0000	0.0001	0.0000		0.9999	0.0096	0.0486	0.0004	0.0564		0.0000	0.0628	0.0004	0.1455	0.0010	0.0008
CVS2-21		0.0000				0.0000	0.0001	0.0000		1.0000	0.0669	0.1290	0.0005	0.0190		0.0000	0.0646	0.0705	0.0847	0.0010	0.0004
CVS2-22		0.0000				0.0000	0.0009	0.0000		0.9999	0.0366	0.0502	0.0006	0.0203		0.0020	0.0703	0.0731	0.1355	0.0093	0.0020
CVS2-23		0.0000				0.0000	0.0001	0.0000		0.9999	0.0561	0.0508	0.0760	0.0188		0.0000	0.0081	0.0004	0.2265	0.0010	0.0002
CVS2-24		0.0000				0.0000	0.0008	0.0000		0.9999	0.0940	0.2008	0.0007	0.0185		0.0200	0.0673	0.0002	0.1290	0.0087	0.0020
CVS2-25		0.0000				0.0000	0.0005	0.0000		0.9998	0.0040	0.0496	0.0765	0.1415		0.0000	0.0663	0.0007	0.1295	0.0054	0.0010
CVS2-26		0.0000				0.0000	0.0001	0.0000		0.9999	0.0250	0.2000	0.0770	0.0190		0.0000	0.0680	0.0010	0.0520	0.0009	0.0004

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
CVS1-16	0.4230	0.0002			0.0002			0.0014		0.0003				0.0002	0.0003	0.0003		0.0005			
CVS1-17	0.4380	0.0004			0.0017			0.0136		0.0029				0.0023	0.0026	0.0026		0.0054			
CVS1-18	0.4190	0.0975			0.0016			0.0126		0.0026				0.0022	0.0022	0.0024		0.0048			
CVS1-19	0.4760	0.0400			0.0007			0.0057		0.0014				0.0010	0.0010	0.0011		0.0022			
CVS1-20	0.4750	0.0411			0.0007			0.0055		0.0012				0.0010	0.0011	0.0011		0.0022			
CVS1-21	0.5540	0.0002			0.0002			0.0014		0.0003				0.0004	0.0003	0.0003		0.0005			
CVS1-22	0.5340	0.0703			0.0002			0.0014		0.0003				0.0002	0.0003	0.0006		0.0005			
CVS1-23	0.5140	0.0064			0.0007			0.0052		0.0011				0.0009	0.0010	0.0010		0.0021			

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1	0.5340	0.0100			0.0014			0.0110		0.0028				0.0021	0.0018	0.0021		0.0043			
CVS2-2	0.5100	0.0280			0.0004			0.0034		0.0013				0.0007	0.0006	0.0007		0.0013			
CVS2-3	0.4670	0.0350			0.0050			0.0033		0.0015				0.0009	0.0005	0.0007		0.0013			
CVS2-4	0.5530	0.0100			0.0004			0.0032		0.0011				0.0008	0.0004	0.0006		0.0013			
CVS2-5	0.4870	0.0073			0.0012			0.0060		0.0025				0.0019	0.0019	0.0019		0.0043			
CVS2-6	0.5390	0.0095			0.0011			0.0082		0.0021				0.0016	0.0016	0.0016		0.0034			
CVS2-7	0.4690	0.0100			0.0011			0.0086		0.0021				0.0017	0.0017	0.0017		0.0035			
CVS2-8	0.4940	0.0049			0.0004			0.0033		0.0011				0.0008	0.0007	0.0007		0.0013			
CVS2-9	0.5470	0.0960			0.0004			0.0003		0.0001				0.0008	0.0006	0.0007		0.0013			
CVS2-10	0.4680	0.0100			0.0005			0.0037		0.0012				0.0009	0.0007	0.0007		0.0016			
CVS2-11	0.4910	0.0870			0.0011			0.0085		0.0024				0.0002	0.0018	0.0017		0.0036			
CVS2-12	0.4640	0.0006			0.0005			0.0034		0.0011				0.0007	0.0006	0.0007		0.0013			
CVS2-13	0.5050	0.0010			0.0005			0.0034		0.0013				0.0001	0.0005	0.0007		0.0013			
CVS2-14	0.4740	0.0900			0.0008			0.0063		0.0019				0.0014	0.0011	0.0012		0.0025			
CVS2-15	0.4740	0.0100			0.0013			0.0099		0.0026				0.0018	0.0017	0.0020		0.0043			
CVS2-16	0.5400	0.0380			0.0010			0.0079		0.0023				0.0016	0.0015	0.0016		0.0032			
CVS2-17	0.4810	0.0410			0.0007			0.0057		0.0018				0.0013	0.0010	0.0010		0.0022			
CVS2-18	0.5320	0.0400			0.0010			0.0080		0.0022				0.0017	0.0015	0.0016		0.0032			
CVS2-19	0.5110	0.0397			0.0023			0.0064		0.0010				0.0010	0.0002	0.0021		0.0019			
CVS2-20	0.5630	0.1180			0.0002			0.0012		0.0055				0.0003	0.0025	0.0003		0.0005			
CVS2-21	0.5495	0.0000			0.0002			0.0013		0.0002				0.0003	0.0003	0.0003		0.0005			
CVS2-22	0.5560	0.0000			0.0017			0.0123		0.0023				0.0021	0.0027	0.0025		0.0054			
CVS2-23	0.5485	0.0000			0.0002			0.0012		0.0001				0.0003	0.0004	0.0002		0.0005			
CVS2-24	0.4360	0.0000			0.0015			0.0116		0.0024				0.0020	0.0028	0.0023		0.0050			
CVS2-25	0.4903	0.0000			0.0009			0.0072		0.0013				0.0012	0.0019	0.0014		0.0030			
CVS2-26	0.4300	0.0890			0.0002			0.0013		0.0048				0.0002	0.0006	0.0003		0.0005			

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
CVS1-16		0.0011	0.0004			0.0005		0.0021			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-17		0.0108	0.0029			0.0053		0.0195			0.0009		0.0018	0.0009			0.0009		0.0021		
CVS1-18		0.0097	0.0025			0.0049		0.0179			0.0008		0.0016	0.0008			0.0008		0.0021		
CVS1-19		0.0044	0.0012			0.0022		0.0081			0.0004		0.0007	0.0004			0.0004		0.0016		
CVS1-20		0.0043	0.0011			0.0022		0.0081			0.0004		0.0007	0.0004			0.0004		0.0013		
CVS1-21		0.0013	0.0004			0.0006		0.0021			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-22		0.0011	0.0003			0.0005		0.0020			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS1-23		0.0041	0.0012			0.0021		0.0076			0.0004		0.0007	0.0004			0.0004		0.0011		

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1		0.0083	0.0032			0.0043		0.0150			0.0007		0.0014	0.0007			0.0007		0.0023		
CVS2-2		0.0027	0.0014			0.0013		0.0048			0.0002		0.0005	0.0002			0.0002		0.0007		
CVS2-3		0.0027	0.0013			0.0013		0.0048			0.0002		0.0005	0.0002			0.0002		0.0014		
CVS2-4		0.0025	0.0023			0.0013		0.0046			0.0002		0.0005	0.0002			0.0002		0.0007		
CVS2-5		0.0341	0.0025			0.0040		0.0130			0.0007		0.0014	0.0007			0.0007		0.0021		
CVS2-6		0.0064	0.0028			0.0032		0.0120			0.0006		0.0012	0.0006			0.0006		0.0018		
CVS2-7		0.0066	0.0030			0.0034		0.0120			0.0006		0.0012	0.0006			0.0006		0.0017		
CVS2-8		0.0025	0.0019			0.0013		0.0047			0.0002		0.0005	0.0002			0.0002		0.0007		
CVS2-9		0.0027	0.0009			0.0013		0.0048			0.0002		0.0005	0.0002			0.0002		0.0007		
CVS2-10		0.0030	0.0018			0.0015		0.0055			0.0003		0.0005	0.0003			0.0003		0.0008		
CVS2-11		0.0066	0.0031			0.0034		0.0120			0.0006		0.0012	0.0006			0.0006		0.0017		
CVS2-12		0.0027	0.0017			0.0014		0.0049			0.0002		0.0005	0.0002			0.0002		0.0007		
CVS2-13		0.0028	0.0022			0.0014		0.0049			0.0002		0.0005	0.0002			0.0002		0.0014		
CVS2-14		0.0048	0.0023			0.0025		0.0085			0.0004		0.0008	0.0004			0.0004		0.0014		
CVS2-15		0.0079	0.0036			0.0040		0.0150			0.0007		0.0014	0.0007			0.0007		0.0019		
CVS2-16		0.0061	0.0024			0.0032		0.0110			0.0005		0.0011	0.0005			0.0005		0.0019		
CVS2-17		0.0042	0.0018			0.0022		0.0079			0.0004		0.0007	0.0004			0.0004		0.0013		
CVS2-18		0.0062	0.0027			0.0032		0.0190			0.0005		0.0011	0.0005			0.0005		0.0018		
CVS2-19		0.0212	0.0024			0.0028		0.0070			0.0000		0.0019	0.0000			0.0000		0.0015		
CVS2-20		0.0010	0.0001			0.0005		0.0019			0.0001		0.0002	0.0001			0.0001		0.0002		
CVS2-21		0.0010	0.0004			0.0005		0.0021			0.0001		0.0002	0.0001			0.0001		0.0002		
CVS2-22		0.0100	0.0024			0.0050		0.0192			0.0001		0.0018	0.0001			0.0001		0.0015		
CVS2-23		0.0009	0.0004			0.0005		0.0016			0.0001		0.0002	0.0001			0.0001		0.0002		
CVS2-24		0.0093	0.0023			0.0047		0.0182			0.0009		0.0017	0.0009			0.0009		0.0016		
CVS2-25		0.0058	0.0013			0.0030		0.0117			0.0005		0.0010	0.0005			0.0005		0.0009		
CVS2-26		0.0008	0.0002			0.0005		0.0020			0.0001		0.0002	0.0001			0.0001		0.0002		

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
CVS1-16		0.0001			0.0005	0.0002				0.0000							0.0001			0.9797
CVS1-17		0.0009			0.0049	0.0018				0.0000							0.0009			0.9901
CVS1-18		0.0008			0.0044	0.0016				0.0003							0.0008			0.9645
CVS1-19		0.0004			0.0020	0.0007				0.0002							0.0004			0.9949
CVS1-20		0.0004			0.0020	0.0007				0.0002							0.0004			1.0122
CVS1-21		0.0001			0.0005	0.0002				0.0000							0.0001			0.9892
CVS1-22		0.0001			0.0005	0.0002				0.0002							0.0001			0.9920
CVS1-23		0.0004			0.0019	0.0007				0.0001							0.0004			0.9805

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1		0.0007			0.0039	0.0014				0.0002							0.0007			1.0390
CVS2-2		0.0002			0.0012	0.0005				0.0004							0.0002			0.9988
CVS2-3		0.0002			0.0012	0.0005				0.0002							0.0003			1.0256
CVS2-4		0.0002			0.0012	0.0005				0.0003							0.0002			0.9824
CVS2-5		0.0007			0.0039	0.0012				0.0003							0.0006			0.9965
CVS2-6		0.0006			0.0032	0.0011				0.0001							0.0006			0.9882
CVS2-7		0.0006			0.0032	0.0012				0.0001							0.0006			0.9790
CVS2-8		0.0002			0.0012	0.0005				0.0003							0.0002			0.9727
CVS2-9		0.0002			0.0012	0.0005				0.0004							0.0002			0.9996
CVS2-10		0.0003			0.0014	0.0005				0.0003							0.0003			0.9726
CVS2-11		0.0006			0.0033	0.0012				0.0003							0.0006			0.9949
CVS2-12		0.0002			0.0012	0.0005				0.0002							0.0002			1.0085
CVS2-13		0.0002			0.0012	0.0005				0.0003							0.0003			1.0350
CVS2-14		0.0004			0.0023	0.0008				0.0006							0.0004			1.0039
CVS2-15		0.0007			0.0039	0.0014				0.0003							0.0007			0.9773
CVS2-16		0.0005			0.0029	0.0010				0.0002							0.0005			1.0237
CVS2-17		0.0004			0.0020	0.0007				0.0003							0.0004			0.9967
CVS2-18		0.0005			0.0029	0.0010				0.0003							0.0006			1.0309
CVS2-19		0.0000			0.0044	0.0000				0.0010							0.0000	0.0048		1.0541
CVS2-20		0.0001			0.0005	0.0002				0.0004							0.0001			1.0222
CVS2-21		0.0001			0.0005	0.0002				0.0001							0.0001			0.9947
CVS2-22		0.0001			0.0049	0.0017				0.0002							0.0008			1.0324
CVS2-23		0.0001			0.0005	0.0002				0.0001							0.0001			0.9941
CVS2-24		0.0009			0.0046	0.0015				0.0001							0.0008			1.0527
CVS2-25		0.0005			0.0028	0.0010				0.0001							0.0005			1.0115
CVS2-26		0.0001			0.0005	0.0002				0.0003							0.0001			0.9753

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
CVS1-16		>1118		spinel				
CVS1-17		1000		spinel				
CVS1-18		>1118		ZrO2				
CVS1-19		961		spinel				
CVS1-20		966		spinel				
CVS1-21		957		SiO2				
CVS1-22		>1118		spinel				
CVS1-23		980		spinel				

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1		1048		spinel				
CVS2-2		839		Ca asilicate				
CVS2-3		942		zircon				
CVS2-4		810		Ca asilicate				
CVS2-5		988		spinel				
CVS2-6		>1004		spinel				
CVS2-7		934		spinel				
CVS2-8		>1118		spinel				
CVS2-9		1018		zircon				
CVS2-10		>868		spinel				
CVS2-11		1035		zircon				
CVS2-12		847		clinopyroxene				
CVS2-13		909		clinopyroxene				
CVS2-14		1118		zircon				
CVS2-15		956		spinel				
CVS2-16		906		spinel				
CVS2-17		971		spinel				
CVS2-18		895		spinel				
CVS2-19		>883		spinel				
CVS2-20		1084		zircon				
CVS2-21		911		orthopyroxene				
CVS2-22		994		spinel				
CVS2-23		887		Ca asilicate				
CVS2-24		800		spinel				
CVS2-25		>951		spinel				
CVS2-26		1049		zircon				

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
CVS1-16	nepheline, spinel	(Fe; Ni,Cr)	15-18 vol% nepheline NaAlSiO4, 1-2 vol% spinel		
CVS1-17	spinel, clinopyroxene	(Fe,Ni,Cr), (Ca,Fe,Si)	1-2 vol% maghemite g-Fe2O3		
CVS1-18	ZrO2, Li2SiO3, clinopyroxene	(zr), (Si), (Ca,Mg,Si; Fe,Ni)	12-13 vol% ZrO2, 2-3 vol% Li2SiO3		
CVS1-19	clinopyroxene, spinel	(Ca,Fe,Mg,Si; Zr), (Fe,Ni,Cr)	8-10 vol% clinopyroxene		
CVS1-20	clinopyroxene, spinel		8-10 vol% clinopyroxene		
CVS1-21	none	none	<1 vol% unidentified		
CVS1-22	zircon, orthopyroxene, clinopyroxene, spinel, hematite	(Zr,Si), (Mg,Fe,Si), (Fe,Si)	10-12 vol% zircon ZrSiO4, 2-4 vol% orthopyroxene (Mg,Fe)SiO3, 2-3 vol% clinopyroxene		
CVS1-23	clinopyroxene, spinel	(Ca,Fe,Si; Na,Al), (Fe,Ni,Cr)	2-3 vol% clinopyroxene		

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1	olivine, spinel	(Mg,Ni,Fe,Si), (Cr,Fe,Ni)	2-3 vol% olivine (Mg,Fe)2SiO4, <1 vol% unidentified		
CVS2-2	none		none		
CVS2-3	oblong crystals		none		
CVS2-4	none		<1 vol% unidentified		
CVS2-5	high-Ni spinel(?)	(Ni,Fe,Cr)	1-2 vol% unidentified		
CVS2-6	clinopyroxene, spinel	(Ca,Fe,Si; Ni,Mg), (Fe,Cr,Ni)	5 vol% clinopyroxene		
CVS2-7	high-Ni spinel(?), spinel	(Ni,Fe,Cr), (Fe,Cr,Ni)	2-3 vol% unidentified		
CVS2-8	spinel, orthopyroxene, hematite	(Fe,Ni,Cr), (Mg,Fe,Si)	3-4 vol% spinel, orthopyroxene (Mg,Fe)SiO3		
CVS2-9	ZrO2 at bottom	none	none		
CVS2-10	spinel	(Fe,Ni,Cr)	2 vol% spinel		
CVS2-11	none	none	<2 vol% unidentified		
CVS2-12	none	none	<2 vol% unidentified		
CVS2-13	RuO2 needles		none		
CVS2-14	none		none		
CVS2-15	high-Ni spinel(?), spinel	(Ni,Fe,Cr), (Fe,Cr,Ni)	2-3 vol% unidentified		
CVS2-16	none		<1 vol% unidentified		
CVS2-17	clinopyroxene, spinel	(Ca,Fe,Mg,Si; Zr,Ni), (Fe,Cr,Ni)	10 vol% clinopyroxene		
CVS2-18	none				
CVS2-19	clinopyroxene		none		
CVS2-20	undissolved ZrO2		none		
CVS2-21	none		none		
CVS2-22	orthopyroxene, olivine	(Mg,Si; Fe,Ni), (Si), (Mg,Ni,Si;Fe)	7 vol% orthopyroxene (MG,Fe)SiO3, 7 vol% Li2SiO3, 2 vol% unidentified		
CVS2-23	RuO2 needles		none		
CVS2-24	high-Ni spinel(?)		1-2 vol% unidentified		
CVS2-25	clinopyroxene, Li2SiO3, spinel	(Ca,Fe,Si; Na,Ni), (Si), (Fe,Ni,Cr)	8 vol% clinopyroxene, 10 vol% Li2SiO3, 4 vol% hematite (a-Fe2O3)		
CVS2-26	RuO2 needles	none	none		

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
CVS1-16		2.5984	-6.15	7080.86	365.44	17.81	-12.047	21223.4	17.59				1348	2.89	1249
CVS1-17		2.9205	-5.14	4146.93	451.94	2.23	-12.736	19360.4	2.39				1252	1.04	1152
CVS1-18		2.9163	-34.31	########	-2730.03	1.87							(1251)	(0.77)	(1052)
CVS1-19		2.6705	-6.45	7170.87	275.46	5.76	-12.484	20317.4	6.01				1251	2.46	1151
CVS1-20		2.6709	-6.53	7629.94	228.06	5.71	-11.740	19235.1	5.91				1252	2.52	1152
CVS1-21		2.502	-3.90	4025.10	494.15	9.36	-13.194	22133.7	10.59				1249	4.14	1150
CVS1-22		2.7923	-6.16	7000.00	435.70	38.11	-13.629	24521.0	36.71				1351	4.43	1252
CVS1-23		2.6919	-6.00	7237.84	214.12	5.69	-10.642	17661.9	5.87				1252	2.66	1153

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1		2.6447	-7.66	10547.27	63.07	7.74	-11.860	19788.6	7.74				1199	5.11	1123
CVS2-2		2.6513	-5.83	6776.14	265.76	6.26	-11.352	18785.1	6.35				1249	2.9	1199
CVS2-3		2.6312	-5.47	5748.80	349.90	5.56	-12.226	19866.7	5.67				1249	2.56	1198
CVS2-4		2.6008	-5.63	6567.10	272.32	6.37	-11.428	18906.0	6.41				1198	4.37	1124
CVS2-5		2.6127	-4.67	5076.07	400.58	8.18	-12.139	20299.4	8.38				1250	3.72	1200
CVS2-6		2.7703	-4.77	4954.98	398.91	6.19	-12.001	19705.3	6.34				1250	2.87	1199
CVS2-7		2.554	-4.67	4761.86	371.35	4.26	-10.811	17473.7	4.34				1250	2.17	1199
CVS2-8		2.6705	-5.83	6627.35	242.42	4.36	-10.480	17050.6	4.49				1299	1.57	1250
CVS2-9		2.7096	-6.50	7389.73	278.00	7.23	-13.167	21579.4	7.37				1250	3.04	1200
CVS2-10		2.5353	-4.02	4618.29	406.77	8.99	-10.994	18801.1	9.19				1250	4.39	1200
CVS2-11		2.8228	-6.37	5985.39	351.41	3.07	-13.876	21352.4	3.09				1198	2.01	1123
CVS2-12		2.5975	-4.24	3704.99	470.67	3.38	-12.361	19332.4	3.40				1198	2.37	1123
CVS2-13		2.6198	-6.36	7751.57	221.29	7.27	-11.573	19310.5	7.37				1248	3.32	1199
CVS2-14		2.7735	-5.65	4912.78	420.85	2.97	-13.573	20898.7	3.04				1249	1.33	1199
CVS2-15		2.5615	-5.34	5529.18	341.84	4.47	-11.615	18686.6	4.56				1249	2.16	1199
CVS2-16		2.6786	-6.70	8140.32	202.92	6.61	-11.864	19585.6	6.68				1248	2.93	1199
CVS2-17		2.6744	-5.44	5744.01	343.47	5.37	-11.995	19490.2	5.48				1250	2.46	1199
CVS2-18		2.6868	-6.12	7093.77	260.62	6.41	-11.780	19427.9	6.51				1248	2.89	1199
CVS2-19		2.6987	-5.69	6319.75	319.03	6.76	-12.176	20074.3	6.90				1249	2.95	1200
CVS2-20		2.7333	-6.53	7702.25	298.49	12.31	-13.843	23295.3	12.52				1245	5.07	1194
CVS2-21		2.492	-5.82	6876.21	246.69	6.01	-11.021	18250.7	6.08				1244	2.93	1195
CVS2-22		2.6611	-5.57	6443.11	273.26	5.92	-11.012	18221.9	6.01				1248	2.79	1198
CVS2-23		2.591	-5.27	6320.83	313.98	9.91	-11.693	19924.7	10.06				1243	4.63	1194
CVS2-24		2.5796	-6.84	7662.12	131.74	1.99	-10.294	15638.9	2.01				1247	1.03	1199
CVS2-25		2.8316	-5.15	4096.93	398.47	1.35	-11.162	16332.5	1.37				1246	0.72	1197
CVS2-26		2.6967	-5.99	4592.64	411.51	1.26	-13.167	19093.2	1.28				1244	0.63	1194

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
CVS1-16	6.48	1149	18.02	(1049)	(113.81)																
CVS1-17	2.22	1052	5.83	953	23.1																
CVS1-18	(4.62)	(952)	(12.23)																		
CVS1-19	5.73	1051	16.35	951	64.53																
CVS1-20	5.51	1053	15.31	953	53.9																
CVS1-21	9.58	(1049)	(28.12)	950	138.75																
CVS1-22	11.2	1153	35.97																		
CVS1-23	5.55	1053	13.91	953	44.72																

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1	9.81	1048	21.29	958	70.77																
CVS2-2	4.24	1150	6.14	1149	6.21	1147	6.47	1100	9.72	1097	10.44	1047	17.22	999	30.68	948	60.06				
CVS2-3	3.58	1150	5.54	1148	5.6	1147	5.86	1100	8.82	1096	9.65	1048	15.67	998	30.09	949	61.85				
CVS2-4	7.81	1048	17.36	948	59.47																
CVS2-5	5.41	1149	7.89	1150	8.07	1147	8.53	1097	13.6	1100	13.65	1047	23.82	999	46.32	948	98.42				
CVS2-6	4.1	1150	6.16	1149	6.18	1148	6.44	1100	9.96	1098	10.01	1048	17.25	999	33.3	949	68.39				
CVS2-7	2.85	1150	4.23	1148	4.35	1149	4.37	1099	6.54	1098	6.57	1048	10.67	998	19.03	949	35.5				
CVS2-8	2.13	1200	2.93	1150	4.27	1148	4.35	1145	4.64	1100	6.59	1097	7.08	1046	11.22	995	19.86	947	35.44		
CVS2-9	4.52	1198	4.68	1150	7.23	1149	7.33	1148	7.38	1123	9.57	1100	12.01	1099	12.43	1048	22.09	1048	23.07	999	42.76
CVS2-10	6.07	1149	8.67	1150	8.7	1147	9.43	1100	14.24	1098	14.54	1048	24.11	999	44.78	949	88.75				
CVS2-11	3.98	1048	9.22	948	38.83																
CVS2-12	4.18	1048	8.93	945	35.62																
CVS2-13	4.85	1149	7.02	1148	7.17	1146	7.67	1099	11.77	1096	12.5	1046	20.52	997	39.31	948	72.4				
CVS2-14	2	1149	2.88	1150	2.88	1148	2.99	1100	4.99	1099	5.03	1048	8.86	998	17.54	949	38.36				
CVS2-15	2.94	1149	4.4	1150	4.44	1148	4.74	1100	6.95	1099	7.18	1048	11.71	998	22.69	949	42.4				
CVS2-16	4.27	1198	4.42	1148	6.68	1149	6.71	1147	6.91	1123	8.38	1099	10.59	1097	11.24	1047	18.61	1048	18.88	998	34.49
CVS2-17	3.45	1149	5.37	1149	5.57	1147	5.69	1100	8.53	1098	8.85	1048	14.9	999	27.35	949	57.68				
CVS2-18	4.2	1148	6.46	1150	6.47	1145	6.84	1099	10.51	1097	10.53	1047	17.78	997	33.96	948	66.75				
CVS2-19	4.44	1149	6.76	1150	6.76	1148	7.14	1100	11.02	1097	11.51	1048	18.73	999	36.93	949	77.01				
CVS2-20	7.8	1144	12.77	1144	13.02	1144	13.12	1094	23.47	1094	23.52	1044	44.72	994	94.47	944	218.42				
CVS2-21	4.16	1145	6.17	1146	6.23	1145	6.4	1096	9.66	1096	9.85	1046	16.2	995	28.76	946	55.62				
CVS2-22	4.1	1148	5.97	1148	6.05	1148	6.17	1098	9.31	1098	9.36	1047	15.63	997	28.16	947	54.27				
CVS2-23	6.76	1145	10.16	1145	10.45	1144	10.64	1095	16.96	1096	16.96	1045	29.41	995	53.72	945	117.22				
CVS2-24	1.41	1144	1.99	1148	2.02	1147	2.11	1098	2.99	1097	3.06	1047	4.66	997	7.33	947	13.11				
CVS2-25	0.97	1148	1.37	1147	1.38	1148	1.44	1098	1.98	1097	2	1048	3.14	998	5.45	947	10.11				
CVS2-26	0.88	1146	1.27	1145	1.3	1147	1.3	1097	2.09	1095	2.13	1046	3.48	996	6.34	946	13.65				

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
CVS1-16					0.523	0.266	0.540	0.241	12.01	21.688	10.075	8.058	1.717	12.28		
CVS1-17					2.235	2.075	2.304	0.663	11.57	1.122	1.200	1.220	0.4335	11.45		
CVS1-18					11.238	8.065	8.040	1.531	12.25	22.186	5.714	12.216	1.699	12.30		
CVS1-19					0.523	0.533	0.433	0.166	10.29	0.410	0.503	0.363	0.138	10.11		
CVS1-20					0.455	0.468	0.396	0.156	10.16	0.443	0.515	0.364	0.149	10.21		
CVS1-21					18.850	15.591	15.536	0.459	9.68	16.881	19.355	18.718	0.694	9.32		
CVS1-22					1.119	0.704	0.760	0.259	9.81	3.859	2.000	1.538	0.458	9.62		
CVS1-23					0.525	0.535	0.487	0.229	10.29	0.370	0.373	0.339	0.193	9.87		

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1					0.312	0.369	0.208	0.17	10.21	0.386	0.305	0.248	0.237	10.30		
CVS2-2					0.128	0.276	0.188	0.075	10.92	0.136	0.215	0.160	0.077	10.77		
CVS2-3					0.137	0.222	0.125	0.064	10.08	0.134	0.198	0.116	0.06	10.14		
CVS2-4					0.158	0.300	0.182	0.101	10.40	0.147	0.241	0.154	0.09	10.30		
CVS2-5					0.284	0.382	0.284	0.106	9.58	0.263	0.285	0.264	0.146	9.61		
CVS2-6					1.185	1.303	1.284	0.421	10.48	1.240	1.064	0.934	0.418	10.26		
CVS2-7					0.740	0.812	0.343	0.164	9.89	0.653	0.666	0.337	0.189	9.82		
CVS2-8					0.484	0.523	0.445	0.263	10.75	0.850	1.183	0.561	0.522	11.34		
CVS2-9	948	93.07	943	111.05	0.560	0.620	0.374	0.241	10.34	0.545	0.484	0.314	0.236	10.24		
CVS2-10					1.332	1.322	0.828	0.115	9.46	0.965	0.968	0.645	0.162	9.51		
CVS2-11					1.587	1.564	1.370	0.51	11.46	1.019	1.108	1.092	0.426	11.33		
CVS2-12					0.194	0.262	0.184	0.075	9.90	0.136	0.213	0.156	0.082	9.90		
CVS2-13					0.360	0.362	0.478	0.182	11.14	0.345	0.335	0.390	0.177	10.94		
CVS2-14					1.656	1.468	1.268	0.261	10.46	1.580	1.254	1.210	0.258	10.50		
CVS2-15					0.331	0.451	0.608	0.18	11.30	1.493	1.558	0.163	0.208	9.87		
CVS2-16	948	65.71	948	70.62	2.937	2.349	2.182	0.558	10.36	2.634	1.878	1.722	0.535	10.30		
CVS2-17					0.495	0.571	0.474	0.167	10.27	0.676	0.629	0.423	0.156	10.30		
CVS2-18					2.578	2.094	1.886	0.546	10.34	2.443	1.778	1.617	0.559	10.23		
CVS2-19					1.990	1.654	1.481	0.45	10.35	1.358	1.095	1.045	0.377	10.26		
CVS2-20					0.347	0.386	0.279	0.187	10.89	0.322	0.402	0.268	0.206	10.90		
CVS2-21					3.854	2.534	2.089	0.506	10.26	3.181	2.458	1.752	0.487	10.34		
CVS2-22					9.646	5.453	6.097	2.249	11.72	5.932	3.978	4.497	2.166	11.48		
CVS2-23					0.173	0.604	0.809	0.144	11.81	0.203	0.559	0.708	0.14	11.76		
CVS2-24					4.522	3.226	2.060	0.179	9.80	4.019	3.226	1.831	0.187	9.91		
CVS2-25					4.662	2.765	3.526	1.214	11.91	1.775	4.255	1.202	1.345	12.04		
CVS2-26					1.628	1.436	1.349	0.275	10.11	1.326	1.567	1.448	0.328	10.17		

Hanford CVS 1 (Hrma et al. 1994)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
CVS1-16												
CVS1-17												
CVS1-18												
CVS1-19												
CVS1-20												
CVS1-21												
CVS1-22												
CVS1-23												

Hanford CVS 2 (Hrma et al. 1994)

CVS2-1												
CVS2-2												
CVS2-3												
CVS2-4												
CVS2-5												
CVS2-6												
CVS2-7												
CVS2-8												
CVS2-9												
CVS2-10												
CVS2-11												
CVS2-12												
CVS2-13												
CVS2-14												
CVS2-15												
CVS2-16												
CVS2-17												
CVS2-18												
CVS2-19												
CVS2-20												
CVS2-21												
CVS2-22												
CVS2-23												
CVS2-24												
CVS2-25												
CVS2-26												

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
CVS2-27	0.0782	0.0500	0.0000	0.0200		0.0000	0.0155	0.0800	0.2000	0.0010	0.0002	0.5463	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-28	0.0555	0.0500	0.0000	0.0200		0.0000	0.0126	0.0000	0.2000	0.0103	0.0018	0.5622	0.0000	0.0000		0.0018	0.0000		0.0134		0.0027
CVS2-29	0.0000	0.2001	0.0800	0.0200		0.0000	0.0100	0.0000	0.0675	0.0103	0.0018	0.4393	0.0834	0.0000		0.0018	0.0000		0.0134		0.0027
CVS2-30	0.0458	0.2000	0.0000	0.1320		0.0000	0.0100	0.0000	0.0832	0.0010	0.0002	0.5190	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-31	0.0526	0.1843	0.0800	0.0200		0.0000	0.0331	0.0000	0.0500	0.0010	0.0002	0.5700	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-32	0.0027	0.0500	0.0000	0.0200		0.0000	0.0428	0.0000	0.2000	0.0010	0.0002	0.5445	0.1300	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-33	0.0892	0.0544	0.0000	0.0200		0.0000	0.0364	0.0800	0.2001	0.0103	0.0018	0.4202	0.0000	0.0000		0.0018	0.0000		0.0134		0.0027
CVS2-34	0.1388	0.1743	0.0000	0.0200		0.0000	0.0369	0.0000	0.2000	0.0010	0.0002	0.4200	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-35	0.1340	0.0500	0.0800	0.0632		0.0000	0.0428	0.0000	0.2000	0.0010	0.0002	0.4200	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-36	0.0088	0.0500	0.0800	0.1500		0.0000	0.0700	0.0000	0.0891	0.0010	0.0002	0.5421	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-37	0.1400	0.0839	0.0000	0.0200		0.0000	0.0700	0.0000	0.1061	0.0010	0.0002	0.5700	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-38	0.0272	0.1109	0.0000	0.1428		0.0000	0.0100	0.0800	0.1044	0.0010	0.0002	0.5147	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-39	0.0258	0.0500	0.0000	0.0742		0.0000	0.0700	0.0800	0.1362	0.0010	0.0002	0.4838	0.0700	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-40	0.1000	0.0639	0.0200	0.0200		0.0000	0.0421	0.0500	0.1500	0.0031	0.0005	0.5040	0.0200	0.0000		0.0005	0.0000		0.0040		0.0008
CVS2-41	0.1000	0.0694	0.0500	0.0300		0.0000	0.0700	0.0200	0.0781	0.0031	0.0005	0.5325	0.0200	0.0000		0.0005	0.0000		0.0040		0.0008
CVS2-42	0.0300	0.0500	0.0320	0.1000		0.0000	0.0700	0.0380	0.0625	0.0031	0.0005	0.5675	0.0200	0.0000		0.0005	0.0000		0.0040		0.0008
CVS2-43	0.0500	0.1477	0.0200	0.0300		0.0000	0.0653	0.0300	0.0500	0.0031	0.0005	0.5070	0.0700	0.0000		0.0005	0.0000		0.0040		0.0008
CVS2-44	0.0623	0.1078	0.0500	0.0200		0.0000	0.0699	0.0200	0.0500	0.0031	0.0005	0.5700	0.0200	0.0000		0.0005	0.0000		0.0040		0.0008
CVS2-45	0.0592	0.1106	0.0200	0.0308		0.0000	0.0595	0.0500	0.0500	0.0072	0.0013	0.5301	0.0200	0.0000		0.0013	0.0000		0.0094		0.0019
CVS2-46	0.0746	0.1259	0.0200	0.0200		0.0000	0.0700	0.0200	0.0577	0.0067	0.0012	0.5266	0.0200	0.0000		0.0012	0.0000		0.0088		0.0018
CVS2-47	0.0400	0.0500	0.0500	0.0200		0.0000	0.0429	0.0200	0.1277	0.0072	0.0013	0.5296	0.0500	0.0000		0.0013	0.0000		0.0094		0.0019
CVS2-48	0.0854	0.1442	0.0500	0.0200		0.0000	0.0390	0.0200	0.0968	0.0056	0.0010	0.4701	0.0200	0.0000		0.0010	0.0000		0.0073		0.0015
CVS2-49	0.0785	0.1357	0.0200	0.0515		0.0000	0.0413	0.0200	0.0957	0.0031	0.0005	0.5073	0.0200	0.0000		0.0005	0.0000		0.0040		0.0008
CVS2-50	0.0636	0.1142	0.0275	0.0568		0.0000	0.0376	0.0363	0.1003	0.0042	0.0007	0.4802	0.0429	0.0000		0.0007	0.0000		0.0055		0.0011
CVS2-51	0.0235	0.1048	0.0082	0.0733		0.0000	0.0373	0.0084	0.1129	0.0060	0.0010	0.5330	0.0392	0.0000		0.0010	0.0000		0.0065		0.0002
CVS2-52	0.0233	0.0817	0.0008	0.0720		0.0000	0.0788	0.0009	0.0450	0.0061	0.0011	0.6002	0.0385	0.0000		0.0011	0.0000		0.0079		0.0016
CVS2-53	0.0800	0.0874	0.0000	0.0400		0.0000	0.0600	0.0500	0.0700	0.0082	0.0014	0.5226	0.0100	0.0000		0.0014	0.0000		0.0107		0.0022
CVS2-54	0.0235	0.1048	0.0082	0.0733		0.0000	0.0373	0.0084	0.1129	0.0061	0.0010	0.5328	0.0392	0.0000		0.0010	0.0000		0.0065		0.0002
CVS2-55	0.0235	0.1048	0.0082	0.0733		0.0000	0.0373	0.0084	0.1129	0.0000	0.0000	0.5328	0.0392	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
CVS2-56	0.0235	0.1048	0.0082	0.0733		0.0000	0.0373	0.0084	0.1129	0.0000	0.0000	0.5328	0.0392	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
CVS2-57	0.0235	0.1048	0.0082	0.0733		0.0000	0.0373	0.0084	0.1129	0.0000	0.0000	0.5328	0.0392	0.0000		0.0000	0.0000		0.0000		0.0000
CVS2-58	0.1500	0.2000	0.0200	0.0200		0.0000	0.0700	0.0800	0.0500	0.0010	0.0002	0.3900	0.0100	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-59	0.1150	0.1718	0.0375	0.0200		0.0000	0.0727	0.0005	0.1268	0.0011	0.0002	0.4380	0.0075	0.0000		0.0002	0.0000		0.0014		0.0003
CVS2-60	0.0925	0.0876	0.0063	0.0200		0.0000	0.0743	0.0005	0.1725	0.0011	0.0002	0.5281	0.0075	0.0000		0.0002	0.0000		0.0014		0.0003
CVS2-61	0.1625	0.0664	0.0000	0.0200		0.0000	0.0730	0.0000	0.1200	0.0013	0.0002	0.5281	0.0175	0.0000		0.0002	0.0000		0.0017		0.0003
CVS2-62	0.0500	0.1765	0.0500	0.0200		0.0000	0.0156	0.0005	0.1125	0.0010	0.0002	0.5579	0.0075	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-63	0.1800	0.1717	0.1000	0.0200		0.0000	0.0051	0.0000	0.1900	0.0010	0.0002	0.3232	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-64	0.0288	0.0509	0.0025	0.0812		0.0009	0.0642	0.0008	0.0925	0.0098	0.0037	0.5697	0.0431	0.0000		0.0000	0.0000		0.0129		0.0026
CVS2-65	0.0196	0.1128	0.0007	0.0013		0.0087	0.0697	0.0004	0.0860	0.0000	0.0000	0.5344	0.1548	0.0000		0.0000	0.0000		0.0000		0.0000

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
CVS2-27			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-28			0.0000	0.0022	0.0027	0.0027		0.0054					0.0112	0.0022			0.0054		0.0221	0.0000	
CVS2-29			0.0000	0.0022	0.0027	0.0027		0.0054					0.0112	0.0022			0.0054		0.0221	0.0000	
CVS2-30			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-31			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-32			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-33			0.0000	0.0022	0.0027	0.0027		0.0054					0.0112	0.0022			0.0054		0.0221	0.0000	
CVS2-34			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-35			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-36			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-37			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-38			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-39			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-40			0.0000	0.0007	0.0008	0.0008		0.0016					0.0034	0.0007			0.0016		0.0066	0.0000	
CVS2-41			0.0000	0.0007	0.0008	0.0008		0.0016					0.0034	0.0007			0.0016		0.0066	0.0000	
CVS2-42			0.0000	0.0007	0.0008	0.0008		0.0016					0.0034	0.0007			0.0016		0.0066	0.0000	
CVS2-43			0.0000	0.0007	0.0008	0.0008		0.0016					0.0034	0.0007			0.0016		0.0066	0.0000	
CVS2-44			0.0000	0.0007	0.0008	0.0008		0.0016					0.0034	0.0007			0.0016		0.0066	0.0000	
CVS2-45			0.0000	0.0016	0.0019	0.0019		0.0038					0.0078	0.0015			0.0038		0.0155	0.0000	
CVS2-46			0.0000	0.0015	0.0018	0.0018		0.0035					0.0073	0.0014			0.0035		0.0145	0.0000	
CVS2-47			0.0000	0.0016	0.0019	0.0019		0.0038					0.0078	0.0015			0.0038		0.0155	0.0000	
CVS2-48			0.0000	0.0012	0.0015	0.0015		0.0029					0.0061	0.0012			0.0029		0.0121	0.0000	
CVS2-49			0.0000	0.0007	0.0008	0.0008		0.0016					0.0034	0.0007			0.0016		0.0066	0.0000	
CVS2-50			0.0000	0.0009	0.0011	0.0011		0.0022					0.0046	0.0009			0.0022		0.0090	0.0000	
CVS2-51			0.0000	0.0013	0.0015	0.0016		0.0019					0.0155	0.0013			0.0031		0.0057	0.0000	
CVS2-52			0.0000	0.0013	0.0016	0.0016		0.0032					0.0066	0.0013			0.0032		0.0130	0.0000	
CVS2-53			0.0000	0.0018	0.0022	0.0022		0.0043					0.0090	0.0018			0.0043		0.0000	0.0000	
CVS2-54			0.0000	0.0013	0.0015	0.0016		0.0019					0.0155	0.0013			0.0031		0.0000	0.0000	
CVS2-55			0.0000	0.0089	0.0000	0.0000		0.0030					0.0000	0.0280			0.0000		0.0167	0.0000	
CVS2-56			0.0000	0.0072	0.0000	0.0000		0.0030					0.0000	0.0465			0.0000		0.0000	0.0000	
CVS2-57			0.0000	0.0054	0.0000	0.0000		0.0030					0.0000	0.0000			0.0000		0.0513	0.0000	
CVS2-58			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-59			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0023	0.0000	
CVS2-60			0.0000	0.0002	0.0003	0.0003		0.0006					0.0012	0.0002			0.0006		0.0024	0.0000	
CVS2-61			0.0000	0.0003	0.0003	0.0003		0.0007					0.0014	0.0003			0.0007		0.0028	0.0000	
CVS2-62			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0021	0.0000	
CVS2-63			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-64			0.0000	0.0011	0.0026	0.0000		0.0003					0.0028	0.0000			0.0024		0.0146	0.0028	
CVS2-65			0.0000	0.0048	0.0000	0.0000		0.0000					0.0004	0.0000			0.0000		0.0062	0.0000	

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
CVS2-27	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-28	0.0009		0.0018	0.0009			0.0009		0.0027				0.0009			0.0049	0.0018		0.0000		0.0000
CVS2-29	0.0009		0.0018	0.0009			0.0009		0.0027				0.0009			0.0049	0.0018		0.0000		0.0000
CVS2-30	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-31	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-32	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-33	0.0009		0.0018	0.0009			0.0009		0.0027				0.0009			0.0049	0.0018		0.0000		0.0000
CVS2-34	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-35	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-36	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-37	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-38	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-39	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-40	0.0003		0.0005	0.0003			0.0003		0.0008				0.0003			0.0015	0.0005		0.0000		0.0000
CVS2-41	0.0003		0.0005	0.0003			0.0003		0.0008				0.0003			0.0015	0.0005		0.0000		0.0000
CVS2-42	0.0003		0.0005	0.0003			0.0003		0.0008				0.0003			0.0015	0.0005		0.0000		0.0000
CVS2-43	0.0003		0.0005	0.0003			0.0003		0.0008				0.0003			0.0015	0.0005		0.0000		0.0000
CVS2-44	0.0003		0.0005	0.0003			0.0003		0.0008				0.0003			0.0015	0.0005		0.0000		0.0000
CVS2-45	0.0006		0.0013	0.0006			0.0006		0.0019				0.0006			0.0035	0.0013		0.0000		0.0000
CVS2-46	0.0006		0.0012	0.0006			0.0006		0.0018				0.0006			0.0032	0.0012		0.0000		0.0000
CVS2-47	0.0006		0.0013	0.0006			0.0006		0.0019				0.0006			0.0035	0.0013		0.0000		0.0000
CVS2-48	0.0005		0.0010	0.0005			0.0005		0.0015				0.0005			0.0027	0.0010		0.0000		0.0000
CVS2-49	0.0003		0.0005	0.0003			0.0003		0.0008				0.0003			0.0015	0.0005		0.0000		0.0000
CVS2-50	0.0004		0.0007	0.0004			0.0004		0.0011				0.0004			0.0020	0.0007		0.0000		0.0000
CVS2-51	0.0000		0.0019	0.0000			0.0000		0.0015				0.0000			0.0044	0.0000		0.0000		0.0000
CVS2-52	0.0005		0.0011	0.0005			0.0005		0.0016				0.0005			0.0029	0.0011		0.0000		0.0000
CVS2-53	0.0007		0.0014	0.0007			0.0007		0.0022				0.0007			0.0039	0.0014		0.0000		0.0000
CVS2-54	0.0000		0.0019	0.0000			0.0000		0.0015				0.0000			0.0044	0.0000		0.0000		0.0000
CVS2-55	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0030	0.0000		0.0000		0.0000
CVS2-56	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0030	0.0000		0.0000		0.0000
CVS2-57	0.0000		0.0000	0.0000			0.0000		0.0000				0.0000			0.0000	0.0000		0.0000		0.0000
CVS2-58	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-59	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-60	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-61	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0006	0.0002		0.0000		0.0000
CVS2-62	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-63	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-64	0.0005		0.0000	0.0000			0.0005		0.0018				0.0000			0.0028	0.0000		0.0000		0.0028
CVS2-65	0.0000		0.0000	0.0000			0.0001		0.0000				0.0000			0.0000	0.0000		0.0000		0.0000

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
CVS2-27		0.0000				0.0000	0.0001	0.0000		0.9999	0.0764	0.0492	0.0005	0.0190		0.0000	0.0168	0.0715	0.2335	0.0009	0.0002
CVS2-28		0.0000				0.0000	0.0009	0.0000		0.9999	0.0486	0.0443	0.0002	0.0175		0.0000	0.0103	0.0001	0.2030	0.0093	0.0020
CVS2-29		0.0000				0.0000	0.0009	0.0000		0.9999	0.0005	0.2018	0.0758	0.0188		0.0000	0.0082	0.0007	0.1080	0.0093	0.0020
CVS2-30		0.0000				0.0000	0.0001	0.0000		0.9999	0.0435	0.1960	0.0001	0.1218		0.0000	0.0084	0.0001	0.1250	0.0009	0.0002
CVS2-31		0.0000				0.0000	0.0001	0.0000		1.0000	0.0514	0.1895	0.0757	0.0193		0.0000	0.0295	0.0007	0.0901	0.0010	0.0004
CVS2-32		0.0000				0.0000	0.0001	0.0000		1.0000	0.0027	0.0491	0.0005	0.0194		0.0000	0.0412	0.0004	0.2445	0.0009	0.0009
CVS2-33		0.0000				0.0000	0.0009	0.0000		0.9999	0.0875	0.0540	0.0005	0.0190		0.0000	0.0350	0.0710	0.2200	0.0092	0.0010
CVS2-34		0.0000				0.0000	0.0001	0.0000		0.9999	0.1350	0.1700	0.0005	0.0195		0.0000	0.0350	0.0002	0.2100	0.0009	0.0001
CVS2-35		0.0000				0.0000	0.0001	0.0000		1.0000	0.1305	0.0493	0.0776	0.0597		0.0000	0.0420	0.0006	0.2450	0.0009	0.0002
CVS2-36		0.0000				0.0000	0.0001	0.0000		1.0000	0.0088	0.0497	0.0780	0.1443		0.0000	0.0692	0.0005	0.1395	0.0009	0.0002
CVS2-37		0.0000				0.0000	0.0001	0.0000		1.0000	0.1358	0.0830	0.0002	0.0190		0.0000	0.0642	0.0000	0.1405	0.0009	0.0004
CVS2-38		0.0000				0.0000	0.0001	0.0000		1.0000	0.0273	0.1100	0.0002	0.1338		0.0000	0.0085	0.0706	0.1435	0.0010	0.0005
CVS2-39		0.0000				0.0000	0.0001	0.0000		1.0000	0.0247	0.0483	0.0005	0.0675		0.0000	0.0643	0.0690	0.1725	0.0009	0.0005
CVS2-40		0.0000				0.0000	0.0003	0.0000		0.9999	0.0970	0.0630	0.0190	0.0190		0.0000	0.0400	0.0440	0.1660	0.0028	0.0005
CVS2-41		0.0000				0.0000	0.0003	0.0000		0.9999	0.0970	0.0680	0.0480	0.0285		0.0000	0.0660	0.0180	0.1200	0.0030	0.0006
CVS2-42		0.0000				0.0000	0.0003	0.0000		0.9999	0.0290	0.0490	0.0310	0.0930		0.0000	0.0660	0.0335	0.0660	0.0029	0.0006
CVS2-43		0.0000				0.0000	0.0003	0.0000		0.9999	0.0477	0.1418	0.0209	0.0283		0.0000	0.0593	0.0266	0.0809	0.0030	0.0008
CVS2-44		0.0000				0.0000	0.0003	0.0000		0.9999	0.0610	0.1050	0.0470	0.0190		0.0000	0.0650	0.0175	0.0530	0.0029	0.0005
CVS2-45		0.0000				0.0000	0.0006	0.0000		0.9999	0.0575	0.1100	0.0190	0.0290		0.0000	0.0560	0.0445	0.0520	0.0065	0.0010
CVS2-46		0.0000				0.0000	0.0006	0.0000		0.9999	0.0721	0.1225	0.0196	0.0194		0.0000	0.0632	0.0181	0.0927	0.0065	0.0010
CVS2-47		0.0000				0.0000	0.0006	0.0000		0.9999	0.0390	0.0495	0.0490	0.0190		0.0000	0.0400	0.0175	0.1300	0.0065	0.0015
CVS2-48		0.0000				0.0000	0.0005	0.0000		0.9998	0.0835	0.1300	0.0490	0.0190		0.0000	0.0380	0.0175	0.1100	0.0051	0.0010
CVS2-49		0.0000				0.0000	0.0003	0.0000		0.9999	0.0763	0.1325	0.0191	0.0494		0.0000	0.0368	0.0176	0.1280	0.0031	0.0006
CVS2-50		0.0000				0.0000	0.0004	0.0000		0.9999	0.0625	0.1150	0.0270	0.0535		0.0000	0.0370	0.0317	0.1100	0.0037	0.0007
CVS2-51		0.0000				0.0000	0.0000	0.0049		0.9999	0.0285	0.0975	0.0099	0.0570		0.0000	0.0320	0.0072	0.1200	0.0059	0.0015
CVS2-52		0.0000				0.0000	0.0005	0.0000		1.0000	0.0260	0.0875	0.0012	0.0755		0.0000	0.0830	0.0001	0.0680	0.0000	0.0020
CVS2-53			0.0177			0.0000	0.0007	0.0000		0.9996	0.0840	0.0910	0.0018	0.0360		0.0000	0.0630	0.0440	0.0650	0.0077	0.0020
CVS2-54			0.0057			0.0000	0.0000	0.0049		0.9998	0.0330	0.1100	0.0094	0.0660		0.0000	0.0390	0.0075	0.1000	0.0056	0.0010
CVS2-55			0.0000			0.0000	0.0000	0.0000		1.0000	0.0270	0.1150	0.0069	0.0765		0.0000	0.0405	0.0071	0.1100	0.0000	0.0004
CVS2-56			0.0000			0.0000	0.0000	0.0000		1.0000	0.0260	0.1100	0.0066	0.0760		0.0000	0.0405	0.0069	0.0940	0.0000	0.0004
CVS2-57		0.0000				0.0000	0.0000	0.0000		1.0000	0.0250	0.1100	0.0067	0.0755		0.0000	0.0385	0.0068	0.1000	0.0000	0.0006
CVS2-58		0.0000				0.0000	0.0001	0.0000		0.9999	0.1500	0.2050	0.0190	0.0210		0.0000	0.0715	0.0755	0.0670	0.0007	0.0004
CVS2-59		0.0000				0.0000	0.0001	0.0000		1.0000	0.1055	0.1620	0.0331	0.0173		0.0000	0.0658	0.0008	0.1140	0.0029	0.0002
CVS2-60		0.0000				0.0000	0.0001	0.0000		0.9999											
CVS2-61		0.0000				0.0000	0.0001	0.0000		1.0000											
CVS2-62		0.0000				0.0000	0.0001	0.0000		1.0000											
CVS2-63		0.0000				0.0000	0.0001	0.0000		0.9999											
CVS2-64		0.0000				0.0000	0.0000	0.0015		1.0000											
CVS2-65		0.0000				0.0000	0.0000	0.0000		1.0000											

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
CVS2-27	0.5333	0.0000			0.0002			0.0012		0.0002				0.0003	0.0003	0.0002		0.0005			
CVS2-28	0.4915	0.0000			0.0015			0.0109		0.0016				0.0012	0.0025	0.0022		0.0054			
CVS2-29	0.4170	0.0736			0.0017			0.0131		0.0065				0.0021	0.0028	0.0025		0.0054			
CVS2-30	0.4915	0.0000			0.0002			0.0012		0.0002				0.0003	0.0003	0.0003		0.0005			
CVS2-31	0.5415	0.0000			0.0002			0.0013		0.0002				0.0001	0.0005	0.0003		0.0005			
CVS2-32	0.5383	0.1225			0.0002			0.0012		0.0055				0.0002	0.0003	0.0002		0.0005			
CVS2-33	0.4100	0.0000			0.0017			0.0125		0.0029				0.0021	0.0028	0.0025		0.0054			
CVS2-34	0.4000	0.0009			0.0002			0.0012		0.0002				0.0002	0.0006	0.0003		0.0005			
CVS2-35	0.3978	0.0000			0.0002			0.0012		0.0002				0.0002	0.0002	0.0002		0.0005			
CVS2-36	0.5338	0.0000			0.0002			0.0012		0.0002				0.0002	0.0002	0.0002		0.0005			
CVS2-37	0.5508	0.0000			0.0002			0.0012		0.0001				0.0003	0.0003	0.0003		0.0005			
CVS2-38	0.5005	0.0000			0.0002			0.0013		0.0002				0.0003	0.0003	0.0003		0.0005			
CVS2-39	0.4551	0.0601			0.0002			0.0012		0.0032				0.0002	0.0004	0.0002		0.0005			
CVS2-40	0.4900	0.0160			0.0005			0.0038		0.0019				0.0007	0.0010	0.0008		0.0016			
CVS2-41	0.5100	0.0170			0.0052			0.0039		0.0019				0.0006	0.0011	0.0008		0.0016			
CVS2-42	0.5500	0.0170			0.0050			0.0037		0.0014				0.0006	0.0009	0.0007		0.0016			
CVS2-43	0.4870	0.0610			0.0005			0.0037		0.0039				0.0007	0.0012	0.0008		0.0016			
CVS2-44	0.4900	0.0160			0.0005			0.0004		0.0018				0.0006	0.0010	0.0008		0.0016			
CVS2-45	0.4700	0.0170			0.0012			0.0088		0.0030				0.0014	0.0022	0.0018		0.0038			
CVS2-46	0.5060	0.0150			0.0011			0.0081		0.0023				0.0014	0.0024	0.0017		0.0035			
CVS2-47	0.5200	0.0440			0.0015			0.0088		0.0041				0.0017	0.0020	0.0018		0.0038			
CVS2-48	0.4600	0.0170			0.0009			0.0069		0.0016				0.0011	0.0017	0.0014		0.0029			
CVS2-49	0.4800	0.0167			0.0005			0.0038		0.0018				0.0001	0.0113	0.0008		0.0016			
CVS2-50	0.4400	0.0370			0.0006			0.0051		0.0030				0.0008	0.0012	0.0001		0.0219			
CVS2-51	0.4600	0.0340			0.0022			0.0059		0.0021				0.0010	0.0016	0.0019		0.0019			
CVS2-52	0.5800	0.0390			0.0011			0.0075		0.0016				0.0013	0.0016	0.0015		0.0032			
CVS2-53	0.5000	0.0091			0.0013			0.0100		0.0020				0.0017	0.0022	0.0020		0.0043			
CVS2-54	0.5100	0.0350			0.0009			0.0062		0.0002				0.0013	0.0015	0.0015		0.0019			
CVS2-55	0.5200	0.0390			0.0000			0.0000		0.0000				0.0082	0.0000	0.0000		0.0030			
CVS2-56	0.5000	0.0370			0.0000			0.0000		0.0002				0.0066	0.0000	0.0066		0.0030			
CVS2-57	0.4900	0.0380			0.0000			0.0000		0.0000				0.0049	0.0000	0.0000		0.0030			
CVS2-58	0.3600	0.0086			0.0002			0.0012		0.0002				0.0002	0.0003	0.0003		0.0005			
CVS2-59	0.3980	0.0064		0.0000	0.0002			0.0018		0.0003			0.0002	0.0003	0.0003	0.0003	0.0000	0.0006		0.0000	
CVS2-60																					
CVS2-61																					
CVS2-62																					
CVS2-63																					
CVS2-64																					
CVS2-65																					

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
CVS2-27		0.0009	0.0002			0.0005		0.0017			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS2-28		0.0087	0.0021			0.0044		0.0166			0.0009		0.0018	0.0009			0.0009		0.0018		
CVS2-29		0.0101	0.0026			0.0051		0.0212			0.0009		0.0018	0.0009			0.0009		0.0015		
CVS2-30		0.0009	0.0001			0.0005		0.0015			0.0001		0.0002	0.0001			0.0001		0.0002		
CVS2-31		0.0010	0.0004			0.0005		0.0021			0.0001		0.0002	0.0001			0.0001		0.0002		
CVS2-32		0.0010	0.0002			0.0005		0.0018			0.0001		0.0002	0.0001			0.0001		0.0003		
CVS2-33		0.0101	0.0024			0.0044		0.0210			0.0009		0.0018	0.0009			0.0009		0.0008		
CVS2-34		0.0011	0.0003			0.0005		0.0020			0.0009		0.0002	0.0009			0.0009		0.0002		
CVS2-35		0.0009	0.0001			0.0005		0.0019			0.0001		0.0002	0.0001			0.0001		0.0002		
CVS2-36		0.0009	0.0002			0.0005		0.0020			0.0001		0.0002	0.0001			0.0001		0.0001		
CVS2-37		0.0009	0.0003			0.0005		0.0017			0.0001		0.0002	0.0001			0.0001		0.0002		
CVS2-38		0.0010	0.0003			0.0005		0.0019			0.0001		0.0002	0.0001			0.0001		0.0001		
CVS2-39		0.0008	0.0002			0.0005		0.0017			0.0001		0.0002	0.0001			0.0001		0.0002		
CVS2-40		0.0029	0.0007			0.0014		0.0063			0.0003		0.0005	0.0003			0.0003		0.0005		
CVS2-41		0.0033	0.0007			0.0015		0.0069			0.0003		0.0005	0.0003			0.0003		0.0005		
CVS2-42		0.0030	0.0007			0.0014		0.0060			0.0003		0.0005	0.0003			0.0003		0.0004		
CVS2-43		0.0028	0.0008			0.0014		0.0060			0.0003		0.0005	0.0003			0.0003		0.0006		
CVS2-44		0.0029	0.0007			0.0014		0.0061			0.0003		0.0005	0.0003			0.0003		0.0005		
CVS2-45		0.0071	0.0017			0.0035		0.0145			0.0006		0.0013	0.0006			0.0006		0.0014		
CVS2-46		0.0066	0.0018			0.0034		0.0135			0.0006		0.0012	0.0006			0.0006		0.0008		
CVS2-47		0.0069	0.0018			0.0035		0.0145			0.0006		0.0013	0.0006			0.0006		0.0010		
CVS2-48		0.0057	0.0015			0.0029		0.0110			0.0005		0.0010	0.0005			0.0005		0.0015		
CVS2-49		0.0031	0.0009			0.0015		0.0062			0.0003		0.0005	0.0003			0.0003		0.0006		
CVS2-50		0.0038	0.0010			0.0021		0.0081			0.0004		0.0007	0.0004			0.0004		0.0006		
CVS2-51		0.0205	0.0021			0.0028		0.0065			0.0000		0.0019	0.0000			0.0000		0.0013		
CVS2-52		0.0061	0.0016			0.0032		0.0130			0.0005		0.0011	0.0005			0.0005		0.0016		
CVS2-53		0.0081	0.0021			0.0042		0.0000			0.0010		0.0014	0.0007			0.0007		0.0015		
CVS2-54		0.0140	0.0016			0.0030		0.0000			0.0000		0.0019	0.0000			0.0000		0.0010		
CVS2-55		0.0000	0.0250			0.0000		0.0170			0.0000		0.0000	0.0000			0.0000		0.0000		
CVS2-56		0.0000	0.0385			0.0000		0.0000			0.0000		0.0000	0.0000			0.0000		0.0000		
CVS2-57		0.0000	0.0000			0.0000		0.0505			0.0000		0.0000	0.0000			0.0000		0.0000		
CVS2-58		0.0010	0.0003			0.0005		0.0020			0.0001		0.0018	0.0001			0.0001		0.0002		
CVS2-59		0.0010	0.0004	0.0000		0.0006		0.0020	0.0000		0.0001		0.0002	0.0001			0.0001		0.0003	0.0000	
CVS2-60																					
CVS2-61																					
CVS2-62																					
CVS2-63																					
CVS2-64																					
CVS2-65																					

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
CVS2-27		0.0001			0.0005	0.0002				0.0007							0.0001			1.0097
CVS2-28		0.0009			0.0049	0.0014				0.0001							0.0007			0.8978
CVS2-29		0.0009			0.0049	0.0017				0.0003							0.0009			1.0032
CVS2-30		0.0001			0.0005	0.0002				0.0001							0.0001			0.9949
CVS2-31		0.0001			0.0005	0.0002				0.0002							0.0001			1.0078
CVS2-32		0.0001			0.0005	0.0002				0.0003							0.0001			1.0336
CVS2-33		0.0009			0.0049	0.0017				0.0001							0.0008			0.9887
CVS2-34		0.0009			0.0005	0.0002				0.0001							0.0000			0.9839
CVS2-35		0.0001			0.0005	0.0002				0.0001							0.0001			1.0112
CVS2-36		0.0001			0.0005	0.0002				0.0002							0.0001			1.0327
CVS2-37		0.0001			0.0005	0.0002				0.0001							0.0001			1.0025
CVS2-38		0.0001			0.0005	0.0002				0.0002							0.0001			1.0041
CVS2-39		0.0001			0.0005	0.0002				0.0002							0.0001			0.9741
CVS2-40		0.0003			0.0015	0.0001				0.0001							0.0001			0.9827
CVS2-41		0.0003			0.0015	0.0006				0.0001							0.0002			1.0080
CVS2-42		0.0003			0.0015	0.0005				0.0001							0.0002			0.9673
CVS2-43		0.0003			0.0015	0.0005				0.0003							0.0003			0.9852
CVS2-44		0.0003			0.0015	0.0005				0.0002							0.0002			0.8991
CVS2-45		0.0006			0.0035	0.0012				0.0001							0.0006			0.9217
CVS2-46		0.0006			0.0032	0.0011				0.0002							0.0006			0.9912
CVS2-47		0.0006			0.0035	0.0012				0.0002							0.0006			0.9764
CVS2-48		0.0005			0.0027	0.0009				0.0001							0.0003			0.9760
CVS2-49		0.0003			0.0015	0.0005				0.0001							0.0003			0.9961
CVS2-50		0.0004			0.0020	0.0007				0.0002							0.0004			0.9716
CVS2-51		0.0000			0.0044	0.0000				0.0011							0.0000	0.0043		0.9147
CVS2-52		0.0005			0.0029	0.0011				0.0002							0.0005	0.0000		1.0130
CVS2-53		0.0007			0.0039	0.0014				0.0001							0.0007	0.0000		0.9537
CVS2-54		0.0000			0.0040	0.0000				0.0002							0.0000	0.0045		0.9602
CVS2-55		0.0000			0.0030	0.0000				0.0002							0.0000	0.0000		0.9988
CVS2-56		0.0000			0.0030	0.0000				0.0002							0.0000	0.0000		0.9554
CVS2-57		0.0000			0.0000	0.0000				0.0002							0.0000	0.0000		0.9496
CVS2-58		0.0000			0.0005	0.0000				0.0001							0.0001	0.0000		0.9882
CVS2-59	0.0000	0.0001			0.0005	0.0002		0.0000	0.0000	0.0002			0.0000		0.0000		0.0001	0.0000		0.9154
CVS2-60																				
CVS2-61																				
CVS2-62																				
CVS2-63																				
CVS2-64																				
CVS2-65																				

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
CVS2-27								
CVS2-28								
CVS2-29		1108		zircon				
CVS2-30		1090		spinel				
CVS2-31		945		SiO2				
CVS2-32		1089		Na-Zr silicate				
CVS2-33		>1038		spinel				
CVS2-34		736		nepheline				
CVS2-35		961		nepheline				
CVS2-36		887		orthopyroxene				
CVS2-37		803		nepheline				
CVS2-38		>1115		spinel				
CVS2-39		1029		zircon				
CVS2-40		862		clinopyroxene				
CVS2-41		887		clinopyroxene				
CVS2-42		1093		spinel				
CVS2-43		1090		zircon				
CVS2-44		884		clinopyroxene				
CVS2-45		>956		spinel				
CVS2-46		1004		spinel				
CVS2-47		935		clinopyroxene				
CVS2-48		868		clinopyroxene				
CVS2-49		957		spinel				
CVS2-50		1025		spinel				
CVS2-51		899		spinel				
CVS2-52		>1038		spinel				
CVS2-53								
CVS2-54								
CVS2-55		>1118		spinel				
CVS2-56		1117		spinel				
CVS2-57		1036		Cr2O3				
CVS2-58		921		olivine				
CVS2-59		715		SiO2				
CVS2-60		788		SiO2				
CVS2-61		792		SiO2				
CVS2-62								
CVS2-63		927		nepheline				
CVS2-64		983		spinel				
CVS2-65		1168		zircon				

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
CVS2-27	RuO2 needles	none	none		
CVS2-28	none		1-2 vol% unidentified		
CVS2-29	none	none	<1 vol% unidentified		
CVS2-30	hematite, spinel	(Fe), (Fe,Ni,Cr)	9 vol% hematite (a-Fe2O3), 2 vol% cristobalite (SiO2), trace quartz (SiO2)		
CVS2-31	none	none	none		
CVS2-32	undissolved ZrO2		none		
CVS2-33	nepheline, olivine, high-Ni spinel(?)	(Na,Al,Si; Fe,Mg), (Mg,Ni,Si;Fe), (Ni,Cr,Fe)	15 vol% nepheline (NaAlSiO4), 2 vol% unidentified		
CVS2-34	RuO2 needles		none		
CVS2-35	nepheline, gehlinite	(Na,Al,Si), (Ca,Al,Si), (Si)	10 vol% nepheline (NaAlSiO4), 7 vol% gehlinite (Ca2Al2SiO7), 2 vol% SiO2(?)		
CVS2-36	clinopyroxene, Li2SiO3	(Ca,Fe,Si), (Si)	5 vol% clinopyroxene, 2 vol% Li2SiO3		
CVS2-37	none	none	none		
CVS2-38	spinel, star-like crystals growing from spinel, olivine	(Fe,Ni,Cr), (Fe,Mg,Na,Si), (Mg,Fe,Si)	7 vol% spinel, 2 vol% krinovite (NaMg2CrSi3O10)		
CVS2-39	Li2SiO3, RuO2 needles		7 vol% Li2SiO3, 3 vol% Li2MgSiO4		
CVS2-40	none		none		
CVS2-41	none		none		
CVS2-42	clinopyroxene, Li2SiO3, spinel	(Ca,Fe,Mg,Si; Zr,Ni), (Si), (Fe,Cr,Ni)	20 vol% clinopyroxene, 10-15 vol% Li2SiO3		
CVS2-43	none	none	none		
CVS2-44	none		none		
CVS2-45	clinopyroxene, spinel	(Ca,Fe,Mg,Si; Zr,Ni), (Fe,Cr,Ni)	9 vol% clinopyroxene		
CVS2-46	none	none	none		
CVS2-47	none	none	none		
CVS2-48	none	none	none		
CVS2-49	none		none		
CVS2-50	clinopyroxene, spinel	(Ca,Fe,Mg,Si; Zr,Ni), (Fe,Ni,Cr)	12 vol% clinopyroxene		
CVS2-51	clinopyroxene		none		
CVS2-52	clinopyroxene		none		
CVS2-53					
CVS2-54					
CVS2-55	Cr2O3	(Cr,Fe)	none		
CVS2-56	none	none	none		
CVS2-57	none	none	none		
CVS2-58	olivine	(Mg,Fe,Ni,Si; Zr)	none		
CVS2-59	RuO2 needles				
CVS2-60	RuO2 needles	none	none		
CVS2-61	none	none	none		
CVS2-62	none				
CVS2-63	nepheline, gehlinite	(Na,Al,Si), (Ca,Al,Si)	15 vol% nepheline (NaAlSiO4)		
CVS2-64	spinel, orthopyroxene	(Fe,Ni,Cr), (Fe,Si; Zr)	unidentified		
CVS2-65	zircon	(Zr,Si)	none		

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
CVS2-27		2.5386	-6.07	8126.56	220.07	14.41	-11.577	20286.0	14.57				1241	6.61	1194
CVS2-28		2.6441	-4.57	5824.32	337.01	13.44	-11.083	19493.3	13.68				1246	6.28	1197
CVS2-29		2.7597	-5.91	5180.47	466.54	5.32	-16.232	25527.3	5.51				1248	2.06	1199
CVS2-30		2.4689	-3.39	4967.63	408.69	27.42	-10.318	19428.3	28.08				1247	12.56	1197
CVS2-31		2.4946	-3.94	4316.83	462.00	10.30	-12.436	21051.0	10.56				1245	4.84	1195
CVS2-32		2.7214	-7.67	9122.28	214.78	8.07	-13.694	22476.2	8.17				1243	3.35	1193
CVS2-33		2.6983	-6.66	7113.98	191.83	2.15	-10.862	16559.9	2.17				1247	1.08	1198
CVS2-34		2.5194	-1.87	1173.64	671.69	1.79	-9.532	14492.6	1.92				1244	1.07	1195
CVS2-35		2.6384	-5.49	5647.30	283.96	2.82	-10.535	16480.3	2.85				1244	1.51	1193
CVS2-36		2.7335	-5.93	5863.67	258.71	1.91	-10.605	16025.4	1.93				1246	1.01	1196
CVS2-37		2.4814	-4.80	6610.03	246.37	12.34	-9.785	17516.1	12.49				1244	6.2	1195
CVS2-38		2.6349	-5.26	6086.86	364.62	12.02	-12.266	21022.0	12.27				1247	5.14	1197
CVS2-39		2.7182	-7.06	6961.55	250.19	1.98	-12.658	18972.9	1.96				1196	1.33	1147
CVS2-40		2.601	-5.75	6742.38	271.62	6.88	-11.406	18994.7	6.98				1247	3.24	1197
CVS2-41		2.6035	-5.40	6099.51	305.66	6.20	-11.340	18754.6	6.30				1246	2.97	1197
CVS2-42		2.6886	-5.74	6416.85	288.43	5.51	-11.526	18851.2	5.59				1247	2.58	1197
CVS2-43		2.6258	-4.86	4564.37	430.53	4.43	-12.595	20073.0	4.53				1247	2.08	1197
CVS2-44		2.5685	-5.65	6415.57	290.01	6.08	-11.482	18930.0	6.18				1246	2.88	1197
CVS2-45		2.6326	-5.46	5948.95	330.69	6.03	-11.907	19526.7	6.14				1248	2.75	1198
CVS2-46		2.5955	-4.81	4922.26	375.69	4.70	-11.304	18317.5	4.80				1248	2.25	1199
CVS2-47		2.7207	-5.90	6497.30	316.28	6.64	-12.505	20515.3	6.77				1248	2.9	1198
CVS2-48		2.6336	-5.06	4906.65	387.16	3.94	-11.875	18879.0	4.03				1248	1.9	1198
CVS2-49		2.5893	-4.99	5515.20	345.32	6.46	-11.360	18847.3	6.58				1247	3.09	1198
CVS2-50		2.6811	-6.13	6769.05	289.66	5.71	-12.261	19948.8	5.80				1247	2.57	1197
CVS2-51		2.7014	-4.93	5280.77	383.49	7.07	-12.148	20101.8	7.23				1248	3.26	1198
CVS2-52		2.639	-4.43	5054.41	390.32	9.22	-11.534	19605.5	9.43				1249	4.26	1198
CVS2-53															
CVS2-54															
CVS2-55		2.6795	-5.48	6007.61	329.16	6.26	-11.972	19671.7	6.37				1247	2.89	1197
CVS2-56		2.6725	-5.22	5672.65	343.32	6.12	-11.741	19312.1	6.23				1247	2.89	1197
CVS2-57		2.7002	-5.51	6014.17	338.91	6.74	-12.298	20241.1	6.86				1247	3.04	1197
CVS2-58		2.5394	-6.53	6403.64	253.59	1.85	-11.522	17290.4	1.88				1245	0.94	1195
CVS2-59		2.535	-5.35	4588.72	313.48	1.15	-9.974	14406.5	1.16				1246	0.62	1196
CVS2-60		2.523	-5.68	6413.79	184.20	2.61	-9.354	14688.7	2.63				1246	1.45	1196
CVS2-61		2.4912	-5.39	7522.86	203.81	12.90	-10.084	18004.5	13.05				1246	6.21	1197
CVS2-62		2.4931	-4.29	4595.09	452.47	9.95	-12.949	21732.8	10.21				1245	4.54	1195
CVS2-63		2.5763	-5.02	4410.76	400.45	2.38	-11.542	17687.4	2.43				1246	1.25	1197
CVS2-64		2.7003	-7.14	9409.83	140.36	8.89	-11.541	19547.1	8.99				1249	3.87	1199
CVS2-65		2.6721	-7.47	8445.48	268.33	8.20	-14.489	23637.6	8.35				1246	3.21	1196

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
CVS2-27	9.77	1144	15.06	1144	15.11	1143	15.85	1094	24.94	1094	25.1	1045	42.92	993	88.73	943	173.11				
CVS2-28	9.21	1147	13.32	1148	13.73	1146	14.54	1097	21.65	1097	22.01	1046	37.5	996	75.7	946	145.16				
CVS2-29	3.23	1149	5.22	1149	5.43	1149	5.45	1099	9.75	1098	9.89	1048	20.38	998	46.62	949	124.81				
CVS2-30	18.61	1147	26.59	1148	28.22	1147	28.92	1098	46.67	1096	46.78	1047	78.55	998	155.75						
CVS2-31	6.82	1146	10.5	1146	10.8	1146	11.08	1096	17.58	1096	17.8	1047	29.96	996	64.17	947	141.91				
CVS2-32	5.27	1142	8.59	1143	8.66	1143	8.78	1093	15.09	1092	15.71	1043	28.16	994	57.52	943	128.61				
CVS2-33	1.52	1148	2.14	1149	2.17	1148	2.24	1099	3.22	1098	3.26	1048	5.2	999	8.74	948	15.52				
CVS2-34	1.44	1146	1.96	1145	1.97	1145	1.98	1097	2.77	1095	2.8	1046	4.14	996	6.57	945	11.29				
CVS2-35	2.04	1144	2.87	1144	2.95	1143	3.01	1094	4.42	1093	4.45	1043	7.12	993	12.06	943	21.65				
CVS2-36	1.38	1145	1.95	1146	1.96	1145	1.98	1096	2.93	1095	2.94	1045	4.67	995	7.5	945	13.65				
CVS2-37	8.7	1146	12.43	1146	12.74	1146	13.05	1097	19.48	1095	20.05	1046	31.75	997	54.67	947	102.97				
CVS2-38	7.75	1147	12.21	1147	12.41	1147	12.44	1096	21.19	1097	21.27	1047	38.8	998	77.06	1097	21.27				
CVS2-39	2.02	1143	2.08	1145	2.14	1097	3.15	1095	3.34	1047	5.45	994	9.61	944	20						
CVS2-40	4.72	1148	6.78	1147	6.81	1147	7.16	1098	11.19	1097	11.42	1048	18.83	998	35.11	947	68.1				
CVS2-41	4.16	1147	6.3	1147	6.4	1147	6.46	1098	10.01	1097	10.23	1047	16.8	998	29.58	947	61.73				
CVS2-42	3.68	1147	5.66	1148	5.71	1147	5.75	1098	8.94	1096	9.05	1047	14.95	998	26.7	948	54.54				
CVS2-43	2.94	1147	4.55	1148	4.59	1147	4.7	1097	7.23	1097	7.27	1047	12.43	997	25.21	947	53.29				
CVS2-44	4.12	1147	6.19	1148	6.19	1147	6.3	1098	9.8	1097	10.01	1047	16.63	998	30.39	948	59.96				
CVS2-45	4.09	1148	6.05	1149	6.08	1149	6.29	1100	9.55	1098	9.73	1049	16.44	998	32.61	948	64.17				
CVS2-46	3.27	1148	4.79	1150	4.82	1148	4.9	1100	7.16	1097	7.31	1048	12.26	998	22.41	948	44.39				
CVS2-47	4.32	1148	6.6	1148	6.81	1149	7.07	1098	10.99	1100	11.03	1048	19.29	999	37.34	948	80.59				
CVS2-48	2.69	1148	3.94	1149	4	1148	4.06	1099	6.23	1098	6.32	1048	10.51	999	19.64	948	39.72				
CVS2-49	4.35	1147	6.63	1147	6.65	1147	6.72	1098	10.31	1098	10.47	1048	17.56	998	31.31	948	64.85				
CVS2-50	3.78	1147	5.85	1147	5.87	1147	5.96	1098	9.46	1096	9.57	1047	16.49	998	31.28	948	63.53				
CVS2-51	4.75	1149	6.97	1149	7.03	1148	7.28	1099	11.55	1099	11.73	1048	19.96	999	39.58	948	82.16				
CVS2-52	6.23	1148	9.2	1149	9.43	1149	9.56	1099	14.71	1098	14.82	1048	25.92	999	48.56	949	100.65				
CVS2-53																					
CVS2-54																					
CVS2-55	4.18	1147	6.35	1147	6.49	1147	6.53	1097	10.36	1096	10.55	1046	17.76	997	33.88	946	70.3				
CVS2-56	4.12	1146	6.22	1147	6.32	1147	6.44	1097	10.05	1096	10.07	1047	17.05	996	32.52	946	65.92				
CVS2-57	4.49	1147	6.9	1147	6.97	1147	7	1097	11.29	1096	11.35	1046	19.9	996	38.62	945	82.58				
CVS2-58	1.31	1146	1.88	1146	1.92	1146	1.93	1097	2.89	1096	2.96	1046	4.75	997	8.05	946	15.25				
CVS2-59	0.89	1147	1.19	1147	1.19	1147	1.23	1098	1.59	1097	1.67	1048	2.41	998	3.77	947	6.82				
CVS2-60	1.92	1147	2.62	1147	2.63	1147	2.69	1098	3.78	1098	3.88	1048	5.74	998	9.12	947	15.18				
CVS2-61	8.78	1148	13.1	1147	13.14	1147	13.6	1098	20.36	1097	20.57	1047	33.64	998	60.13	948	111.03				
CVS2-62	6.7	1147	9.82	1147	10.36	1146	10.58	1097	17.03	1097	17.09	1047	30.72	997	65.34	946	149.73				
CVS2-63	1.65	1147	2.4	1147	2.43	1147	2.45	1098	3.68	1097	3.77	1047	6.06	998	10.92	947	20.93				
CVS2-64	5.79	1149	8.85	1149	8.88	1149	9.03	1100	14.55	1099	14.82	1049	24.81	999	45.69	948	91.58				
CVS2-65	5.06	1146	8.53	1146	8.6	1146	8.73	1096	15.14	1096	15.26	1046	29.64	996	62.62	945	149.06				

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
CVS2-27					3.270	1.835	2.342	0.89	11.87	2.572	1.734	2.096	0.86	11.84		
CVS2-28					5.144	3.682	3.538	1.654	11.54	3.601	3.158	3.032	1.654	11.54		
CVS2-29					1.286	1.355	1.273	0.192	9.11	0.949	1.075	1.108	0.243	9.22		
CVS2-30					6.512	4.194	2.552	0.174	8.74	18.006	14.462	8.682	0.3005	8.76		
CVS2-31					0.411	0.460	0.318	0.121	9.54	0.584	0.682	0.539	0.172	9.60		
CVS2-32					9.646	5.527	5.896	2.747	12.31	7.588	6.231	5.660	2.924	12.16		
CVS2-33					1.723	1.438	1.608	0.516	11.94	11.526	5.908	7.412	1.526	12.50		
CVS2-34					4.340	3.468	2.700	0.265	11.55	4.520	3.497	2.594	0.28	11.42		
CVS2-35					0.320	0.580	0.910	0.204	11.90	25.048	9.283	11.742	2.16	12.60		
CVS2-36					0.480	0.630	0.654	0.276	11.34	0.354	0.568	0.431	0.223	11.40		
CVS2-37					0.246	0.300	0.177	0.206	10.45	0.230	0.320	0.177	0.236	10.35		
CVS2-38					1.119	0.726	0.807	0.28	9.56	0.725	0.602	0.574	0.27	9.84		
CVS2-39					12.701	6.528	7.668	1.612	12.50	15.386	5.046	8.312	1.634	12.36		
CVS2-40					0.337	0.328	0.399	0.172	11.13	0.317	0.347	0.364	0.171	11.12		
CVS2-41					0.177	0.260	0.188	0.104	10.89	0.199	0.307	0.199	0.124	10.91		
CVS2-42					1.694	1.220	1.337	0.574	11.19	6.109	4.301	3.763	2.259	11.45		
CVS2-43					0.767	0.697	0.451	0.196	9.97	0.697	0.593	0.445	0.198	9.88		
CVS2-44					0.255	0.294	0.194	0.128	10.31	0.388	0.323	0.310	0.174	10.40		
CVS2-45					0.500	0.478	0.374	0.186	10.05	0.397	0.439	0.240	0.169	9.97		
CVS2-46					0.317	0.346	0.188	0.148	10.19	0.294	0.307	0.199	0.146	10.09		
CVS2-47					1.159	1.124	1.055	0.434	11.39	1.286	0.902	0.945	0.478	11.40		
CVS2-48					0.307	0.318	0.284	0.102	10.09	0.229	0.309	0.258	0.114	10.09		
CVS2-49					0.303	0.334	0.217	0.136	9.97	0.206	0.279	0.204	0.141	9.91		
CVS2-50					0.442	0.426	0.368	0.15	10.23	0.563	0.486	0.376	0.158	10.27		
CVS2-51					1.764	1.496	1.283	0.411	10.30	1.442	1.067	0.997	0.359	10.23		
CVS2-52					0.557	0.554	0.260	0.294	10.16	0.551	0.478	0.270	0.285	10.08		
CVS2-53					0.304	0.305	0.202	0.176	10.02							
CVS2-54					2.761	1.715	1.612	0.571	10.23							
CVS2-55					1.342	1.127	0.880	0.352	10.19	0.930	0.894	0.728	0.373	10.08		
CVS2-56					1.419	1.218	0.946	0.368	10.20	1.212	1.193	1.027	0.461	10.21		
CVS2-57					1.164	1.081	0.842	0.346	10.26	0.828	0.778	0.657	0.281	9.91		
CVS2-58					0.778	0.636	0.620	0.138	9.87	0.820	0.829	0.768	0.156	9.81		
CVS2-59					1.591	1.287	1.222	0.268	11.47	1.591	1.390	1.116	0.268	11.52		
CVS2-60					1.624	1.158	1.523	0.415	11.96	1.542	1.621	1.457	0.577	11.99		
CVS2-61					0.222	0.280	0.230	0.195	10.89	0.232	0.354	0.225	0.223	10.83		
CVS2-62					1.002	0.862	0.928	0.268	9.56	1.093	1.034	0.958	0.287	9.54		
CVS2-63					0.332	0.222	0.390	0.079	10.59	3.652	3.584	2.163	0.102	10.29		
CVS2-64					0.379	0.376	0.342	0.234	10.62	0.354	0.419	0.297	0.242	10.79		
CVS2-65					0.335	0.355	0.200	0.148	10.62	0.356	0.417	0.204	0.156	10.72		

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
CVS2-27												
CVS2-28												
CVS2-29												
CVS2-30												
CVS2-31												
CVS2-32												
CVS2-33												
CVS2-34												
CVS2-35												
CVS2-36												
CVS2-37												
CVS2-38												
CVS2-39												
CVS2-40												
CVS2-41												
CVS2-42												
CVS2-43												
CVS2-44												
CVS2-45												
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CVS2-61												
CVS2-62												
CVS2-63												
CVS2-64												
CVS2-65												

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
CVS2-66	0.1183	0.0919	0.0097	0.0389		0.0000	0.0524	0.0061	0.1214	0.0052	0.0000	0.5189	0.0026	0.0000		0.0005	0.0000		0.0000		0.0000
CVS2-67	0.2043	0.1587	0.0024	0.0004		0.0000	0.0583	0.0001	0.1086	0.0000	0.0049	0.4596	0.0000	0.0000		0.0000	0.0000		0.0000		0.0000
CVS2-68	0.1641	0.1356	0.0007	0.0046		0.0016	0.0696	0.0002	0.0797	0.0000	0.0000	0.5042	0.0001	0.0000		0.0000	0.0000		0.0000		0.0000
CVS2-69	0.0818	0.0783	0.0079	0.0334		0.0000	0.0715	0.0032	0.0666	0.0000	0.0326	0.5676	0.0005	0.0000		0.0000	0.0000		0.0011		0.0000
CVS2-70	0.1820	0.1419	0.0008	0.0080		0.0000	0.0691	0.0008	0.0813	0.0008	0.0007	0.4857	0.0005	0.0000	0.0011	0.0000	0.0000		0.0011		0.0013
CVS2-71	0.0288	0.0509	0.0025	0.0812		0.0000	0.0642	0.0008	0.0925	0.0068	0.0012	0.5699	0.0431	0.0000		0.0012	0.0000		0.0089		0.0018
CVS2-72	0.1180	0.0917	0.0097	0.0388		0.0000	0.0523	0.0061	0.1211	0.0043	0.0008	0.5176	0.0026	0.0000		0.0008	0.0000		0.0057		0.0011
CVS2-73	0.1640	0.1355	0.0007	0.0046		0.0000	0.0696	0.0002	0.0797	0.0043	0.0007	0.5040	0.0001	0.0000		0.0007	0.0000		0.0056		0.0011
CVS2-74	0.0816	0.0781	0.0079	0.0334		0.0000	0.0713	0.0032	0.0664	0.0094	0.0016	0.5662	0.0005	0.0000		0.0016	0.0000		0.0123		0.0025
CVS2-75	0.1819	0.1418	0.0008	0.0080		0.0000	0.0691	0.0008	0.0812	0.0031	0.0005	0.4855	0.0005	0.0000		0.0005	0.0000		0.0041		0.0008
CVS2-76	0.0200	0.0600	0.0400	0.1050		0.0000	0.0632	0.0050	0.1800	0.0021	0.0004	0.5018	0.0050	0.0000		0.0004	0.0000		0.0027		0.0005
CVS2-77	0.0200	0.0600	0.0050	0.0050		0.0000	0.0700	0.0050	0.1801	0.0093	0.0016	0.4552	0.1100	0.0000		0.0016	0.0000		0.0121		0.0024
CVS2-78	0.0200	0.1600	0.0050	0.0699		0.0000	0.0254	0.0400	0.0500	0.0021	0.0004	0.5600	0.0497	0.0000		0.0004	0.0000		0.0027		0.0005
CVS2-79	0.0200	0.1601	0.0050	0.1050		0.0000	0.0121	0.0050	0.0500	0.0093	0.0016	0.5481	0.0050	0.0000		0.0016	0.0000		0.0121		0.0024
CVS2-80	0.0200	0.1600	0.0050	0.1050		0.0000	0.0176	0.0400	0.0500	0.0021	0.0004	0.5074	0.0750	0.0000		0.0004	0.0000		0.0027		0.0005
CVS2-81	0.0200	0.0600	0.0050	0.1050		0.0000	0.0700	0.0400	0.1735	0.0084	0.0015	0.4402	0.0050	0.0000		0.0015	0.0000		0.0110		0.0022
CVS2-82	0.0200	0.0950	0.0050	0.0050		0.0000	0.0700	0.0400	0.1800	0.0021	0.0004	0.5600	0.0050	0.0000		0.0004	0.0000		0.0027		0.0005
CVS2-83	0.0200	0.0951	0.0400	0.0050		0.0000	0.0699	0.0050	0.1801	0.0093	0.0016	0.4902	0.0050	0.0000		0.0016	0.0000		0.0121		0.0024
CVS2-84	0.0200	0.0600	0.0050	0.1050		0.0000	0.0700	0.0050	0.1800	0.0021	0.0004	0.4550	0.0800	0.0000		0.0004	0.0000		0.0027		0.0005
CVS2-85	0.1700	0.0600	0.0050	0.0050		0.0000	0.0700	0.0200	0.1800	0.0046	0.0008	0.4401	0.0050	0.0000		0.0008	0.0000		0.0060		0.0012
CVS2-86	0.1700	0.0600	0.0400	0.0050		0.0000	0.0136	0.0050	0.1800	0.0046	0.0008	0.4765	0.0050	0.0000		0.0008	0.0000		0.0060		0.0012
CVS2-87	0.0987	0.0800	0.0137	0.0250		0.0000	0.0180	0.0050	0.1800	0.0021	0.0004	0.4983	0.0613	0.0000		0.0004	0.0000		0.0027		0.0005
CVS2-88	0.1050	0.0600	0.0400	0.0250		0.0000	0.0700	0.0050	0.1403	0.0021	0.0004	0.4597	0.0750	0.0000		0.0004	0.0000		0.0027		0.0005
CVS2-89	0.0200	0.1171	0.0400	0.1050		0.0000	0.0100	0.0050	0.1800	0.0021	0.0004	0.4400	0.0629	0.0000		0.0004	0.0000		0.0027		0.0005
CVS2-90	0.0200	0.1600	0.0050	0.1008		0.0000	0.0700	0.0050	0.0542	0.0021	0.0004	0.5600	0.0050	0.0000		0.0004	0.0000		0.0027		0.0005
CVS2-91	0.0200	0.1601	0.0050	0.0050		0.0000	0.0100	0.0400	0.1050	0.0093	0.0016	0.5602	0.0050	0.0000		0.0016	0.0000		0.0121		0.0024
CVS2-92	0.0200	0.1601	0.0050	0.0050		0.0000	0.0700	0.0400	0.1000	0.0093	0.0016	0.4402	0.0700	0.0000		0.0016	0.0000		0.0121		0.0024
CVS2-93	0.0200	0.1338	0.0098	0.0986		0.0000	0.0700	0.0050	0.1279	0.0093	0.0016	0.4402	0.0050	0.0000		0.0016	0.0000		0.0121		0.0024
CVS2-94	0.0703	0.1600	0.0400	0.0271		0.0000	0.0526	0.0050	0.1800	0.0021	0.0004	0.4400	0.0050	0.0000		0.0004	0.0000		0.0027		0.0005
CVS2-95	0.0367	0.1112	0.0113	0.0897		0.0004	0.0428	0.0166	0.1671	0.0061	0.0000	0.4895	0.0041	0.0000		0.0000	0.0000		0.0000		0.0000
CVS2-96	0.0636	0.1142	0.0275	0.0568		0.0000	0.0376	0.0363	0.1003	0.0042	0.0007	0.4802	0.0429	0.0000		0.0007	0.0000		0.0055		0.0011
CVS2-97	0.0235	0.1048	0.0082	0.0733		0.0000	0.0373	0.0084	0.1129	0.0060	0.0010	0.5330	0.0392	0.0000		0.0010	0.0000		0.0065		0.0002
CVS2-98	0.1388	0.1743	0.0000	0.0200		0.0000	0.0369	0.0000	0.2000	0.0010	0.0002	0.4200	0.0000	0.0000		0.0002	0.0000		0.0013		0.0003
CVS2-99	0.0523	0.0970	0.0097	0.1019		0.0212	0.0356	0.0077	0.0981	0.0029	0.0055	0.5208	0.0199	0.0010		0.0005	0.0000		0.0030		0.0014
CVS2-100	0.0286	0.0740	0.0035	0.1229		0.0164	0.0596	0.0012	0.0626	0.0069	0.0088	0.5331	0.0443	0.0003		0.0007	0.0000		0.0080		0.0000
CVS2-101	0.0367	0.1112	0.0113	0.0897		0.0004	0.0428	0.0166	0.1671	0.0055	0.0000	0.4895	0.0041	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
CVS2-102	0.0231	0.1053	0.0083	0.0719		0.0000	0.0375	0.0084	0.1125	0.0061	0.0011	0.5353	0.0385	0.0000	0.0000	0.0011	0.0000		0.0080		0.0016

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
CVS2-66			0.0000	0.0108	0.0000	0.0000		0.0006					0.0043	0.0119			0.0063		0.0000	0.0000	
CVS2-67			0.0000	0.0014	0.0000	0.0000		0.0013					0.0000	0.0000			0.0000		0.0000	0.0000	
CVS2-68			0.0000	0.0297	0.0000	0.0000		0.0057					0.0000	0.0022			0.0007		0.0000	0.0000	
CVS2-69			0.0000	0.0238	0.0000	0.0018		0.0011					0.0000	0.0122			0.0000		0.0017	0.0015	
CVS2-70			0.0000	0.0117	0.0000	0.0016		0.0000					0.0005	0.0029			0.0000		0.0005	0.0000	
CVS2-71			0.0000	0.0015	0.0018	0.0018		0.0036					0.0074	0.0015			0.0036		0.0147	0.0000	
CVS2-72			0.0000	0.0009	0.0011	0.0011		0.0023					0.0047	0.0009			0.0023		0.0093	0.0000	
CVS2-73			0.0000	0.0009	0.0011	0.0011		0.0022					0.0047	0.0009			0.0022		0.0092	0.0000	
CVS2-74			0.0000	0.0021	0.0025	0.0025		0.0049					0.0103	0.0020			0.0049		0.0202	0.0000	
CVS2-75			0.0000	0.0007	0.0008	0.0008		0.0016					0.0034	0.0007			0.0016		0.0067	0.0000	
CVS2-76			0.0000	0.0004	0.0005	0.0005		0.0011					0.0022	0.0004			0.0011		0.0044	0.0000	
CVS2-77			0.0000	0.0020	0.0024	0.0024		0.0048					0.0101	0.0020			0.0048		0.0199	0.0000	
CVS2-78			0.0000	0.0004	0.0005	0.0005		0.0011					0.0022	0.0004			0.0011		0.0044	0.0000	
CVS2-79			0.0000	0.0020	0.0024	0.0024		0.0048					0.0101	0.0020			0.0048		0.0199	0.0000	
CVS2-80			0.0000	0.0004	0.0005	0.0005		0.0011					0.0022	0.0004			0.0011		0.0044	0.0000	
CVS2-81			0.0000	0.0018	0.0022	0.0022		0.0044					0.0091	0.0018			0.0044		0.0180	0.0000	
CVS2-82			0.0000	0.0004	0.0005	0.0005		0.0011					0.0022	0.0004			0.0011		0.0044	0.0000	
CVS2-83			0.0000	0.0020	0.0024	0.0024		0.0048					0.0101	0.0020			0.0048		0.0199	0.0000	
CVS2-84			0.0000	0.0004	0.0005	0.0005		0.0011					0.0022	0.0004			0.0011		0.0044	0.0000	
CVS2-85			0.0000	0.0010	0.0012	0.0012		0.0024					0.0050	0.0010			0.0024		0.0099	0.0000	
CVS2-86			0.0000	0.0010	0.0012	0.0012		0.0024					0.0050	0.0010			0.0024		0.0099	0.0000	
CVS2-87			0.0000	0.0004	0.0005	0.0005		0.0011					0.0022	0.0004			0.0011		0.0044	0.0000	
CVS2-88			0.0000	0.0004	0.0005	0.0005		0.0011					0.0022	0.0004			0.0011		0.0044	0.0000	
CVS2-89			0.0000	0.0004	0.0005	0.0005		0.0011					0.0022	0.0004			0.0011		0.0044	0.0000	
CVS2-90			0.0000	0.0004	0.0005	0.0005		0.0011					0.0022	0.0004			0.0011		0.0044	0.0000	
CVS2-91			0.0000	0.0020	0.0024	0.0024		0.0048					0.0101	0.0020			0.0048		0.0199	0.0000	
CVS2-92			0.0000	0.0020	0.0024	0.0024		0.0048					0.0101	0.0020			0.0048		0.0199	0.0000	
CVS2-93			0.0000	0.0020	0.0024	0.0024		0.0048					0.0101	0.0020			0.0048		0.0199	0.0000	
CVS2-94			0.0000	0.0004	0.0005	0.0005		0.0011					0.0022	0.0004			0.0011		0.0044	0.0000	
CVS2-95			0.0000	0.0000	0.0000	0.0000		0.0000					0.0041	0.0134			0.0000		0.0000	0.0000	
CVS2-96			0.0000	0.0009	0.0011	0.0011		0.0022					0.0046	0.0009			0.0022		0.0090	0.0000	
CVS2-97			0.0000	0.0013	0.0015	0.0016		0.0019					0.0155	0.0013			0.0031		0.0057	0.0000	
CVS2-98			0.0000	0.0002	0.0003	0.0003		0.0005					0.0011	0.0002			0.0005		0.0022	0.0000	
CVS2-99			0.0010	0.0020	0.0000	0.0002		0.0000					0.0014	0.0039			0.0001		0.0046	0.0020	
CVS2-100			0.0000	0.0006	0.0000	0.0003		0.0000					0.0046	0.0017			0.0000		0.0145	0.0011	
CVS2-101			0.0000	0.0000	0.0000	0.0000		0.0000					0.0037	0.0149			0.0000		0.0000	0.0000	
CVS2-102			0.0000	0.0013	0.0016	0.0016		0.0032					0.0066	0.0016			0.0032		0.0131	0.0000	

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
CVS2-66	0.0000		0.0000	0.0000			0.0000		0.0000				0.0000			0.0000	0.0000		0.0000		0.0000
CVS2-67	0.0000		0.0000	0.0000			0.0000		0.0000				0.0000			0.0000	0.0000		0.0000		0.0000
CVS2-68	0.0000		0.0000	0.0000			0.0000		0.0000				0.0000			0.0001	0.0000		0.0000		0.0000
CVS2-69	0.0014		0.0000	0.0000			0.0006		0.0006	0.0000		0.0036	0.0000			0.0069	0.0000		0.0000		0.0000
CVS2-70	0.0014		0.0000	0.0000			0.0007		0.0007	0.0005		0.0035	0.0000			0.0003	0.0000		0.0005		0.0000
CVS2-71	0.0006		0.0012	0.0006			0.0006		0.0018				0.0006			0.0033	0.0012		0.0000		0.0000
CVS2-72	0.0004		0.0008	0.0004			0.0004		0.0011				0.0004			0.0021	0.0008		0.0000		0.0000
CVS2-73	0.0004		0.0007	0.0004			0.0004		0.0011				0.0004			0.0021	0.0007		0.0000		0.0000
CVS2-74	0.0008		0.0016	0.0008			0.0008		0.0025				0.0008			0.0045	0.0016		0.0000		0.0000
CVS2-75	0.0003		0.0005	0.0003			0.0003		0.0008				0.0003			0.0015	0.0005		0.0000		0.0000
CVS2-76	0.0002		0.0004	0.0002			0.0002		0.0005				0.0002			0.0010	0.0004		0.0000		0.0000
CVS2-77	0.0008		0.0016	0.0008			0.0008		0.0024				0.0008			0.0044	0.0016		0.0000		0.0000
CVS2-78	0.0002		0.0004	0.0002			0.0002		0.0005				0.0002			0.0010	0.0004		0.0000		0.0000
CVS2-79	0.0008		0.0016	0.0008			0.0008		0.0024				0.0008			0.0044	0.0016		0.0000		0.0000
CVS2-80	0.0002		0.0004	0.0002			0.0002		0.0005				0.0002			0.0010	0.0004		0.0000		0.0000
CVS2-81	0.0007		0.0015	0.0007			0.0007		0.0022				0.0007			0.0040	0.0015		0.0000		0.0000
CVS2-82	0.0002		0.0004	0.0002			0.0002		0.0005				0.0002			0.0010	0.0004		0.0000		0.0000
CVS2-83	0.0008		0.0016	0.0008			0.0008		0.0024				0.0008			0.0044	0.0016		0.0000		0.0000
CVS2-84	0.0002		0.0004	0.0002			0.0002		0.0005				0.0002			0.0010	0.0004		0.0000		0.0000
CVS2-85	0.0004		0.0008	0.0004			0.0004		0.0012				0.0004			0.0022	0.0008		0.0000		0.0000
CVS2-86	0.0004		0.0008	0.0004			0.0004		0.0012				0.0004			0.0022	0.0008		0.0000		0.0000
CVS2-87	0.0002		0.0004	0.0002			0.0002		0.0005				0.0002			0.0010	0.0004		0.0000		0.0000
CVS2-88	0.0002		0.0004	0.0002			0.0002		0.0005				0.0002			0.0010	0.0004		0.0000		0.0000
CVS2-89	0.0002		0.0004	0.0002			0.0002		0.0005				0.0002			0.0010	0.0004		0.0000		0.0000
CVS2-90	0.0002		0.0004	0.0002			0.0002		0.0005				0.0002			0.0010	0.0004		0.0000		0.0000
CVS2-91	0.0008		0.0016	0.0008			0.0008		0.0024				0.0008			0.0044	0.0016		0.0000		0.0000
CVS2-92	0.0008		0.0016	0.0008			0.0008		0.0024				0.0008			0.0044	0.0016		0.0000		0.0000
CVS2-93	0.0008		0.0016	0.0008			0.0008		0.0024				0.0008			0.0044	0.0016		0.0000		0.0000
CVS2-94	0.0002		0.0004	0.0002			0.0002		0.0005				0.0002			0.0010	0.0004		0.0000		0.0000
CVS2-95	0.0000		0.0000	0.0000			0.0000		0.0000				0.0000			0.0000	0.0000		0.0000		0.0071
CVS2-96	0.0004		0.0007	0.0004			0.0004		0.0011				0.0004			0.0020	0.0007		0.0000		0.0000
CVS2-97	0.0000		0.0019	0.0000			0.0000		0.0015				0.0000			0.0044	0.0000		0.0000		0.0000
CVS2-98	0.0001		0.0002	0.0001			0.0001		0.0003				0.0001			0.0005	0.0002		0.0000		0.0000
CVS2-99	0.0000		0.0000	0.0000			0.0000		0.0000				0.0000			0.0040	0.0004		0.0000		0.0012
CVS2-100	0.0000		0.0000	0.0000			0.0000		0.0009				0.0000			0.0032	0.0005		0.0005		0.0008
CVS2-101	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0065
CVS2-102	0.0005		0.0011	0.0005			0.0005		0.0016	0.0000		0.0000	0.0005			0.0029	0.0011		0.0000		0.0000

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
CVS2-66		0.0000				0.0000	0.0000	0.0000		0.9998											
CVS2-67		0.0000				0.0000	0.0000	0.0000		1.0000											
CVS2-68		0.0000				0.0000	0.0000	0.0012		0.9999											
CVS2-69		0.0000				0.0000	0.0000	0.0000		0.9999	0.0774	0.0768	0.0059	0.0306		0.0000	0.0665	0.0030	0.0655	0.0003	0.0167
CVS2-70		0.0000				0.0000	0.0000	0.0000		0.9999	0.1670	0.1335	0.0008	0.0064		0.0000	0.0623	0.0008	0.0746	0.0008	0.0007
CVS2-71		0.0000				0.0000	0.0006	0.0000		0.9999											
CVS2-72		0.0000				0.0000	0.0004	0.0000		0.9999											
CVS2-73		0.0000				0.0000	0.0004	0.0000		0.9999											
CVS2-74		0.0000				0.0000	0.0008	0.0000		0.9998	0.0741	0.0751	0.0070	0.0293		0.0000	0.0638	0.0027	0.0623	0.0081	0.0020
CVS2-75		0.0000				0.0000	0.0003	0.0000		0.9999											
CVS2-76		0.0000				0.0000	0.0002	0.0000		0.9999											
CVS2-77		0.0000				0.0000	0.0008	0.0000		0.9999											
CVS2-78		0.0000				0.0000	0.0002	0.0000		0.9999											
CVS2-79		0.0000				0.0000	0.0008	0.0000		0.9999	0.0200	0.1565	0.0046	0.0999		0.0000	0.0115	0.0044	0.0475	0.0085	0.0015
CVS2-80		0.0000				0.0000	0.0002	0.0000		0.9999											
CVS2-81		0.0000				0.0000	0.0007	0.0000		0.9999											
CVS2-82		0.0000				0.0000	0.0002	0.0000		0.9999											
CVS2-83		0.0000				0.0000	0.0008	0.0000		0.9999											
CVS2-84		0.0000				0.0000	0.0002	0.0000		0.9999											
CVS2-85		0.0000				0.0000	0.0004	0.0000		0.9999											
CVS2-86		0.0000				0.0000	0.0004	0.0000		0.9999											
CVS2-87		0.0000				0.0000	0.0002	0.0000		0.9999											
CVS2-88		0.0000				0.0000	0.0002	0.0000		0.9999											
CVS2-89		0.0000				0.0000	0.0002	0.0000		0.9999											
CVS2-90		0.0000				0.0000	0.0002	0.0000		0.9999											
CVS2-91		0.0000				0.0000	0.0008	0.0000		0.9999	0.0185	0.1545	0.0044	0.0036		0.0000	0.0091	0.0342	0.0999	0.0081	0.0020
CVS2-92		0.0000				0.0000	0.0008	0.0000		0.9999											
CVS2-93		0.0000				0.0000	0.0008	0.0000		0.9999											
CVS2-94		0.0000				0.0000	0.0002	0.0000		0.9999											
CVS2-95		0.0000				0.0000	0.0000	0.0000		1.0001	0.0339	0.1055	0.0107	0.0833		0.0000	0.0407	0.0140	0.1600	0.0055	0.0006
CVS2-96		0.0000				0.0000	0.0004	0.0000		0.9999	0.0597	0.1120	0.0247	0.0527		0.0000	0.0347	0.0317	0.0994	0.0036	0.0007
CVS2-97		0.0000				0.0000	0.0000	0.0049		0.9999	0.0287	0.0994	0.0098	0.0590		0.0000	0.0328	0.0078	0.1140	0.0060	0.0015
CVS2-98		0.0000				0.0000	0.0001	0.0000		0.9999	0.1275	0.1645	0.0008	0.0172		0.0000	0.0333	0.0000	0.1840	0.0008	0.0002
CVS2-99		0.0000				0.0000	0.0000	0.0005		0.9999											
CVS2-100		0.0000				0.0000	0.0000	0.0002		0.9998											
CVS2-101			0.0000			0.0000	0.0000	0.0000		1.0000	0.0341	0.1055	0.0100	0.0850		0.0000	0.0415	0.0155	0.1650	0.0054	
CVS2-102			0.0000			0.0000	0.0005	0.0000		1.0000											

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
CVS2-66																					
CVS2-67																					
CVS2-68																					
CVS2-69	0.5240	0.0005		0.0000	0.0000			0.0008		0.0000			0.0000	0.0223	0.0000	0.0017	0.0000	0.0011		0.0000	
CVS2-70	0.4460	0.0006		0.0008	0.0000			0.0010		0.0010			0.0000	0.0106	0.0000	0.0015	0.0000	0.0000		0.0000	
CVS2-71																					
CVS2-72																					
CVS2-73																					
CVS2-74	0.5165	0.0008		0.0000	0.0015			0.0104		0.0021			0.0000	0.0019	0.0025	0.0022	0.0000	0.0049		0.0000	
CVS2-75																					
CVS2-76																					
CVS2-77																					
CVS2-78																					
CVS2-79	0.5240	0.0048		0.0000	0.0015			0.0107		0.0021			0.0000	0.0019	0.0024	0.0023	0.0000	0.0048		0.0000	
CVS2-80																					
CVS2-81																					
CVS2-82																					
CVS2-83																					
CVS2-84																					
CVS2-85																					
CVS2-86																					
CVS2-87																					
CVS2-88																					
CVS2-89																					
CVS2-90																					
CVS2-91	0.4895	0.0050		0.0000	0.0015			0.0102		0.0021			0.0000	0.0019	0.0024	0.0022	0.0000	0.0048		0.0000	
CVS2-92																					
CVS2-93																					
CVS2-94																					
CVS2-95	0.4630	0.0036		0.0000	0.0006			0.0042		0.0008			0.0001	0.0007	0.0008	0.0008	0.0000	0.0017		0.0000	
CVS2-96	0.4460	0.0398		0.0000	0.0007			0.0047		0.0010			0.0000	0.0009	0.0011	0.0010	0.0000	0.0022		0.0000	
CVS2-97	0.4850	0.0367		0.0000	0.0023			0.0060		0.0002			0.0004	0.0011	0.0015	0.0020	0.0000	0.0019		0.0000	
CVS2-98	0.3840	0.0001		0.0000	0.0002			0.0011		0.0003			0.0000	0.0003	0.0003	0.0003	0.0000	0.0005		0.0000	
CVS2-99																					
CVS2-100																					
CVS2-101	0.4610	0.0043						0.0001					0.0001								
CVS2-102																					

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
CVS2-66																					
CVS2-67																					
CVS2-68																					
CVS2-69		0.0000	0.0142	0.0000		0.0000		0.0013	0.0020		0.0014		0.0000	0.0000			0.0006		0.0006	0.0000	
CVS2-70		0.0004	0.0033	0.0000		0.0000		0.0004	0.0000		0.0014		0.0000	0.0000			0.0007		0.0006	0.0005	
CVS2-71																					
CVS2-72																					
CVS2-73																					
CVS2-74		0.0084	0.0022	0.0000		0.0044		0.0170	0.0000		0.0008		0.0016	0.0008			0.0008		0.0017	0.0000	
CVS2-75																					
CVS2-76																					
CVS2-77																					
CVS2-78																					
CVS2-79		0.0086	0.0024	0.0000		0.0045		0.0174	0.0000		0.0008		0.0016	0.0008			0.0008		0.0017	0.0000	
CVS2-80																					
CVS2-81																					
CVS2-82																					
CVS2-83																					
CVS2-84																					
CVS2-85																					
CVS2-86																					
CVS2-87																					
CVS2-88																					
CVS2-89																					
CVS2-90																					
CVS2-91		0.0083	0.0022	0.0000		0.0043		0.0167	0.0000		0.0008		0.0016	0.0008			0.0008		0.0018	0.0000	
CVS2-92																					
CVS2-93																					
CVS2-94																					
CVS2-95		0.0035	0.0125	0.0000		0.0017		0.0069	0.0000		0.0003		0.0006	0.0003			0.0003		0.0008	0.0000	
CVS2-96		0.0039	0.0011	0.0000		0.0020		0.0077	0.0000		0.0004		0.0007	0.0004			0.0004		0.0011	0.0000	
CVS2-97		0.0196	0.0023	0.0000		0.0029		0.0066	0.0000		0.0000		0.0019	0.0000			0.0000		0.0010	0.0000	
CVS2-98		0.0007	0.0003	0.0000		0.0005		0.0015	0.0000		0.0001		0.0002	0.0001			0.0001		0.0003	0.0000	
CVS2-99																					
CVS2-100																					
CVS2-101		0.0038	0.0153	0.0000																	
CVS2-102																					

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
CVS2-66																				
CVS2-67																				
CVS2-68																				
CVS2-69	0.0036	0.0000			0.0069	0.0000		0.0000	0.0000	0.0003			0.0000		0.0000		0.0000	0.0000		0.9238
CVS2-70	0.0035	0.0000			0.0003	0.0000		0.0006	0.0000	0.0001			0.0000		0.0000		0.0000	0.0000		0.9199
CVS2-71																				
CVS2-72																				
CVS2-73																				
CVS2-74	0.0000	0.0008			0.0045	0.0015		0.0000	0.0000	0.0002			0.0000		0.0000		0.0007	0.0000		0.9121
CVS2-75																				
CVS2-76																				
CVS2-77																				
CVS2-78																				
CVS2-79	0.0000	0.0008			0.0044	0.0015		0.0000	0.0000	0.0002			0.0000		0.0000		0.0007	0.0000		0.9550
CVS2-80																				
CVS2-81																				
CVS2-82																				
CVS2-83																				
CVS2-84																				
CVS2-85																				
CVS2-86																				
CVS2-87																				
CVS2-88																				
CVS2-89																				
CVS2-90																				
CVS2-91	0.0000	0.0008			0.0044	0.0014		0.0000	0.0000	0.0002			0.0000		0.0000		0.0007	0.0000		0.8986
CVS2-92																				
CVS2-93																				
CVS2-94																				
CVS2-95	0.0000	0.0003			0.0015	0.0006		0.0000	0.0000	0.0065			0.0000		0.0000		0.0003	0.0000		0.9661
CVS2-96	0.0000	0.0004			0.0020	0.0007		0.0000	0.0000	0.0003			0.0000		0.0000		0.0003	0.0000		0.9378
CVS2-97	0.0000	0.0000			0.0044	0.0000		0.0000	0.0000	0.0012			0.0000		0.0000		0.0000	0.0048		0.9406
CVS2-98	0.0000	0.0001			0.0005	0.0001		0.0000	0.0000	0.0001			0.0000		0.0000		0.0001	0.0000		0.9200
CVS2-99																				
CVS2-100																				
CVS2-101										0.0064								0.0002		0.9531
CVS2-102																				

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
CVS2-66		>1114		spinel				
CVS2-67		1022		Cr2O3				
CVS2-68		>1114		Cr2O3				
CVS2-69		>1114		spinel				
CVS2-70		>1114		Cr2O3				
CVS2-71		1004		spinel				
CVS2-72		>868		spinel				
CVS2-73		840		Li-Al silicate				
CVS2-74		1066		spinel				
CVS2-75		826		Li-Al silicate				
CVS2-76		761		clinopyroxene				
CVS2-77		1090		Na-Zr silicate				
CVS2-78		1129		zircon				
CVS2-79		>1154		spinel				
CVS2-80		1154		zircon				
CVS2-81		>1154		Li2SiO3				
CVS2-82		745		Li2SiO3				
CVS2-83		741		Li2SiO3				
CVS2-84		983		Na-Zr silicate				
CVS2-85		>1150		Li2SiO3				
CVS2-86		1015		nepheline				
CVS2-87								
CVS2-88		982		ZrO2				
CVS2-89		838		clinopyroxene				
CVS2-90		897		orthopyroxene				
CVS2-91		>967		spinel				
CVS2-92		897		zircon				
CVS2-93		>983		spinel				
CVS2-94		663		Ca asilicate				
CVS2-95		804		clinopyroxene				
CVS2-96		1010		spinel				
CVS2-97		887		spinel				
CVS2-98		740		nepheline				
CVS2-99		988		spinel				
CVS2-100		1030		spinel				
CVS2-101								
CVS2-102								

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
CVS2-66	spinel	(Cr; Mn,Fe,Ni)	5 vol% spinel		
CVS2-67	none	none	none		
CVS2-68	Li, Al silicate, Cr2O3	(Cr)	8 vol% Li, Al silicate, 2 vol% eskolaite (Cr2O3)		
CVS2-69	Cr2O3, Li3PO4	(Cr), (P)	3 vol% eskolaite (Cr2O3), 2 vol% Li3PO4		
CVS2-70	Li, Al silicate, Cr2O3	(Cr)	10 vol% Li, Al silicate, <1 vol% eskolaite (Cr2O3)		
CVS2-71	orthopyroxene(?), spinel	(Fe,Si), (Fe,Ni,Cr)	<3 vol% clinopyroxene(?), <1 vol% spinel		
CVS2-72	none				
CVS2-73	none				
CVS2-74	spinel	(Cr,Fe,Ni)	<5 vol% spinel		
CVS2-75	none				
CVS2-76	Li2SiO3, RuO2 needles	(Si)	5 vol% Li2SiO3		
CVS2-77	SiO2, Na-Zr silicate, RuO2 needles	(Si), (Na,Zr,Si)	<2 vol% cristobalite (SiO2), unidentified		
CVS2-78	SiO2, zircon, olivine	(Zr,Si), (Fe,Mg,Si; Zr,Ni)	22 vol% cristobalite (SiO2), 3 vol% zircon (ZrSiO4), 3 vol% unidentified		
CVS2-79	SiO2, spinel, hematite	(Si), (Fe; Ni,Cr), (Fe)	20 vol% cristobalite (SiO2), 5 vol% spinel, 1 vol% hematite (Fe2O3)		
CVS2-80	SiO2, zircon, olivine	(Si), (Zr,Si), (Fe, Mg,Si; Ni)	15 vol% cristobalite (SiO2), 9 vol% zircon (ZrSiO4), 6 vol% unidentified		
CVS2-81	spinel, Li2SiO3	(Fe,Ni,Cr), (Si)	5 vol% spinel, 4 vol% Li2SiO3		
CVS2-82	Li2SiO3, RuO2 needles	(Si)	4 vol% Li2SiO3		
CVS2-83	RuO2 needles	none	none		
CVS2-84	Li2SiO3, RuO2 needles	(Si)	5 vol% Li2SiO3		
CVS2-85	nepheline, Li2SiO3	(Na,Al,Si), (Si)	33 vol% nepheline, 30 vol% Li2SiO3		
CVS2-86	nepheline	(Na,Al,Si)	5 vol% nepheline		
CVS2-87	none				
CVS2-88	RuO2 needles				
CVS2-89	RuO2 needles				
CVS2-90	SiO2, spinel	(Si), (Fe,Ni)	5 vol% cristobalite (SiO2), <1 vol% spinel, <1 vol% LiAl silicate(?)		
CVS2-91	(?)	none	<2 vol% unidentified, <1 vol% cristobalite (SiO2)		
CVS2-92	none	none	<2 vol% unidentified		
CVS2-93	spinel	(Fe,Cr,Ni)	<4 vol% spinel		
CVS2-94	RuO2 needles	none	none		
CVS2-95	none	none	none		
CVS2-96	clinopyroxene, spinel	(Ca,Mg,Fe,Si)	15 vol% clinopyroxene		
CVS2-97	clinopyroxene	(Ca,Fe,Si; Mg)	none		
CVS2-98	RuO2 needles	none	none		
CVS2-99	none				
CVS2-100	orthopyroxene, spinel	(Fe,Si), (Fe,Ni)	3 vol% orthopyroxene, 2 vol% spinel		
CVS2-101					
CVS2-102					

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
CVS2-66		2.5259	-5.34	6683.87	253.16	8.24	-10.489	17948.2	8.36				1250	3.9	1200
CVS2-67		2.4243	-5.23	6894.45	221.22	8.97	-9.892	17214.0	9.07				1244	4.51	1195
CVS2-68		2.4447	-5.99	9991.45	18.11	17.05							(1250)	(8.54)	(1201)
CVS2-69		2.4905	-6.07	8377.90	235.63	21.97							(1251)	(8.63)	(1201)
CVS2-70		2.4566	-6.89	10305.91	37.89	10.80	-9.807	17352.4	10.89				1253	4.87	1204
CVS2-71		2.6833	-7.34	9636.07	133.89	8.50	-11.709	19722.3	8.59				1250	3.56	1200
CVS2-72		2.5505	-5.86	7570.66	193.65	7.81	-10.349	17670.1	7.91				1249	3.69	1200
CVS2-73		2.4597	-5.88	7844.44	174.32	8.67	-10.158	17544.2	8.77				1248	4.12	1199
CVS2-74		2.5884	-5.11	6427.61	277.16	9.55	-10.586	18298.2	9.71				1251	4.42	1201
CVS2-75		2.46	-5.34	6896.99	229.66	8.66	-10.126	17499.1	8.77				1249	4.13	1200
CVS2-76		2.6688	-5.33	4925.24	254.58	1.18	-9.164	13296.0	1.20				1248	0.69	1198
CVS2-77		2.7897	-6.28	5333.94	356.37	1.55	-12.748	18792.4	1.58				1247	0.75	1199
CVS2-78		2.5264	-7.05	10022.81	184.77	28.12	-12.385	22393.9	28.55				1250	10.91	1200
CVS2-79		2.5481	-3.37	5588.22	418.24	71.38	-11.634	22619.4	70.95				(1252)	(14.46)	(1152)
CVS2-80		2.5691	-3.97	4098.99	637.80	56.30	(-18.56)	32185.898	(57.878)				(1252)	(17.32)	1200
CVS2-81		2.7419	-3.82	1666.90	667.51	0.69	-13.944	19495.3	0.78				1248	0.35	1198
CVS2-82		2.5412	-2.99	2066.37	550.60	1.58	-10.280	15194.6	1.49				(1246)	(1.02)	(1196)
CVS2-83		2.6567	-5.51	3926.44	395.30	0.74	-11.175	15493.5	0.75				1246	0.39	1196
CVS2-84		2.755	-6.13	5274.80	313.34	1.19	-11.384	16472.1	1.21				1250	0.61	1201
CVS2-85		2.5555	-6.99	8887.61	90.21	4.02	-10.291	16635.3	4.05				1247	1.99	1198
CVS2-86		2.4915	-5.33	7632.33	275.12	29.69	-11.328	20971.0	30.24				1249	12.14	1199
CVS2-87		2.5798	-6.86	9243.27	201.98	17.98	-12.563	22009.1	18.24				1248	7.26	1198
CVS2-88		2.6556	6.28	6455.00	295.58	3.57	-12.241	19255.7	3.64				1250	1.63	1200
CVS2-89		2.7538	-5.75	5167.78	387.33	2.78	-12.922	19876.7	2.85				1248	1.29	1199
CVS2-90		2.5718	-4.95	5090.70	334.61	3.65	-10.554	16883.6	3.71				1248	1.86	1199
CVS2-91		2.5271	-4.20	4818.26	447.80	14.31	-12.976	22294.8	14.75				1250	6.09	1200
CVS2-92		2.7211	-6.34	5237.82	323.83	1.00	-11.846	16872.3	1.01				1247	0.51	1197
CVS2-93		2.7521	-6.17	5113.18	255.81	0.64	-10.162	13835.4	0.64				1247	0.36	1198
CVS2-94		2.5884	-4.78	3416.96	401.23	0.81	-9.278	12906.3	0.81				1197	0.61	1148
CVS2-95		2.649	-4.21	3304.95	443.20	1.60	-10.066	15022.5	1.63				1251	0.89	1202
CVS2-96		2.6666	-5.39	5539.08	370.69	5.55	-12.531	20302.5	5.68				1250	2.51	1199
CVS2-97			-5.72	6451.33	312.06	7.25	-12.122	20096.6	7.39				1250	3.16	1200
CVS2-98		2.5128	-4.75	4415.06	330.91	1.90	-9.549	14519.7	1.92				1246	1.08	1196
CVS2-99		2.6321	-5.40	6369.71	305.31	8.53	-11.593	19571.6	8.68				1247	3.93	1198
CVS2-100		2.7136	-5.33	5934.93	332.06	6.85	-11.813	19573.0	6.97				1247	3.19	1197
CVS2-101		2.6602	-5.26	4730.46	315.57	1.51	-10.009	14846.3	1.53				1251	0.81	1202
CVS2-102		2.6754													

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
CVS2-66	5.55	1150	8.13	1150	8.28	1150	8.38	1100	12.74	1100	12.86	1050	20.69	1000	37.33	949	70.7				
CVS2-67	6.37	1146	9.17	1146	9.3	1146	9.42	1096	14.2	1096	14.29	1046	22.44	996	39.41	946	72.63				
CVS2-68	(11.39)	(1151)	(16.13)	(1150)	(17.68)	(1151)	(17.83)	(1101)	(23.9)	(1101)	(24.29)	(1051)	(39.77)	(1000)	(74.27)	(950)	(106.71)				
CVS2-69	(13.6)	(1151)	(19.77)	(1150)	(21.97)	(1151)	(22.56)	(1101)	(36.91)	(1101)	(36.91)	(1051)	(66.83)	(1000)	(105.67)						
CVS2-70	7.39	1154	9.98	1153	10.3	1154	10.52	1105	15.97	1104	16.19	1053	27.16	1003	43.48	953	79.55				
CVS2-71	5.49	1150	8.33	1150	8.62	1150	8.84	1100	13.86	1100	13.89	1050	23.4	1000	43.34	950	87.96				
CVS2-72	5.28	1150	7.74	1150	7.84	1150	8.02	1101	11.89	1100	12.16	1050	19.29	1000	34.41	950	63.4				
CVS2-73	5.98	1149	8.72	1149	8.75	1149	8.83	1100	13.37	1098	13.63	1049	21.49	999	38.4	949	69.65				
CVS2-74	6.39	1151	9.28	1151	9.54	1151	9.69	1102	14.7	1101	14.73	1050	24.26	1001	44.16	950	84.97				
CVS2-75	5.93	1150	8.53	1150	8.72	1150	8.87	1100	13.19	1100	13.41	1050	21.28	1000	37.21	950	69.65				
CVS2-76	0.88	1148	1.18	1148	1.2	1148	1.23	1098	1.66	1098	1.69	1048	2.47	999	3.42	947	6.07				
CVS2-77	1.04	1150	1.52	1148	1.59	1149	1.6	1099	2.44	1100	2.46	1049	4.06	999	7.69	948	15.29				
CVS2-78	16.79	1149	26.93	1149	27.31	1150	28.28	1099	47.63	1100	54.86	1050	97.61	999	187.57						
CVS2-79	(32.87)	(1203)	(34.75)	1151	69.68	1151	71.59	1101	121.28	1102	124.22	(1002)	(199.92)	1051	235.79						
CVS2-80	27.62	1150	54.77	1150	57.93	(1149)	(110.88)	1101	128.15	1100	136.93										
CVS2-81	0.54	1150	0.72	1149	0.74	1149	0.76	(1099)	(0.99)	(1099)	(1)	(1050)	(1.4)	1000	3.88	949	7.89				
CVS2-82	(1.26)	1146	1.52	1146	1.54	1147	1.56	1098	2.24	1097	2.26	1047	3.31	997	5.26	946	9.17				
CVS2-83	0.56	1147	0.77	1148	0.77	1148	0.78	1097	1.08	1098	1.08	1048	1.55	999	2.75	948	5				
CVS2-84	0.82	1152	1.16	1152	1.18	1152	1.18	1101	1.75	1102	1.8	1051	2.74	1002	4.6	951	8.55				
CVS2-85	2.79	1148	4.06	1148	4.06	1148	4.16	1099	6.18	1098	6.21	1049	9.66	999	16.19	948	29.05				
CVS2-86	18.49	1150	29.75	1150	30.22	1149	30.75	1100	49.92	1100	50.16	1049	90.26	999	185.81						
CVS2-87	11.13	1149	17.89	1150	17.98	1150	18.13	1100	30.9	1100	31.37	1050	56.56	999	114.01	949	247.66				
CVS2-88	2.32	1152	3.5	1151	3.51	1150	3.63	1102	5.58	1102	5.62	1052	9.48	1001	17.69	951	35.32				
CVS2-89	1.85	1149	2.77	1149	2.78	1149	2.83	1099	4.53	1100	4.53	1049	7.86	999	14.7	949	31.52				
CVS2-90	2.58	1149	3.64	1149	3.68	1149	3.68	1099	5.52	1100	5.52	1049	8.8	999	15.06	948	28.52				
CVS2-91	9.14	1150	13.91	1150	14.29	1150	14.82	1100	23.87	1100	23.93	1049	44.34	1000	97.17	949	219.91				
CVS2-92	0.7	1149	1.00	1148	1.01	1148	1.03	1099	1.52	1099	1.54	1049	2.36	999	4.06	949	7.72				
CVS2-93	0.48	1148	0.64	1148	0.64	1148	0.67	1099	0.9	1099	0.9	1049	1.3	999	2.04	949	3.36				
CVS2-94	0.81	1148	0.82	1099	1.14	1098	1.17	1048	1.62												
CVS2-95	1.18	1152	1.55	1152	1.55	1152	1.59	1102	2.25	1102	2.26	1051	3.43	1002	5.55	951	9.95				
CVS2-96	3.6	1150	5.53	1149	5.56	1149	5.56	1099	9.11	1100	9.17	1049	15.88	999	31.16	948	66.15				
CVS2-97	4.72	1151	7.14	1151	7.23	1150	7.49	1101	11.53	1100	11.67	1051	19.97	1001	39.29	950	80.52				
CVS2-98	1.43	1146	1.93	1147	1.95	1147	1.95	1098	2.73	1096	2.75	1047	4.19	997	6.52	947	11.22				
CVS2-99	5.67	1148	8.74	1146	8.8	1146	8.81	1098	14.07	1096	14.33	1045	24.52	997	45.71	946	93.86				
CVS2-100	4.61	1147	6.92	1148	6.96	1145	7.27	1098	11.22	1097	11.32	1047	19.14	998	36.92	947	74.36				
CVS2-101	1.09	1153	1.46	1152	1.5	1152	1.49	1103	2.09	1103	2.11	1053	3.21	1002	5.05	952	8.82				
CVS2-102																					

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
CVS2-66					0.210	0.247	0.223	0.164	10.54	0.210	0.267	0.195	0.019	10.39		
CVS2-67					0.512	0.480	0.214	0.23	9.73	0.446	0.480	0.205	0.232	9.63		
CVS2-68					0.308	0.340	0.127	0.254	9.84	11.320	7.153	2.934	0.6625	9.94		
CVS2-69					0.226	0.302	0.112	0.186	10.18	0.391	0.317	0.406	0.223	10.17		
CVS2-70					0.312	0.381	0.128	0.286	9.89	13.152	8.138	3.643	0.5	9.86		
CVS2-71					0.411	0.427	0.350	0.244	10.78	0.370	0.444	0.318	0.223	10.80		
CVS2-72					0.210	0.226	0.228	0.153	10.48	0.193	0.278	0.218	0.171	10.54		
CVS2-73					0.244	0.301	0.074	0.179	9.96	2.658	1.869	0.680	0.2925	10.10		
CVS2-74					0.226	0.279	0.147	0.163	10.41	0.247	0.302	0.152	0.194	10.30		
CVS2-75					0.278	0.334	0.100	0.22	9.88	2.426	1.619	0.704	0.274	9.96		
CVS2-76					14.871	7.571	12.541	4.045	12.46	13.130	6.550	9.546	4.024	12.27		
CVS2-77					9.512	6.221	6.552	2.29	12.26	8.039	41.475	4.155	1.785	12.21		
CVS2-78					0.934	0.698	0.593	0.191	9.21	19.092	22.013	14.825	0.248	9.29		
CVS2-79					0.744	0.684	0.660	0.19	8.96	40.193	43.544	38.275	1.638	8.84		
CVS2-80					0.764	0.672	0.600	0.195	9.15	25.774	29.631	21.159	0.3485	9.28		
CVS2-81					16.613	8.064	12.824	3.036	12.51	20.351	4.270	15.136	2.1595	12.58		
CVS2-82					44.000	19.969	35.377	16.884	12.18	50.093	20.123	37.436	21.558	12.09		
CVS2-83					34.656	19.228	27.890	11.447	12.33	29.247	18.613	21.751	7.566	12.43		
CVS2-84					12.460	6.682	8.236	0.493	12.42	20.364	8.848	12.728	3.287	12.48		
CVS2-85					0.456	0.422	0.749	0.291	11.68	45.552	6.605	18.344	0.364	12.36		
CVS2-86					0.115	0.091	0.254	0.082	10.98	0.268	0.269	0.299	0.105	11.04		
CVS2-87					0.178	0.131	0.286	0.114	10.90	0.161	0.185	0.261	0.142	10.77		
CVS2-88					0.308	0.376	0.473	0.162	11.52	0.340	0.484	0.463	0.173	11.66		
CVS2-89					1.716	1.236	1.348	0.364	11.04	1.194	0.978	1.048	0.267	10.25		
CVS2-90					5.577	3.764	3.481	0.716	9.98	6.129	4.670	3.916	0.763	9.96		
CVS2-91					8.642	6.774	6.738	0.468	9.38	8.240	6.667	6.418	0.515	9.73		
CVS2-92					18.590	12.442	11.792	1.214	11.12	16.077	12.750	10.377	1.87	11.08		
CVS2-93					13.227	7.757	10.010	1.967	11.76	14.430	9.524	12.118	1.02	11.80		
CVS2-94					4.070	3.066	3.350	0.935	11.84	3.195	3.700	3.594	1.02	11.89		
CVS2-95					9.976	4.271	7.259	2.008	11.81	8.718	5.168	7.727	2.236	11.83		
CVS2-96					0.493	0.429	0.410	0.159	10.24	0.662	0.486	0.349	0.145	10.11		
CVS2-97					1.434	1.052	1.134	0.391	10.25	1.105	1.182	1.158	0.401	10.29		
CVS2-98					4.520	3.497	2.796	0.267	11.58	2.970	3.730	2.763	0.282	11.62		
CVS2-99					0.232	0.246	0.199	0.131	10.10	0.183	0.254	0.199	0.117	9.73		
CVS2-100					0.326	0.343	0.226	0.17	10.34	0.326	0.386	0.269	0.206	10.41		
CVS2-101					8.644	3.831	6.586	1.819	11.92	9.590	5.049	8.144	2.333	11.84		
CVS2-102					2.672	1.921	1.677	0.559	10.28	2.638	1.880	1.722	0.536	10.30		

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
CVS2-66												
CVS2-67												
CVS2-68												
CVS2-69												
CVS2-70												
CVS2-71												
CVS2-72												
CVS2-73												
CVS2-74												
CVS2-75												
CVS2-76												
CVS2-77												
CVS2-78												
CVS2-79												
CVS2-80												
CVS2-81												
CVS2-82												
CVS2-83												
CVS2-84												
CVS2-85												
CVS2-86												
CVS2-87												
CVS2-88												
CVS2-89												
CVS2-90												
CVS2-91												
CVS2-92												
CVS2-93												
CVS2-94												
CVS2-95												
CVS2-96												
CVS2-97												
CVS2-98												
CVS2-99												
CVS2-100												
CVS2-101												
CVS2-102												

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
CVS2-103	0.0293	0.1337	0.0105	0.0913		0.0000	0.0476	0.0107	0.1428	0.0077	0.0013	0.4100	0.0489	0.0000	0.0000	0.0013	0.0000		0.0101		0.0020
CVS2-104	0.0273	0.1246	0.0098	0.0851		0.0000	0.0444	0.0099	0.1332	0.0072	0.0013	0.4500	0.0456	0.0000	0.0000	0.0013	0.0000		0.0094		0.0019
CVS2-105	0.0254	0.1156	0.0091	0.0789		0.0000	0.0412	0.0092	0.1235	0.0067	0.0012	0.4900	0.0423	0.0000	0.0000	0.0012	0.0000		0.0087		0.0017
CVS2-106	0.0214	0.0974	0.0077	0.0665		0.0000	0.0347	0.0078	0.1041	0.0056	0.0010	0.5700	0.0356	0.0000	0.0000	0.0010	0.0000		0.0074		0.0015
CVS2-107	0.0245	0.0500	0.0088	0.0763		0.0000	0.0398	0.0089	0.1195	0.0065	0.0011	0.5684	0.0409	0.0000	0.0000	0.0011	0.0000		0.0084		0.0017
CVS2-108	0.0220	0.1500	0.0079	0.0683		0.0000	0.0356	0.0080	0.1069	0.0058	0.0010	0.5086	0.0366	0.0000	0.0000	0.0010	0.0000		0.0076		0.0015
CVS2-109	0.0207	0.2000	0.0074	0.0643		0.0000	0.0335	0.0075	0.1006	0.0055	0.0009	0.4786	0.0344	0.0000	0.0000	0.0009	0.0000		0.0071		0.0014
CVS2-110	0.0247	0.1127	0.0089	0.0770		0.0000	0.0401	0.0090	0.0500	0.0065	0.0011	0.5730	0.0412	0.0000	0.0000	0.0011	0.0000		0.0085		0.0017
CVS2-111	0.0221	0.1009	0.0080	0.0689		0.0000	0.0359	0.0081	0.1500	0.0058	0.0010	0.5127	0.0369	0.0000	0.0000	0.0010	0.0000		0.0076		0.0015
CVS2-112	0.0208	0.0949	0.0075	0.0648		0.0000	0.0338	0.0076	0.2000	0.0055	0.0010	0.4825	0.0347	0.0000	0.0000	0.0010	0.0000		0.0072		0.0014
CVS2-113	0.0238	0.1083	0.0085	0.0740		0.0000	0.0100	0.0086	0.1157	0.0063	0.0011	0.5506	0.0396	0.0000	0.0000	0.0011	0.0000		0.0082		0.0016
CVS2-114	0.0226	0.1028	0.0081	0.0702		0.0000	0.0600	0.0082	0.1099	0.0060	0.0010	0.5228	0.0376	0.0000	0.0000	0.0010	0.0000		0.0078		0.0016
CVS2-115	0.0223	0.1017	0.0080	0.0695		0.0000	0.0700	0.0081	0.1087	0.0059	0.0010	0.5172	0.0372	0.0000	0.0000	0.0010	0.0000		0.0077		0.0015
CVS2-116	0.0228	0.1041	0.0200	0.0711		0.0000	0.0371	0.0083	0.1112	0.0060	0.0010	0.5290	0.0381	0.0000	0.0000	0.0010	0.0000		0.0079		0.0016
CVS2-117	0.0233	0.1062	0.0084	0.0725		0.0000	0.0378	0.0000	0.1135	0.0061	0.0011	0.5398	0.0388	0.0000	0.0000	0.0011	0.0000		0.0080		0.0016
CVS2-118	0.0228	0.1041	0.0082	0.0711		0.0000	0.0371	0.0200	0.1112	0.0060	0.0010	0.5290	0.0381	0.0000	0.0000	0.0010	0.0000		0.0079		0.0016
CVS2-119	0.0000	0.1078	0.0085	0.0736		0.0000	0.0384	0.0086	0.1152	0.0062	0.0011	0.5480	0.0394	0.0000	0.0000	0.0011	0.0000		0.0081		0.0016
CVS2-120	0.0500	0.1024	0.0081	0.0699		0.0000	0.0365	0.0082	0.1094	0.0059	0.0010	0.5206	0.0374	0.0000	0.0000	0.0010	0.0000		0.0077		0.0015
CVS2-121	0.1000	0.0970	0.0077	0.0662		0.0000	0.0346	0.0077	0.1036	0.0056	0.0010	0.4932	0.0355	0.0000	0.0000	0.0010	0.0000		0.0073		0.0015
CVS2-122	0.1500	0.0916	0.0072	0.0626		0.0000	0.0326	0.0073	0.0979	0.0053	0.0009	0.4658	0.0335	0.0000	0.0000	0.0009	0.0000		0.0069		0.0014
CVS2-123	0.0235	0.1048	0.0082	0.0733		0.0000	0.0373	0.0084	0.1129	0.0060	0.0010	0.5328	0.0392	0.0000	0.0000	0.0010	0.0000		0.0065		0.0002

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1	0.0487	0.0005	0.0126	0.0680		0.0013	0.0286	0.0005	0.1234	0.0140	0.0079	0.5333	0.0438	0.0000	0.0000	0.0000	0.0137		0.0006		0.0169
CVS3-2	0.0417	0.0004	0.0108	0.0583		0.0011	0.0245	0.0004	0.1057	0.0120	0.0068	0.6000	0.0375	0.0000	0.0000	0.0000	0.0118		0.0005		0.0145
CVS3-3	0.0574	0.0005	0.0148	0.0801		0.0015	0.0337	0.0006	0.1454	0.0165	0.0094	0.4500	0.0516	0.0000	0.0000	0.0000	0.0162		0.0007		0.0199
CVS3-4	0.0626	0.0006	0.0162	0.0874		0.0017	0.0367	0.0006	0.1586	0.0180	0.0102	0.4000	0.0563	0.0000	0.0000	0.0000	0.0176		0.0007		0.0217
CVS3-5	0.0657	0.0006	0.0170	0.0918		0.0018	0.0386	0.0006	0.1665	0.0189	0.0107	0.3700	0.0591	0.0000	0.0000	0.0000	0.0185		0.0008		0.0228
CVS3-6	0.0446	0.0837	0.0116	0.0623		0.0012	0.0262	0.0004	0.1131	0.0129	0.0073	0.4889	0.0401	0.0000	0.0000	0.0000	0.0126		0.0005		0.0155
CVS3-7	0.0468	0.0400	0.0121	0.0653		0.0013	0.0274	0.0005	0.1185	0.0135	0.0076	0.5122	0.0420	0.0000	0.0000	0.0000	0.0132		0.0005		0.0162
CVS3-8	0.0430	0.0004	0.0111	0.0600		0.0012	0.0252	0.0004	0.2258	0.0124	0.0070	0.4710	0.0387	0.0000	0.0000	0.0000	0.0121		0.0005		0.0149
CVS3-9	0.0527	0.0005	0.0137	0.0737		0.0014	0.0309	0.0005	0.0500	0.0152	0.0086	0.5779	0.0474	0.0000	0.0000	0.0000	0.0149		0.0006		0.0183
CVS3-10	0.0465	0.0004	0.0120	0.0650		0.0013	0.0716	0.0005	0.1179	0.0134	0.0076	0.5097	0.0418	0.0000	0.0000	0.0000	0.0131		0.0005		0.0161
CVS3-11	0.0476	0.0005	0.0123	0.0665		0.0013	0.0500	0.0005	0.1206	0.0137	0.0078	0.5215	0.0428	0.0000	0.0000	0.0000	0.0134		0.0005		0.0165
CVS3-12	0.0501	0.0005	0.0130	0.0700		0.0014	0.0000	0.0005	0.1270	0.0144	0.0082	0.5490	0.0451	0.0000	0.0000	0.0000	0.0141		0.0006		0.0174
CVS3-13	0.0444	0.0004	0.0115	0.1500		0.0012	0.0260	0.0004	0.1125	0.0128	0.0072	0.4864	0.0399	0.0000	0.0000	0.0000	0.0125		0.0005		0.0154
CVS3-14	0.0465	0.0004	0.0120	0.1100		0.0013	0.0273	0.0005	0.1178	0.0134	0.0076	0.5093	0.0418	0.0000	0.0000	0.0000	0.0131		0.0005		0.0161
CVS3-15	0.0522	0.0005	0.0135	0.0000		0.0014	0.0306	0.0005	0.1324	0.0151	0.0085	0.5722	0.0470	0.0000	0.0000	0.0000	0.0147		0.0006		0.0181
CVS3-16	0.2500	0.0004	0.0099	0.0536		0.0010	0.0225	0.0004	0.0972	0.0111	0.0063	0.4204	0.0345	0.0000	0.0000	0.0000	0.0108		0.0004		0.0133
CVS3-17	0.1800	0.0004	0.0109	0.0586		0.0011	0.0246	0.0004	0.1063	0.0121	0.0068	0.4597	0.0377	0.0000	0.0000	0.0000	0.0118		0.0005		0.0146
CVS3-18	0.1300	0.0004	0.0115	0.0622		0.0012	0.0261	0.0004	0.1128	0.0128	0.0073	0.4877	0.0400	0.0000	0.0000	0.0000	0.0126		0.0005		0.0154
CVS3-19	0.0000	0.0005	0.0132	0.0715		0.0014	0.0300	0.0005	0.1297	0.0148	0.0084	0.5606	0.0460	0.0000	0.0000	0.0000	0.0144		0.0006		0.0178
CVS3-20	0.0428	0.0004	0.0111	0.0597		0.0012	0.0251	0.0004	0.1084	0.0123	0.0070	0.4685	0.1600	0.0000	0.0000	0.0000	0.0121		0.0005		0.0148

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
CVS2-103			0.0000	0.0017	0.0020	0.0020		0.0040					0.0084	0.0020			0.0040		0.0166	0.0000	
CVS2-104			0.0000	0.0016	0.0019	0.0019		0.0038					0.0078	0.0019			0.0038		0.0155	0.0000	
CVS2-105			0.0000	0.0015	0.0017	0.0017		0.0035					0.0073	0.0017			0.0035		0.0144	0.0000	
CVS2-106			0.0000	0.0012	0.0015	0.0015		0.0029					0.0061	0.0015			0.0029		0.0121	0.0000	
CVS2-107			0.0000	0.0014	0.0017	0.0017		0.0034					0.0070	0.0017			0.0034		0.0139	0.0000	
CVS2-108			0.0000	0.0013	0.0015	0.0015		0.0030					0.0063	0.0015			0.0030		0.0124	0.0000	
CVS2-109			0.0000	0.0012	0.0014	0.0014		0.0028					0.0059	0.0014			0.0028		0.0117	0.0000	
CVS2-110			0.0000	0.0014	0.0017	0.0017		0.0034					0.0071	0.0017			0.0034		0.0140	0.0000	
CVS2-111			0.0000	0.0013	0.0015	0.0015		0.0030					0.0063	0.0015			0.0030		0.0125	0.0000	
CVS2-112			0.0000	0.0012	0.0014	0.0014		0.0029					0.0060	0.0014			0.0029		0.0118	0.0000	
CVS2-113			0.0000	0.0014	0.0016	0.0016		0.0033					0.0068	0.0016			0.0033		0.0135	0.0000	
CVS2-114			0.0000	0.0013	0.0016	0.0016		0.0031					0.0065	0.0016			0.0031		0.0128	0.0000	
CVS2-115			0.0000	0.0013	0.0015	0.0015		0.0031					0.0064	0.0015			0.0031		0.0126	0.0000	
CVS2-116			0.0000	0.0013	0.0016	0.0016		0.0031					0.0065	0.0016			0.0031		0.0129	0.0000	
CVS2-117			0.0000	0.0013	0.0016	0.0016		0.0032					0.0067	0.0016			0.0032		0.0132	0.0000	
CVS2-118			0.0000	0.0013	0.0016	0.0016		0.0031					0.0065	0.0016			0.0031		0.0129	0.0000	
CVS2-119			0.0000	0.0014	0.0016	0.0016		0.0033					0.0068	0.0016			0.0033		0.0134	0.0000	
CVS2-120			0.0000	0.0013	0.0015	0.0015		0.0031					0.0064	0.0015			0.0031		0.0127	0.0000	
CVS2-121			0.0000	0.0012	0.0015	0.0015		0.0029					0.0061	0.0015			0.0029		0.0120	0.0000	
CVS2-122			0.0000	0.0012	0.0014	0.0014		0.0028					0.0058	0.0014			0.0028		0.0114	0.0000	
CVS2-123			0.0000	0.0013	0.0015	0.0016		0.0019					0.0155	0.0016			0.0031		0.0057	0.0000	

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1			0.0000	0.0053	0.0000	0.0000		0.0034					0.0026	0.0112			0.0005		0.0602	0.0000	
CVS3-2			0.0000	0.0045	0.0000	0.0000		0.0029					0.0023	0.0096			0.0004		0.0516	0.0000	
CVS3-3			0.0000	0.0062	0.0000	0.0000		0.0040					0.0031	0.0132			0.0005		0.0710	0.0000	
CVS3-4			0.0000	0.0068	0.0000	0.0000		0.0044					0.0034	0.0144			0.0006		0.0774	0.0000	
CVS3-5			0.0000	0.0071	0.0000	0.0000		0.0046					0.0036	0.0152			0.0006		0.0813	0.0000	
CVS3-6			0.0000	0.0049	0.0000	0.0000		0.0031					0.0024	0.0103			0.0004		0.0552	0.0000	
CVS3-7			0.0000	0.0051	0.0000	0.0000		0.0033					0.0025	0.0108			0.0004		0.0578	0.0000	
CVS3-8			0.0000	0.0047	0.0000	0.0000		0.0030					0.0023	0.0099			0.0004		0.0532	0.0000	
CVS3-9			0.0000	0.0057	0.0000	0.0000		0.0037					0.0029	0.0122			0.0005		0.0652	0.0000	
CVS3-10			0.0000	0.0051	0.0000	0.0000		0.0032					0.0025	0.0107			0.0004		0.0575	0.0000	
CVS3-11			0.0000	0.0052	0.0000	0.0000		0.0033					0.0026	0.0110			0.0004		0.0589	0.0000	
CVS3-12			0.0000	0.0054	0.0000	0.0000		0.0035					0.0027	0.0116			0.0005		0.0620	0.0000	
CVS3-13			0.0000	0.0048	0.0000	0.0000		0.0031					0.0024	0.0102			0.0004		0.0549	0.0000	
CVS3-14			0.0000	0.0051	0.0000	0.0000		0.0032					0.0025	0.0107			0.0004		0.0575	0.0000	
CVS3-15			0.0000	0.0057	0.0000	0.0000		0.0036					0.0028	0.0120			0.0005		0.0646	0.0000	
CVS3-16			0.0000	0.0042	0.0000	0.0000		0.0027					0.0021	0.0089			0.0004		0.0475	0.0000	
CVS3-17			0.0000	0.0046	0.0000	0.0000		0.0029					0.0023	0.0097			0.0004		0.0519	0.0000	
CVS3-18			0.0000	0.0048	0.0000	0.0000		0.0031					0.0024	0.0103			0.0004		0.0551	0.0000	
CVS3-19			0.0000	0.0056	0.0000	0.0000		0.0036					0.0028	0.0118			0.0005		0.0633	0.0000	
CVS3-20			0.0000	0.0047	0.0000	0.0000		0.0030					0.0023	0.0099			0.0004		0.0529	0.0000	

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
CVS2-103	0.0007		0.0013	0.0007			0.0007		0.0020	0.0000		0.0000	0.0007			0.0037	0.0013		0.0000		0.0000
CVS2-104	0.0006		0.0013	0.0006			0.0006		0.0019	0.0000		0.0000	0.0006			0.0035	0.0013		0.0000		0.0000
CVS2-105	0.0006		0.0012	0.0006			0.0006		0.0017	0.0000		0.0000	0.0006			0.0032	0.0012		0.0000		0.0000
CVS2-106	0.0005		0.0010	0.0005			0.0005		0.0015	0.0000		0.0000	0.0005			0.0027	0.0010		0.0000		0.0000
CVS2-107	0.0006		0.0011	0.0006			0.0006		0.0017	0.0000		0.0000	0.0006			0.0031	0.0011		0.0000		0.0000
CVS2-108	0.0005		0.0010	0.0005			0.0005		0.0015	0.0000		0.0000	0.0005			0.0028	0.0010		0.0000		0.0000
CVS2-109	0.0005		0.0009	0.0005			0.0005		0.0014	0.0000		0.0000	0.0005			0.0026	0.0009		0.0000		0.0000
CVS2-110	0.0006		0.0011	0.0006			0.0006		0.0017	0.0000		0.0000	0.0006			0.0031	0.0011		0.0000		0.0000
CVS2-111	0.0005		0.0010	0.0005			0.0005		0.0015	0.0000		0.0000	0.0005			0.0028	0.0010		0.0000		0.0000
CVS2-112	0.0005		0.0010	0.0005			0.0005		0.0014	0.0000		0.0000	0.0005			0.0026	0.0010		0.0000		0.0000
CVS2-113	0.0005		0.0011	0.0005			0.0005		0.0016	0.0000		0.0000	0.0005			0.0030	0.0011		0.0000		0.0000
CVS2-114	0.0005		0.0010	0.0005			0.0005		0.0016	0.0000		0.0000	0.0005			0.0029	0.0010		0.0000		0.0000
CVS2-115	0.0005		0.0010	0.0005			0.0005		0.0015	0.0000		0.0000	0.0005			0.0028	0.0010		0.0000		0.0000
CVS2-116	0.0005		0.0010	0.0005			0.0005		0.0016	0.0000		0.0000	0.0005			0.0029	0.0010		0.0000		0.0000
CVS2-117	0.0005		0.0011	0.0005			0.0005		0.0016	0.0000		0.0000	0.0005			0.0029	0.0011		0.0000		0.0000
CVS2-118	0.0005		0.0010	0.0005			0.0005		0.0016	0.0000		0.0000	0.0005			0.0029	0.0010		0.0000		0.0000
CVS2-119	0.0005		0.0011	0.0005			0.0005		0.0016	0.0000		0.0000	0.0005			0.0030	0.0011		0.0000		0.0000
CVS2-120	0.0005		0.0010	0.0005			0.0005		0.0015	0.0000		0.0000	0.0005			0.0028	0.0010		0.0000		0.0000
CVS2-121	0.0005		0.0010	0.0005			0.0005		0.0015	0.0000		0.0000	0.0005			0.0027	0.0010		0.0000		0.0000
CVS2-122	0.0005		0.0009	0.0005			0.0005		0.0014	0.0000		0.0000	0.0005			0.0025	0.0009		0.0000		0.0000
CVS2-123	0.0000		0.0019	0.0000			0.0000		0.0015	0.0000		0.0000	0.0000			0.0044	0.0000		0.0000		0.0000

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0020	0.0000		0.0000		0.0000
CVS3-2	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0017	0.0000		0.0000		0.0000
CVS3-3	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0024	0.0000		0.0000		0.0000
CVS3-4	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0026	0.0000		0.0000		0.0000
CVS3-5	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0028	0.0000		0.0000		0.0000
CVS3-6	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000
CVS3-7	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0020	0.0000		0.0000		0.0000
CVS3-8	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0018	0.0000		0.0000		0.0000
CVS3-9	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0022	0.0000		0.0000		0.0000
CVS3-10	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0020	0.0000		0.0000		0.0000
CVS3-11	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0020	0.0000		0.0000		0.0000
CVS3-12	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0021	0.0000		0.0000		0.0000
CVS3-13	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000
CVS3-14	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000
CVS3-15	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0022	0.0000		0.0000		0.0000
CVS3-16	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0016	0.0000		0.0000		0.0000
CVS3-17	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0018	0.0000		0.0000		0.0000
CVS3-18	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000
CVS3-19	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0021	0.0000		0.0000		0.0000
CVS3-20	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0018	0.0000		0.0000		0.0000

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
CVS2-103			0.0000			0.0000	0.0007	0.0000		1.0000											
CVS2-104			0.0000			0.0000	0.0006	0.0000		1.0000											
CVS2-105			0.0000			0.0000	0.0006	0.0000		1.0000											
CVS2-106			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-107			0.0000			0.0000	0.0006	0.0000		1.0000											
CVS2-108			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-109			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-110			0.0000			0.0000	0.0006	0.0000		1.0000											
CVS2-111			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-112			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-113			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-114			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-115			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-116			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-117			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-118			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-119			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-120			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-121			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-122			0.0000			0.0000	0.0005	0.0000		1.0000											
CVS2-123			0.0000			0.0000	0.0000	0.0049		1.0000											

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1			0.0000			0.0011	0.0000	0.0000		1.0000											
CVS3-2			0.0000			0.0009	0.0000	0.0000		1.0000											
CVS3-3			0.0000			0.0013	0.0000	0.0000		1.0000											
CVS3-4			0.0000			0.0014	0.0000	0.0000		1.0000											
CVS3-5			0.0000			0.0015	0.0000	0.0000		1.0000											
CVS3-6			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-7			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-8			0.0000			0.0009	0.0000	0.0000		1.0000											
CVS3-9			0.0000			0.0012	0.0000	0.0000		1.0000											
CVS3-10			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-11			0.0000			0.0011	0.0000	0.0000		1.0000											
CVS3-12			0.0000			0.0011	0.0000	0.0000		1.0000											
CVS3-13			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-14			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-15			0.0000			0.0012	0.0000	0.0000		1.0000											
CVS3-16			0.0000			0.0008	0.0000	0.0000		1.0000											
CVS3-17			0.0000			0.0009	0.0000	0.0000		1.0000											
CVS3-18			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-19			0.0000			0.0011	0.0000	0.0000		1.0000											
CVS3-20			0.0000			0.0009	0.0000	0.0000		1.0000											

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
CVS2-103																					
CVS2-104																					
CVS2-105																					
CVS2-106																					
CVS2-107																					
CVS2-108																					
CVS2-109																					
CVS2-110																					
CVS2-111																					
CVS2-112																					
CVS2-113																					
CVS2-114																					
CVS2-115																					
CVS2-116																					
CVS2-117																					
CVS2-118																					
CVS2-119																					
CVS2-120																					
CVS2-121																					
CVS2-122																					
CVS2-123																					

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1																					
CVS3-2																					
CVS3-3																					
CVS3-4																					
CVS3-5																					
CVS3-6																					
CVS3-7																					
CVS3-8																					
CVS3-9																					
CVS3-10																					
CVS3-11																					
CVS3-12																					
CVS3-13																					
CVS3-14																					
CVS3-15																					
CVS3-16																					
CVS3-17																					
CVS3-18																					
CVS3-19																					
CVS3-20																					

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
CVS2-103																					
CVS2-104																					
CVS2-105																					
CVS2-106																					
CVS2-107																					
CVS2-108																					
CVS2-109																					
CVS2-110																					
CVS2-111																					
CVS2-112																					
CVS2-113																					
CVS2-114																					
CVS2-115																					
CVS2-116																					
CVS2-117																					
CVS2-118																					
CVS2-119																					
CVS2-120																					
CVS2-121																					
CVS2-122																					
CVS2-123																					

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1																					
CVS3-2																					
CVS3-3																					
CVS3-4																					
CVS3-5																					
CVS3-6																					
CVS3-7																					
CVS3-8																					
CVS3-9																					
CVS3-10																					
CVS3-11																					
CVS3-12																					
CVS3-13																					
CVS3-14																					
CVS3-15																					
CVS3-16																					
CVS3-17																					
CVS3-18																					
CVS3-19																					
CVS3-20																					

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
CVS2-103																				
CVS2-104																				
CVS2-105																				
CVS2-106																				
CVS2-107																				
CVS2-108																				
CVS2-109																				
CVS2-110																				
CVS2-111																				
CVS2-112																				
CVS2-113																				
CVS2-114																				
CVS2-115																				
CVS2-116																				
CVS2-117																				
CVS2-118																				
CVS2-119																				
CVS2-120																				
CVS2-121																				
CVS2-122																				
CVS2-123																				

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1																				
CVS3-2																				
CVS3-3																				
CVS3-4																				
CVS3-5																				
CVS3-6																				
CVS3-7																				
CVS3-8																				
CVS3-9																				
CVS3-10																				
CVS3-11																				
CVS3-12																				
CVS3-13																				
CVS3-14																				
CVS3-15																				
CVS3-16																				
CVS3-17																				
CVS3-18																				
CVS3-19																				
CVS3-20																				

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
CVS2-103								
CVS2-104								
CVS2-105								
CVS2-106								
CVS2-107								
CVS2-108								
CVS2-109								
CVS2-110								
CVS2-111								
CVS2-112								
CVS2-113								
CVS2-114								
CVS2-115								
CVS2-116								
CVS2-117								
CVS2-118								
CVS2-119								
CVS2-120								
CVS2-121								
CVS2-122								
CVS2-123								

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1			1153	spinel	No XL			
CVS3-2			1181	spinel	No XL			
CVS3-3			1130	spinel	<<.1 undisolved cluster <<.1 spinel			
CVS3-4			1186	Ce, Zr, Oy	2.6% spinel, possibly und Zr	spinel, (Si, Zr, Ce, Nd, [Na?])	5 vol% XL, 90w% sp, 10w% ZrCeO	
CVS3-5			1232	Nd, Ce, Zr, Oy	3.6% spinel, possibly und. Zr	spinel	3 vol% XL, 75w% NiO, 25w% sp	
CVS3-6			1066	?	No XL			
CVS3-7			1132	spinel	No XL			
CVS3-8			1066	Na, Zr, Si	No XL			
CVS3-9			1374	spinel	very small particles			
CVS3-10			1021	spinel	No XL			
CVS3-11			1075	spinel	No XL			
CVS3-12			1278	spinel	very small particles	hi Cr spinel		
CVS3-13			1295	spinel	<.1% spinel	spinel		
CVS3-14			1227	spinel	No XL			
CVS3-15			1111	Cr	No XL			
CVS3-16					3.8% XL, inhomo	spinel	10 vol% XL, 75w% sp, 25w% NdZrO	
CVS3-17					2.2% XL, inhomo			
CVS3-18			1293	spinel	very small particles similar to 3-17			
CVS3-19			1070	spinel	No XL			
CVS3-20					3.1% XL inhomo, und Zr and other	ZrO2	10% ZrO2, YZrO type	

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
CVS2-103					
CVS2-104					
CVS2-105					
CVS2-106					
CVS2-107					
CVS2-108					
CVS2-109					
CVS2-110					
CVS2-111					
CVS2-112					
CVS2-113					
CVS2-114					
CVS2-115					
CVS2-116					
CVS2-117					
CVS2-118					
CVS2-119					
CVS2-120					
CVS2-121					
CVS2-122					
CVS2-123					

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1	3.7% XL inhomo	spinel			
CVS3-2	very few spinel near crucible		Amorphous		
CVS3-3	2.2% XL spinel +?	spinel only			
CVS3-4	13.2% XL 2 types	spinel, (Si,Ca,Nd, [Na?]), (Si, Zr, Ce, Nd, [Na?]), hiCr sp	35vol% XL, 45w%CaNdPO4SiO4, 35w%spinel, 20w%ZrCeO		
CVS3-5	33% XL 2 types (same as 3-4)	spinel, (Si,Ca,Nd, [Na?]), (Si, Zr, Ce, Nd, [Na?])	40vol% XL, 30w%CaNdPO4SiO4, 30w%spinel, 40w%ZrCeO		
CVS3-6	No XL				
CVS3-7	No XL				
CVS3-8	No XL				
CVS3-9	4.4% XL spinel+?	spinel, hiCr sp			
CVS3-10	<.1% stars (spinel?)	spinel, hiCr sp, hiNi sp			
CVS3-11	No XL				
CVS3-12	Very high XL many phases, inhomo	spinel, hiCr sp			
CVS3-13	5.9% tiny spinel at bottom, 4.5% larger spinel at top	spinel	10 vol% Spinel		
CVS3-14	sp 2.3%				
CVS3-15	no XL				
CVS3-16	Fully XL? two distinct phases maybe more	(Si, Al), (Si, Al, Zr), (Si, Al, Zr, Nd, Fe), spinel	fully XL, 45w% LiAlSi, 40w% np, 10w% NaNdSi		
CVS3-17	2.9% XL seem to be all spinel	spinel, (Si, Al, Nd [dend]), (Fe, Al, Ni [sp?])	25 vol% XL, 50w% NaNdSi, 35w% sp		
CVS3-18	1.9% XL same as 3-17 only smaller				
CVS3-19	No XL				
CVS3-20	6.7% XL	Zr, (Si, Fe, Zr, Ni)	15% ZrO2, Sp		

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
CVS2-103		2.7777													
CVS2-104		2.7522													
CVS2-105		2.7246													
CVS2-106		2.5875													
CVS2-107		2.6985													
CVS2-108		2.6611													
CVS2-109		2.6299													
CVS2-110		2.618													
CVS2-111		2.7025													
CVS2-112		2.7129													
CVS2-113		2.5891													
CVS2-114		2.6978													
CVS2-115		2.6885													
CVS2-116		2.6922													
CVS2-117		2.6714													
CVS2-118		2.6821													
CVS2-119		2.6949													
CVS2-120		2.6587													
CVS2-121		2.6213													
CVS2-122		2.577													
CVS2-123		2.7144													

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1			-7.17	10073	492.1		-12.040	22335.1	38.70				1095	76.079	1145
CVS3-2			-2.61	3388.7	979.1		-11.320	22774.9	108.29				1194	74.061	1245
CVS3-3			-8.15	9715.8	490.4		-13.610	22648.3	10.03				1000	71.0640	1100
CVS3-4							-13.640	21802.3	5.37				1044	16.676	1094
CVS3-5							(-39.99)	(59812.9)	(7.7134)				1051	188.3760	1126
CVS3-6			-7.88	10857	366.6		-11.240	19441.9	11.28				1043	35.037	1094
CVS3-7			-6.1	7680.2	577.2		-11.310	20355.7	19.98				1093	37.886	1144
CVS3-8			-8.61	11477	332.8		-11.950	19755.5	6.91				992	40.279	1043
CVS3-9			-3.38	4309.2	942.4		-11.530	23596.9	156.41				1244	60.786	1294
CVS3-10			-6.51	6836.5	584		-12.910	20788.1	5.47				949	65.5650	1000
CVS3-11			-6.85	8702.9	501.4		-12.050	20895.7	13.93				992	93.903	1042
CVS3-12			-3.33	4247.6	977.9		-12.580	25798.1	257.08				1245	92.087	1294
CVS3-13							(-12.45)	(22264.6)	(24.44)				1093	42.993	1144
CVS3-14			-8.24	11874	401.9		-12.190	22179.8	29.86				1093	59.388	1144
CVS3-15			-6.9	10081	508.2		-11.620	22350.5	59.54				1143	66.794	1194
CVS3-16							(-15.756)	(31073.01)	(437.26)				1244	120.44	1294
CVS3-17			-3.82	4518.2	948.9		-12.570	25176.8	167.80				1245	60.506	1295
CVS3-18			-4.17	5022.3	863.4		-12.200	23840.3	94.97				1194	61.98	1245
CVS3-19			-6.22	7808.3	584.3		-11.660	20994.0	22.05				1095	42.114	1145
CVS3-20							(-16.606)	31488.601	(250.22)				1194	94.237	1245

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
CVS2-103																					
CVS2-104																					
CVS2-105																					
CVS2-106																					
CVS2-107																					
CVS2-108																					
CVS2-109																					
CVS2-110																					
CVS2-111																					
CVS2-112																					
CVS2-113																					
CVS2-114																					
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CVS2-116																					
CVS2-117																					
CVS2-118																					
CVS2-119																					
CVS2-120																					
CVS2-121																					
CVS2-122																					
CVS2-123																					

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1	40.684	1194	23.198	1244	14.135	1245	14.357	1294	8.8702	1294	9.0916	1295	9.1074	1344	5.9372	1395	4.0161				
CVS3-2	41.304	1294	23.435	1344	14.786	1344	15.009	1394	8.8410	1395	10.266	1395	10.464	1445	7.2353	1497	5.4573				
CVS3-3	16.723	1150	9.9264	1199	5.6753	1200	5.8163	1235	4.0115	1235	4.0538	1235	3.9480	1300	2.2222	1350	1.5454				
CVS3-4	10.903	1143	6.1885	1144	5.8498	1193	3.3329	1194	3.5869	1194	3.1712	1244	1.9735								
CVS3-5	21.037	1126	21.263	1126	7.8678	1200	1.9655														
CVS3-6	19.427	1144	11.768	1195	7.2584	1244	4.7183	1245	4.6799	1294	3.1712	1294	3.2097	1295	3.2328	1344	2.2353				
CVS3-7	21.2990	1194	12.678	1244	7.8553	1244	7.9159	1294	5.1494	1294	5.3187	1295	5.3803	1344	3.6331	1395	2.5708				
CVS3-8	21.123	1094	12.177	1144	7.2199	1194	4.4797	1194	4.4566	1243	2.8910	1244	2.9342	1245	2.9619	1294	2.0043				
CVS3-9	34.41	1344	20.304	1394	12.935	1394	13.421	1444	8.4467	1444	8.8713	1445	8.9926	1495	6.1577	1547	4.7568				
CVS3-10	30.851	1100	8.7279	1149	5.1042	1199	3.1373	1199	3.243	1249	2.1347	1249	2.1770	1249	2.2334	1299	1.5143				
CVS3-11	46.147	1094	24.927	1143	14.3	1193	8.5528	1193	8.6135	1243	5.5342	1243	5.6574	1244	5.7113	1294	3.7254	1344	2.5585		
CVS3-12	49.166	1344	27.706	1394	16.589	1394	17.232	1444	10.661	1445	11.222	1446	11.116	1496	7.9159	1547	5.5112				
CVS3-13	22.966	1194	18.479	1244	10.377	1244	10.693	1294	5.8297	1294	5.9205	1295	5.1114	1344	3.5689	1396	2.2744				
CVS3-14	30.65	1195	18.637	1244	11.358	1245	10.979	1294	7.0121	1295	6.7658	1295	7.0583	1345	4.5182	1395	3.1635				
CVS3-15	36.803	1244	21.621	1294	13.7240	1294	13.891	1343	8.6742	1344	8.9320	1345	8.9471	1394	6.1038	1445	4.1334				
CVS3-16	45.916	1345	38.751	1395	18.508	1395	20.473	1445	9.5335	1445	10.1660	1446	8.7654	1496	5.6558	1547	4.1209				
CVS3-17	32.075	1345	19.924	1395	12.056	1395	12.374	1444	7.5355	1445	7.4913	1446	7.4307	1496	5.0570	1547	4.2873				
CVS3-18	33.993	1294	19.3	1344	12.034	1344	12.29	1394	7.6358	1395	7.8165	1396	8.0123	1446	5.2551	1496	4.0831				
CVS3-19	23.382	1194	13.605	1244	8.5366	1244	8.6131	1294	5.5339	1294	5.6508	1295	5.6451	1345	3.8140	1395	2.6561				
CVS3-20	35.827	1295	80.0100	1345	24.316	1345	23.201	1395	11.687	1395	10.347	1396	5.7466	1446	5.1643	1496	2.3818				

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
CVS2-103					6.073	4.066	4.082	0.691	11.61	5.901	4.397	4.250	0.780	11.49		
CVS2-104					5.548	3.633	3.668	0.712	11.29	6.435	4.523	4.141	0.805	11.20		
CVS2-105					4.590	3.132	2.974	0.687	10.82	3.539	3.020	2.743	0.656	10.67		
CVS2-106					1.651	1.348	1.165	0.447	10.18	1.330	1.102	0.936	0.393	10.03		
CVS2-107					0.788	0.662	0.620	0.348	10.68	0.660	0.484	0.449	0.260	10.50		
CVS2-108					2.144	1.646	1.387	0.357	9.79	2.190	1.783	1.485	0.370	9.80		
CVS2-109					5.707	4.494	3.584	0.313	9.54	4.331	3.868	3.032	0.331	9.40		
CVS2-110					0.314	0.402	0.118	0.160	9.61	2.635	2.239	1.557	0.236	9.80		
CVS2-111					6.135	3.894	4.043	1.199	11.35	4.638	4.570	4.648	1.329	11.20		
CVS2-112					14.400	7.794	9.603	0.454	12.04	15.325	7.945	9.908	0.454	12.05		
CVS2-113					0.612	0.630	0.510	0.216	9.63	0.558	0.515	0.437	0.202	9.63		
CVS2-114					7.116	4.928	4.599	1.860	11.41	7.038	4.498	4.170	1.758	11.35		
CVS2-115					9.406	5.837	5.765	1.942	11.55	9.472	5.704	5.611	1.827	11.55		
CVS2-116					3.012	2.203	2.030	0.606	10.43	2.754	2.019	1.922	0.570	10.40		
CVS2-117					1.590	1.337	1.099	0.445	10.19	1.600	1.366	1.141	0.436	10.20		
CVS2-118					3.630	2.609	2.394	0.606	10.40	2.808	2.106	1.968	0.555	10.30		
CVS2-119					3.803	2.688	2.574	0.829	10.32	3.593	3.014	2.815	0.827	10.34		
CVS2-120					0.291	0.324	0.231	0.154	10.10	0.291	0.306	0.216	0.138	10.09		
CVS2-121					0.199	0.311	0.137	0.129	10.06	0.175	0.270	0.135	0.119	10.01		
CVS2-122					0.193	0.363	0.089	0.128	9.91	0.213	0.309	0.089	0.116	9.92		
CVS2-123					1.473	1.125	1.075	0.391	10.22	1.352	1.054	1.006	0.356	10.20		

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1					0.422	0.383	0.400	0.160	11.20	0.294	0.361	0.354	0.152	11.15		
CVS3-2					4.803	0.360	0.306	0.132	10.80	0.262	0.328	0.286	0.131	10.77		
CVS3-3					0.450	0.447	0.609	0.202	11.61	0.450	0.477	0.606	0.206	11.63		
CVS3-4					0.654	0.595	0.907	0.254	11.88	0.645	0.882	1.3555	0.3585	12.045		
CVS3-5					0.627	0.620	1.174	0.271	12.03	1.216	1.300	2.237	0.479	12.30		
CVS3-6					0.309	0.346	0.296	0.151	10.23	0.275	0.3055	0.2675	0.144	10.17		
CVS3-7					0.264	0.326	0.307	0.150	11.73	0.241	0.295	0.278	0.137	10.59		
CVS3-8					1.266	1.643	2.625	0.585	12.45	1.548	1.477	2.462	0.580	12.42		
CVS3-9					0.209	0.355	0.034	0.100	10.24	0.627	0.345	0.045	0.101	10.21		
CVS3-10					0.703	0.865	0.824	0.334	11.85		1.324	0.732	0.319	11.79		
CVS3-11					0.429	0.54	0.567	0.224	11.575		0.844	0.502	0.229	11.47		
CVS3-12					0.100	0.000	0.314	0.113	10.79	0.268		0.299	0.114	10.64		
CVS3-13					0.804	0.380	0.336	0.162	11.02	0.583	0.364	0.332	0.160	11.05		
CVS3-14					0.301	0.356	0.346	0.155	11.06	0.503	0.554	0.614	0.200	11.51		
CVS3-15					0.466	0.529	0.585	0.187	11.54	0.306	0.333	0.320	0.139	11.14		
CVS3-16					0.268	0.511	0.079	0.120	10.35	1.250	0.418	0.037	0.117	9.46		
CVS3-17					0.523	0.422	0.129	0.118	10.64	0.563	0.476	0.126	0.160	10.48		
CVS3-18					0.643	0.304	0.199	0.111	10.74	0.302	0.301	0.199	0.112	10.70		
CVS3-19					2.022	1.640	1.717	0.842	11.43	2.220	1.398	1.470	0.743	11.30		
CVS3-20					0.181	0.331	0.298	0.110	11.03	0.804	0.396	0.364	0.135	11.18		

Hanford CVS 2 (Hrma et al. 1994)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
CVS2-103												
CVS2-104												
CVS2-105												
CVS2-106												
CVS2-107												
CVS2-108												
CVS2-109												
CVS2-110												
CVS2-111												
CVS2-112												
CVS2-113												
CVS2-114												
CVS2-115												
CVS2-116												
CVS2-117												
CVS2-118												
CVS2-119												
CVS2-120												
CVS2-121												
CVS2-122												
CVS2-123												

Hanford CVS 3 (Vienna et al. 1996)

CVS3-1												
CVS3-2												
CVS3-3												
CVS3-4												
CVS3-5												
CVS3-6												
CVS3-7												
CVS3-8												
CVS3-9												
CVS3-10												
CVS3-11												
CVS3-12												
CVS3-13												
CVS3-14												
CVS3-15												
CVS3-16												
CVS3-17												
CVS3-18												
CVS3-19												
CVS3-20												

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
CVS3-21	0.0448	0.0004	0.0116	0.0626		0.0012	0.0263	0.0004	0.1135	0.0129	0.0073	0.4908	0.1200	0.0000	0.0000	0.0000	0.0126		0.0005		0.0155
CVS3-22	0.0468	0.0004	0.0121	0.0654		0.0013	0.0275	0.0005	0.1187	0.0135	0.0076	0.5131	0.0800	0.0000	0.0000	0.0000	0.0132		0.0005		0.0163
CVS3-23	0.0509	0.0005	0.0132	0.0711		0.0014	0.0299	0.0005	0.1290	0.0147	0.0083	0.5577	0.0000	0.0000	0.0000	0.0000	0.0144		0.0006		0.0177
CVS3-24	0.0453	0.0004	0.0117	0.0633		0.0019	0.0266	0.0004	0.1149	0.0199	0.0113	0.4966	0.0408	0.0000	0.0000	0.0000	0.0195		0.0008		0.0240
CVS3-25	0.0524	0.0005	0.0136	0.0732		0.0007	0.0307	0.0005	0.1328	0.0075	0.0042	0.5742	0.0471	0.0000	0.0000	0.0000	0.0073		0.0003		0.0090
CVS3-26	0.0235	0.1048	0.0082	0.0733		0.0000	0.0373	0.0084	0.1129	0.0060	0.0010	0.5328	0.0392	0.0000	0.0000	0.0010	0.0000		0.0065		0.0002
CVS3-27	0.0444	0.0004	0.0115	0.1500		0.0012	0.0260	0.0004	0.1125	0.0128	0.0072	0.4864	0.0399	0.0000	0.0000	0.0000	0.0125		0.0005		0.0154
CVS3-28	0.0472	0.0005	0.0122	0.0659		0.0013	0.0277	0.0005	0.1196	0.0136	0.0077	0.5170	0.0424	0.0000	0.0000	0.0000	0.0437		0.0005		0.0164
CVS3-29	0.0462	0.0005	0.0120	0.0645		0.0012	0.0271	0.0005	0.1171	0.0133	0.0075	0.5062	0.0416	0.0000	0.0000	0.0000	0.0637		0.0005		0.0160
CVS3-30	0.0437	0.0005	0.0113	0.0611		0.0012	0.0257	0.0004	0.1109	0.0126	0.0071	0.4792	0.0393	0.0000	0.0000	0.0000	0.1137		0.0005		0.0152
CVS3-31	0.0413	0.0004	0.0107	0.0576		0.0011	0.0242	0.0004	0.1046	0.0119	0.0067	0.4522	0.0371	0.0000	0.0000	0.0000	0.1637		0.0005		0.0143
CVS3-32	0.0452	0.0004	0.0117	0.0631		0.0012	0.0287	0.0004	0.1146	0.0130	0.0074	0.5306	0.0407	0.0000	0.0000	0.0000	0.0127		0.0005		0.0156
CVS3-33	0.0481	0.0005	0.0124	0.0672		0.0013	0.0305	0.0005	0.1219	0.0138	0.0078	0.5644	0.0432	0.0000	0.0000	0.0000	0.0135		0.0006		0.0166
CVS3-34	0.0467	0.0004	0.0121	0.0652		0.0013	0.0296	0.0005	0.1182	0.0134	0.0076	0.5475	0.0420	0.0000	0.0000	0.0000	0.0131		0.0005		0.0161
CVS3-35	0.0438	0.0004	0.0113	0.0611		0.0012	0.0277	0.0004	0.1109	0.0126	0.0071	0.5136	0.0394	0.0000	0.0000	0.0000	0.0123		0.0005		0.0152
CVS3-36	0.0423	0.0004	0.0110	0.0591		0.0011	0.0268	0.0004	0.1072	0.0122	0.0069	0.4966	0.0381	0.0000	0.0000	0.0000	0.0119		0.0005		0.0147
CVS3-37	0.0476	0.0005	0.0123	0.0665		0.0013	0.0279	0.0005	0.1206	0.0137	0.0300	0.5214	0.0428	0.0000	0.0000	0.0000	0.0134		0.0005		0.0165
CVS3-38	0.0466	0.0005	0.0121	0.0651		0.0013	0.0274	0.0005	0.1181	0.0134	0.0500	0.5107	0.0419	0.0000	0.0000	0.0000	0.0131		0.0005		0.0162
CVS3-39	0.0456	0.0005	0.0118	0.0637		0.0012	0.0268	0.0004	0.1156	0.0132	0.0700	0.4999	0.0410	0.0000	0.0000	0.0000	0.0129		0.0005		0.0158
CVS3-40	0.0447	0.0005	0.0116	0.0624		0.0012	0.0262	0.0004	0.1132	0.0129	0.0900	0.4892	0.0402	0.0000	0.0000	0.0000	0.0126		0.0005		0.0155

TRU Study (Crum et al. 1997)

TRU-BL-1	0.0230	0.0815	0.0098	0.0435		0.0027	0.0458	0.0026	0.1139	0.0007	0.0087	0.4676	0.1070	0.0002		0.0004	0.0542				0.0000
TRU-AZ-1	0.0300	0.0803	0.0096	0.0429		0.0027	0.0452	0.0026	0.1122	0.0007	0.0086	0.4606	0.1130	0.0002		0.0004	0.0533				0.0000
TRU-NL-1	0.0235	0.0834	0.0100	0.0446		0.0028	0.0100	0.0027	0.1300	0.0007	0.0089	0.4786	0.1095	0.0002		0.0005	0.0554				0.0000
TRU-AB-1	0.0400	0.1200	0.0092	0.0408		0.0025	0.0430	0.0025	0.1069	0.0006	0.0082	0.4386	0.1003	0.0002		0.0004	0.0508				0.0000
TRU-NB-1	0.0234	0.1000	0.0099	0.0444		0.0028	0.0467	0.0027	0.0800	0.0007	0.0089	0.4766	0.1090	0.0002		0.0004	0.0552				0.0000
TRU-ZN-1	0.0221	0.0785	0.0094	0.0419		0.0026	0.0441	0.0025	0.1300	0.0007	0.0084	0.4501	0.1200	0.0002		0.0004	0.0521				0.0000
TRU-ZB-1	0.0215	0.1200	0.0091	0.0408		0.0025	0.0429	0.0025	0.1067	0.0006	0.0082	0.4379	0.1200	0.0002		0.0004	0.0507				0.0000
TRU-ANZ-1	0.0400	0.0744	0.0089	0.0397		0.0025	0.0418	0.0024	0.1500	0.0006	0.0080	0.4267	0.1200	0.0002		0.0004	0.0494				0.0000
TRU-ABZ-1	0.0400	0.1000	0.0092	0.0409		0.0025	0.0430	0.0025	0.1069	0.0006	0.0082	0.4388	0.1200	0.0002		0.0004	0.0508				0.0000
TRU-NBZ-1	0.0227	0.0600	0.0097	0.0431		0.0027	0.0453	0.0026	0.1300	0.0007	0.0086	0.4625	0.1200	0.0002		0.0004	0.0536				0.0000
TRU-Al-1	0.0600	0.0784	0.0094	0.0419		0.0026	0.0441	0.0025	0.1096	0.0007	0.0084	0.4499	0.1029	0.0002		0.0004	0.0521				0.0000
TRU-Al-6	0.0400	0.0801	0.0096	0.0428		0.0027	0.0450	0.0026	0.1119	0.0007	0.0086	0.4595	0.1051	0.0002		0.0004	0.0532				0.0000

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
CVS3-21			0.0000	0.0049	0.0000	0.0000		0.0031					0.0024	0.0103			0.0004		0.0554	0.0000	
CVS3-22			0.0000	0.0051	0.0000	0.0000		0.0033					0.0025	0.0108			0.0004		0.0579	0.0000	
CVS3-23			0.0000	0.0055	0.0000	0.0000		0.0036					0.0028	0.0117			0.0005		0.0630	0.0000	
CVS3-24			0.0000	0.0075	0.0000	0.0000		0.0048					0.0038	0.0159			0.0006		0.0855	0.0000	
CVS3-25			0.0000	0.0028	0.0000	0.0000		0.0018					0.0014	0.0060			0.0002		0.0321	0.0000	
CVS3-26			0.0000	0.0013	0.0015	0.0016		0.0019					0.0155	0.0016			0.0031		0.0057	0.0000	
CVS3-27			0.0000	0.0048	0.0000	0.0000		0.0031					0.0024	0.0102			0.0004		0.0549	0.0000	
CVS3-28			0.0000	0.0051	0.0000	0.0000		0.0033					0.0026	0.0109			0.0004		0.0584	0.0000	
CVS3-29			0.0000	0.0050	0.0000	0.0000		0.0032					0.0025	0.0107			0.0004		0.0572	0.0000	
CVS3-30			0.0000	0.0048	0.0000	0.0000		0.0031					0.0024	0.0101			0.0004		0.0541	0.0000	
CVS3-31			0.0000	0.0045	0.0000	0.0000		0.0029					0.0022	0.0095			0.0004		0.0511	0.0000	
CVS3-32			0.0000	0.0049	0.0000	0.0000		0.0031					0.0024	0.0104			0.0004		0.0000	0.0000	
CVS3-33			0.0000	0.0052	0.0000	0.0000		0.0033					0.0026	0.0111			0.0004		0.0000	0.0000	
CVS3-34			0.0000	0.0051	0.0000	0.0000		0.0032					0.0025	0.0107			0.0004		0.0000	0.0000	
CVS3-35			0.0000	0.0048	0.0000	0.0000		0.0030					0.0024	0.0101			0.0004		0.0000	0.0000	
CVS3-36			0.0000	0.0046	0.0000	0.0000		0.0030					0.0023	0.0098			0.0004		0.0000	0.0000	
CVS3-37			0.0000	0.0052	0.0000	0.0000		0.0033					0.0026	0.0110			0.0004		0.0589	0.0000	
CVS3-38			0.0000	0.0051	0.0000	0.0000		0.0033					0.0025	0.0107			0.0004		0.0577	0.0000	
CVS3-39			0.0000	0.0050	0.0000	0.0000		0.0032					0.0025	0.0105			0.0004		0.0564	0.0000	
CVS3-40			0.0000	0.0049	0.0000	0.0000		0.0031					0.0024	0.0103			0.0004		0.0552	0.0000	

TRU Study (Crum et al. 1997)

TRU-BL-1			0.0000	0.0036		0.0002		0.0042					0.0108		0.0173					0.0012	
TRU-AZ-1			0.0000	0.0035		0.0002		0.0041					0.0106		0.0170					0.0011	
TRU-NL-1			0.0000	0.0037		0.0002		0.0043					0.0111		0.0177					0.0012	
TRU-AB-1			0.0000	0.0034		0.0002		0.0039					0.0101		0.0162					0.0011	
TRU-NB-1			0.0000	0.0037		0.0002		0.0043					0.0110		0.0176					0.0012	
TRU-ZN-1			0.0000	0.0035		0.0002		0.0040					0.0104		0.0167					0.0011	
TRU-ZB-1			0.0000	0.0034		0.0001		0.0039					0.0101		0.0162					0.0011	
TRU-ANZ-1			0.0000	0.0033		0.0001		0.0038					0.0099		0.0158					0.0010	
TRU-ABZ-1			0.0000	0.0034		0.0002		0.0039					0.0101		0.0162					0.0011	
TRU-NBZ-1			0.0000	0.0036		0.0002		0.0042					0.0107		0.0171					0.0011	
TRU-Al-1			0.0000	0.0035		0.0002		0.0040					0.0104		0.0166					0.0011	
TRU-Al-6			0.0000	0.0035		0.0002		0.0041					0.0106		0.0170					0.0011	

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
CVS3-21	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000
CVS3-22	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0020	0.0000		0.0000		0.0000
CVS3-23	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0021	0.0000		0.0000		0.0000
CVS3-24	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0029	0.0000		0.0000		0.0000
CVS3-25	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0011	0.0000		0.0000		0.0000
CVS3-26	0.0000		0.0019	0.0000			0.0000		0.0015	0.0000		0.0000	0.0000			0.0044	0.0000		0.0000		0.0000
CVS3-27	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000
CVS3-28	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0020	0.0000		0.0000		0.0000
CVS3-29	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000
CVS3-30	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0018	0.0000		0.0000		0.0000
CVS3-31	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0017	0.0000		0.0000		0.0000
CVS3-32	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000
CVS3-33	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0020	0.0000		0.0000		0.0000
CVS3-34	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000
CVS3-35	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0018	0.0000		0.0000		0.0000
CVS3-36	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0018	0.0000		0.0000		0.0000
CVS3-37	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0020	0.0000		0.0000		0.0000
CVS3-38	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0020	0.0000		0.0000		0.0000
CVS3-39	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000
CVS3-40	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0019	0.0000		0.0000		0.0000

TRU Study (Crum et al. 1997)

TRU-BL-1																	0.0006				
TRU-AZ-1																	0.0006				
TRU-NL-1																	0.0006				
TRU-AB-1																	0.0006				
TRU-NB-1																	0.0006				
TRU-ZN-1																	0.0006				
TRU-ZB-1																	0.0006				
TRU-ANZ-1																	0.0005				
TRU-ABZ-1																	0.0006				
TRU-NBZ-1																	0.0006				
TRU-Al-1																	0.0006				
TRU-Al-6																	0.0006				

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
CVS3-21			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-22			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-23			0.0000			0.0011	0.0000	0.0000		1.0000											
CVS3-24			0.0000			0.0015	0.0000	0.0000		1.0000											
CVS3-25			0.0000			0.0006	0.0000	0.0000		1.0000											
CVS3-26			0.0000			0.0000	0.0000	0.0049		1.0000											
CVS3-27			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-28			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-29			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-30			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-31			0.0000			0.0009	0.0000	0.0000		1.0000											
CVS3-32			0.0900			0.0010	0.0000	0.0000		1.0000											
CVS3-33			0.0320			0.0011	0.0000	0.0000		1.0000											
CVS3-34			0.0610			0.0010	0.0000	0.0000		1.0000											
CVS3-35			0.1190			0.0010	0.0000	0.0000		1.0000											
CVS3-36			0.1480			0.0009	0.0000	0.0000		1.0000											
CVS3-37			0.0000			0.0011	0.0000	0.0000		1.0000											
CVS3-38			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-39			0.0000			0.0010	0.0000	0.0000		1.0000											
CVS3-40			0.0000			0.0010	0.0000	0.0000		1.0000											

TRU Study (Crum et al. 1997)

TRU-BL-1								0.0005		1.0000											
TRU-AZ-1								0.0005		1.0000											
TRU-NL-1								0.0005		1.0000											
TRU-AB-1								0.0005		1.0000											
TRU-NB-1								0.0005		1.0000											
TRU-ZN-1								0.0005		1.0000											
TRU-ZB-1								0.0005		1.0000											
TRU-ANZ-1								0.0005		1.0000											
TRU-ABZ-1								0.0005		1.0000											
TRU-NBZ-1								0.0005		1.0000											
TRU-Al-1								0.0005		1.0000											
TRU-Al-6								0.0005		1.0000											

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
CVS3-21																					
CVS3-22																					
CVS3-23																					
CVS3-24																					
CVS3-25																					
CVS3-26																					
CVS3-27																					
CVS3-28																					
CVS3-29																					
CVS3-30																					
CVS3-31																					
CVS3-32																					
CVS3-33																					
CVS3-34																					
CVS3-35																					
CVS3-36																					
CVS3-37																					
CVS3-38																					
CVS3-39																					
CVS3-40																					

TRU Study (Crum et al. 1997)

TRU-BL-1																					
TRU-AZ-1																					
TRU-NL-1																					
TRU-AB-1																					
TRU-NB-1																					
TRU-ZN-1																					
TRU-ZB-1																					
TRU-ANZ-1																					
TRU-ABZ-1																					
TRU-NBZ-1																					
TRU-Al-1																					
TRU-Al-6																					

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
CVS3-21																					
CVS3-22																					
CVS3-23																					
CVS3-24																					
CVS3-25																					
CVS3-26																					
CVS3-27																					
CVS3-28																					
CVS3-29																					
CVS3-30																					
CVS3-31																					
CVS3-32																					
CVS3-33																					
CVS3-34																					
CVS3-35																					
CVS3-36																					
CVS3-37																					
CVS3-38																					
CVS3-39																					
CVS3-40																					

TRU Study (Crum et al. 1997)

TRU-BL-1																					
TRU-AZ-1																					
TRU-NL-1																					
TRU-AB-1																					
TRU-NB-1																					
TRU-ZN-1																					
TRU-ZB-1																					
TRU-ANZ-1																					
TRU-ABZ-1																					
TRU-NBZ-1																					
TRU-Al-1																					
TRU-Al-6																					

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
CVS3-21																				
CVS3-22																				
CVS3-23																				
CVS3-24																				
CVS3-25																				
CVS3-26																				
CVS3-27																				
CVS3-28																				
CVS3-29																				
CVS3-30																				
CVS3-31																				
CVS3-32																				
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CVS3-34																				
CVS3-35																				
CVS3-36																				
CVS3-37																				
CVS3-38																				
CVS3-39																				
CVS3-40																				

TRU Study (Crum et al. 1997)

TRU-BL-1																				
TRU-AZ-1																				
TRU-NL-1																				
TRU-AB-1																				
TRU-NB-1																				
TRU-ZN-1																				
TRU-ZB-1																				
TRU-ANZ-1																				
TRU-ABZ-1																				
TRU-NBZ-1																				
TRU-Al-1																				
TRU-Al-6																				

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
CVS3-21			1400	zircon	.32% same as 3-20			
CVS3-22			1177	spinel	No XL			
CVS3-23			1122	spinel	No XL			
CVS3-24			1127	spinel	very small particles inhomo	spinel	amorphous	
CVS3-25			1150	spinel	No XL			
CVS3-26			1047	spinel				
CVS3-27			1285	spinel	scattered spinel			
CVS3-28			1141	spinel	No XL			
CVS3-29			1136	spinel	No XL			
CVS3-30			1121	spinel	No XL			
CVS3-31			1109	spinel	No XL			
CVS3-32							amorphous	
CVS3-33							amorphous	
CVS3-34							amorphous	
CVS3-35							amorphous	
CVS3-36							amorphous	
CVS3-37			1175	spinel	No XL		amorphous	
CVS3-38			1171	spinel	No XL		1 vol% XL, NaNdPO4	
CVS3-39			1168	spinel	No XL		3 vol% XL, NaNdPO4	
CVS3-40			1198	Zr Re Oy	No XL	phase separated	7 vol% XL, NaNdPO4	

TRU Study (Crum et al. 1997)

TRU-BL-1			1012	Zircon				
TRU-AZ-1			1065	Zircon				
TRU-NL-1			1095	Zircon				
TRU-AB-1			1056	Zircon				
TRU-NB-1			1161	Zircon				
TRU-ZN-1			988	Zircon				
TRU-ZB-1			1094	Zircon				
TRU-ANZ-1			1032	Zircon				
TRU-ABZ-1			1151	Zircon				
TRU-NBZ-1			1010	Zircon				
TRU-Al-1			1196	ZrO2				
TRU-Al-6			1069	Zircon				

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
CVS3-21	3.6% XL more than one phase	Zr, spinel, hiCr spinel (spinel in Zr interstecies) streaks of Cr rich area	10 vol% XL, 60w% ZrO2, 40w% sp		
CVS3-22	1.6% XL same as 3-21				
CVS3-23	few tiny XL				
CVS3-24	3.4% XL many phase inhomo	(Si, Ca, Nd, Ce), hiCr sp, spinel	5% Sp		
CVS3-25	No XL				
CVS3-26					
CVS3-27	Lots of colorful flowers and Botom agglom of XL	hiCr sp, spinel, (Nd, Si, Ca, Ce),	10vol% XL, 70wt% Spinel, 30wt% Ca5((Si,P,S)O4)3F		
CVS3-28	<0.01 vol% sp	star shaped sp (Cr, Ni, Fe, Mn)	Amorphous		
CVS3-29	<0.01 vol% sp	star shaped sp (Cr, Ni, Fe, Mn)	Amorphous		
CVS3-30	<0.01 vol% sp	star shaped sp (Cr, Ni, Fe, Mn)	Amorphous		
CVS3-31	few tiny XL	cube shaped sp (Cr, Ni mostly)	Amorphous		
CVS3-32			Amorphous		
CVS3-33			Amorphous		
CVS3-34			small amt of Al2O3, cp		
CVS3-35			small amt of Ce2O3 and cp		
CVS3-36			cp, CeO2 type crystals		
CVS3-37	<0.01 vol%	sp (Cr, Ni, Fe, Mn)	2 vol% XL, Na3Nd(PO4)2, Li3PO4, NdPO4		
CVS3-38	0.21 vol%	Phase separated region of NaCaNdCeFe, sp, possible Li3PO4	8 vol% XL, Na3Nd(PO4)2, Li3PO4, NdPO4, sp		
CVS3-39	1.58 vol%	Phase separated region of NaCaNdLaCeFePNi, sp, possible Li3PO4	17 vol% XL, Na3Nd(PO4)2, Li3PO4, NdPO4, sp		
CVS3-40	3.19 vol%	Phase separated region of NaNdCaPFe, sp, possible Li3PO4	22 vol% XL, Na3Nd(PO4)2, Li3PO4, NdPO4, sp		

TRU Study (Crum et al. 1997)

TRU-BL-1					
TRU-AZ-1					
TRU-NL-1					
TRU-AB-1					
TRU-NB-1					
TRU-ZN-1					
TRU-ZB-1					
TRU-ANZ-1					
TRU-ABZ-1					
TRU-NBZ-1					
TRU-Al-1					
TRU-Al-6					

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
CVS3-21							-14.540	26635.5	65.23				1144	73.108	1195
CVS3-22			-6.41	7887.1	655.4		-13.330	24483.5	48.21				1094	106.9	1144
CVS3-23			-6.13	8624.7	513		-10.230	19285.4	27.73				1144	30.252	1194
CVS3-24			-10.59	17178	188.2		-12.460	22463.8	27.83				1093	54.8630	1144
CVS3-25			-6.4	9108.6	547		-10.890	21058.0	49.81				1193	33.2710	1244
CVS3-26															
CVS3-27							-12.300	22012.2	23.78				1094	43.412	1144
CVS3-28			-5.28	6550.7	671.7		-11.730	21601.3	31.50				1093	63.952	1144
CVS3-29			-5.73	7242.1	623.2		-11.620	21281.6	28.09				1093	55.661	1144
CVS3-30			-5.15	6062.3	677		-12.090	21496.7	20.42				1043	76.066	1093
CVS3-31			-6.05	7152.5	601.3		-12.850	22130.1	14.91				993	110.8590	1043
CVS3-32			-4.86	5810.8	762.6		-12.060	22652.7	47.42				1160	45.21	1241
CVS3-33			-4.05	4904.8	816.2		-11.700	22277.1	52.20				1162	48.4700	1234
CVS3-34			-2.26	2504.3	1035.1		-12.320	23248.5	55.57				1160	56.8020	1243
CVS3-35			-3.44	3717.8	917.3		-12.530	23315.2	47.21				1136.5	60.795	1242
CVS3-36			-1.58	1563.1	1154.7		-10.750	20346.7	34.76				(1136.5)	94.1288	1243
CVS3-37			-6.25	8214.7	606.9		-11.860	22236.4	43.23				1144	48.668	1194
CVS3-38			-6.4	8599.9	590		-11.900	22463.8	48.73				1144	54.859	1194
CVS3-39			-4.46	5383.3	795.1		-12.000	22833.0	57.15				1144	66.2050	1194
CVS3-40			-5.8	7434.1	687.1		-12.190	23294.0	65.34				1194	42.0180	1245

TRU Study (Crum et al. 1997)

TRU-BL-1															
TRU-AZ-1															
TRU-NL-1															
TRU-AB-1															
TRU-NB-1															
TRU-ZN-1															
TRU-ZB-1															
TRU-ANZ-1															
TRU-ABZ-1															
TRU-NBZ-1															
TRU-Al-1															
TRU-Al-6															

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
CVS3-21	32.159	1245	21.558	1294	12.44	1295	11.883	1344	6.7220	1345	7.1756	1346	6.1095	1395	4.1889	1446	2.5708				
CVS3-22	51.787	1195	27.589	1244	15.097	1294	9.2201	1295	9.4172	1344	5.9037	1345	6.0961	1345	6.1269	1395	3.9640	1446	2.7156		
CVS3-23	18.578	1244	11.646	1294	7.5975	1294	7.7946	1344	5.2110	1345	5.4496	1345	5.5727	1396	3.8101	1446	2.7525				
CVS3-24	29.055	1194	17.379	1244	10.373	1244	10.615	1294	6.3655	1295	6.5503	1295	6.3732	1345	4.1257	1396	2.7741				
CVS3-25	19.924	1293	12.738	1343	8.1889	1344	8.2799	1393	5.6497	1394	5.7267	1394	5.6728	1444	3.9025	1495	2.9126				
CVS3-26																					
CVS3-27	23.025	1195	16.413	1244	9.7660	1245	9.4476	1295	5.5189	1295	5.7190	1296	5.2648	1345	3.5946	1396	2.3676				
CVS3-28	33.534	1194	19.153	1244	11.928	1244	12.034	1293	7.6358	1294	7.6509	1295	7.6057	1344	5.2702	1395	3.6597				
CVS3-29	29.98	1194	17.1000	1244	10.633	1244	10.799	1294	6.9034	1294	6.9942	1295	6.9488	1345	4.8543	1395	3.2665				
CVS3-30	38.35	1143	20.972	1193	12.6510	1193	12.787	1243	7.8165	1243	7.9069	1245	7.8617	1294	5.1190	1344	3.7201				
CVS3-31	52.279	1093	27.425	1142	15.37	1143	15.135	1192	9.2624	1193	9.1569	1194	9.2774	1243	5.8902	1294	3.8638				
CVS3-32	17.379	1289	11	1289	11.034	1337	7.3502	1338	7.4016	1338	7.4701	1424	3.8293								
CVS3-33	21.132	1281	13.021	1281	13.484	1329	8.7722	1329	9.1663	1330	9.2862	1401	5.2342								
CVS3-34	18.943	1289	11.993	1290	11.925	1336	7.6843	1337	7.9670	1338	9.2520	1425	4.5061								
CVS3-35	16.187	1289	10.3200	1289	10.357	1336	6.8619	1337	6.8048	1338	6.9190	1424	3.8087								
CVS3-36	15.129	1289	9.7488	1290	9.6632	1336	6.4078	1338	6.3479	1339	6.3564	1424	3.6494								
CVS3-37	27.483	1244	15.575	1294	10.061	1295	9.8497	1377	6.3137	1345	6.6237	1346	6.6615	1396	4.4158	1446	3.0774				
CVS3-38	30.554	1244	17.3640	1294	11.13	1295	10.9040	1344	7.0395	1345	7.3117	1346	7.3269	1396	4.8619	1446	3.3421				
CVS3-39	35.4260	1244	20.0920	1294	12.4400	1294	12.6360	1344	7.9220	1344	8.0880	1345	8.0270	1396	5.4590	1446	4.0000				
CVS3-40	23.0540	1295	14.0670	1295	14.1720	1344	8.7200	1345	8.9160	1346	8.9910	1396	5.9810	1447	4.0230						

TRU Study (Crum et al. 1997)

TRU-BL-1																					
TRU-AZ-1																					
TRU-NL-1																					
TRU-AB-1																					
TRU-NB-1																					
TRU-ZN-1																					
TRU-ZB-1																					
TRU-ANZ-1																					
TRU-ABZ-1																					
TRU-NBZ-1																					
TRU-Al-1																					
TRU-Al-6																					

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
CVS3-21					0.196	0.301	0.254	0.097	11.03	0.530	0.359	0.322	0.124	11.14		
CVS3-22					0.324	0.310	0.303	0.119	11.07	0.432	0.330	0.303	0.118	10.97		
CVS3-23					0.402	0.502	0.562	0.232	11.28	0.515	0.481	0.528	0.228	11.17		
CVS3-24					0.261	0.355	0.380	0.151	11.07	0.362	0.356	0.342	0.155	10.97		
CVS3-25					0.209	0.384	0.420	0.161	11.26	0.338	0.368	0.382	0.156	11.18		
CVS3-26																
CVS3-27					0.342	0.358	0.329	0.157	10.98	0.704	0.395	0.391	0.159	11.15		
CVS3-28					0.305	0.382	0.400	0.160	11.21	1.094	0.365	0.366	0.157	11.09		
CVS3-29					0.241	0.411	0.432	0.189	11.22	0.531	0.376	0.381	0.155	11.16		
CVS3-30					0.338	0.397	0.420	0.183	11.23	0.463	0.385	0.379	0.159	11.03		
CVS3-31					0.261	0.451	0.465	0.202	11.25	2.311	0.382	0.376	0.156	11.05		
CVS3-32					0.487	0.370	0.326	0.159	10.88	0.412	0.367	0.289	0.155	10.84		
CVS3-33					0.403	0.338	0.335	0.149	10.95	0.368	0.334	0.299	0.144	10.87		
CVS3-34					0.411	0.357	0.331	0.154	10.89	0.394	0.369	0.297	0.151	10.88		
CVS3-35					0.422	0.395	0.325	0.163	10.78	0.441	0.468	0.343	1.740	10.94		
CVS3-36					0.543	0.393	0.304	0.165	10.80	0.523	0.458	0.313	0.174	10.88		
CVS3-37					0.547	0.188	0.370	0.151	10.52	0.294	0.354	0.361	0.152	10.96		
CVS3-38					0.418	0.292	0.327	0.147	11.03	0.370	0.326	0.283	0.120	10.90		
CVS3-39					0.209	0.234	0.252	0.121	10.81	0.242	0.681	0.286	0.130	10.89		
CVS3-40					0.225	0.205	0.248	0.141	10.59	0.290	1.055	0.359	0.168	10.72		

TRU Study (Crum et al. 1997)

TRU-BL-1																
TRU-AZ-1																
TRU-NL-1																
TRU-AB-1																
TRU-NB-1																
TRU-ZN-1																
TRU-ZB-1																
TRU-ANZ-1																
TRU-ABZ-1																
TRU-NBZ-1																
TRU-Al-1																
TRU-Al-6																

Hanford CVS 3 (Vienna et al. 1996)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
CVS3-21												
CVS3-22												
CVS3-23												
CVS3-24												
CVS3-25												
CVS3-26												
CVS3-27												
CVS3-28												
CVS3-29												
CVS3-30												
CVS3-31												
CVS3-32												
CVS3-33												
CVS3-34												
CVS3-35												
CVS3-36												
CVS3-37												
CVS3-38												
CVS3-39												
CVS3-40												

TRU Study (Crum et al. 1997)

TRU-BL-1												
TRU-AZ-1												
TRU-NL-1												
TRU-AB-1												
TRU-NB-1												
TRU-ZN-1												
TRU-ZB-1												
TRU-ANZ-1												
TRU-ABZ-1												
TRU-NBZ-1												
TRU-Al-1												
TRU-Al-6												

TRU Study (Crum et al. 1997)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
TRU-B-1	0.0250	0.0000	0.0106	0.0474		0.0029	0.0499	0.0029	0.1240	0.0007	0.0095	0.5091	0.1165	0.0002		0.0005	0.0590				0.0000
TRU-B-2	0.0245	0.0200	0.0104	0.0465		0.0029	0.0489	0.0028	0.1216	0.0007	0.0093	0.4989	0.1141	0.0002		0.0005	0.0578				0.0000
TRU-B-3	0.0238	0.0500	0.0101	0.0450		0.0028	0.0474	0.0027	0.1178	0.0007	0.0090	0.4836	0.1106	0.0002		0.0005	0.0560				0.0000
TRU-B-4	0.0220	0.1200	0.0094	0.0417		0.0026	0.0439	0.0025	0.1091	0.0007	0.0083	0.4480	0.1025	0.0002		0.0004	0.0519				0.0000
TRU-B-5	0.0248	0.0100	0.0105	0.0469		0.0029	0.0494	0.0028	0.1228	0.0007	0.0094	0.5040	0.1153	0.0002		0.0005	0.0584				0.0000
TRU-Bi-1	0.0243	0.0862	0.0103	0.0460		0.0029	0.0485	0.0028	0.1204	0.0007	0.0092	0.4944	0.1131	0.0002		0.0005	0.0000				0.0000
TRU-Bi-2	0.0237	0.0840	0.0101	0.0449		0.0028	0.0473	0.0027	0.1174	0.0007	0.0090	0.4820	0.1103	0.0002		0.0005	0.0250				0.0000
TRU-Bi-3	0.0225	0.0797	0.0096	0.0426		0.0026	0.0448	0.0026	0.1114	0.0007	0.0085	0.4573	0.1046	0.0002		0.0004	0.0750				0.0000
TRU-Bi-4	0.0219	0.0776	0.0093	0.0414		0.0026	0.0436	0.0025	0.1084	0.0006	0.0083	0.4449	0.1018	0.0002		0.0004	0.1000				0.0000
TRU-Ce-1	0.0226	0.0803	0.0096	0.0429		0.0027	0.0452	0.0026	0.1122	0.0007	0.0086	0.4606	0.1054	0.0002		0.0004	0.0533				0.0150
TRU-Ce-2	0.0223	0.0791	0.0095	0.0422		0.0026	0.0445	0.0026	0.1105	0.0007	0.0085	0.4536	0.1038	0.0002		0.0004	0.0525				0.0300
TRU-Ce-3	0.0219	0.0778	0.0093	0.0416		0.0026	0.0438	0.0025	0.1088	0.0006	0.0083	0.4466	0.1022	0.0002		0.0004	0.0517				0.0450
TRU-Li-1	0.0241	0.0854	0.0102	0.0456		0.0028	0.0000	0.0028	0.1194	0.0007	0.0091	0.4901	0.1121	0.0002		0.0005	0.0568				0.0000
TRU-Li-2	0.0237	0.0841	0.0101	0.0450		0.0028	0.0150	0.0027	0.1176	0.0007	0.0090	0.4827	0.1104	0.0002		0.0005	0.0559				0.0000
TRU-Li-3	0.0234	0.0829	0.0099	0.0443		0.0027	0.0300	0.0027	0.1158	0.0007	0.0089	0.4754	0.1087	0.0002		0.0004	0.0551				0.0000
TRU-Li-4	0.0226	0.0803	0.0096	0.0429		0.0027	0.0600	0.0026	0.1122	0.0007	0.0086	0.4607	0.1054	0.0002		0.0004	0.0534				0.0000
TRU-Na-1	0.0248	0.0878	0.0105	0.0469		0.0029	0.0494	0.0028	0.0450	0.0007	0.0094	0.5040	0.1153	0.0002		0.0005	0.0584				0.0000
TRU-Na-2	0.0241	0.0855	0.0102	0.0457		0.0028	0.0481	0.0028	0.0700	0.0007	0.0091	0.4908	0.1123	0.0002		0.0005	0.0568				0.0000
TRU-Na-3	0.0235	0.0832	0.0100	0.0445		0.0028	0.0468	0.0027	0.0950	0.0007	0.0089	0.4776	0.1093	0.0002		0.0004	0.0553				0.0000
TRU-Na-4	0.0226	0.0800	0.0096	0.0428		0.0027	0.0450	0.0026	0.1300	0.0007	0.0086	0.4591	0.1050	0.0002		0.0004	0.0532				0.0000
TRU-P-1	0.0227	0.0806	0.0097	0.0430		0.0027	0.0453	0.0026	0.1126	0.0007	0.0200	0.4623	0.1058	0.0002		0.0004	0.0535				0.0000
TRU-P-2	0.0225	0.0798	0.0096	0.0426		0.0026	0.0449	0.0026	0.1115	0.0007	0.0300	0.4576	0.1047	0.0002		0.0004	0.0530				0.0000
TRU-P-3	0.0222	0.0789	0.0095	0.0422		0.0026	0.0444	0.0026	0.1103	0.0007	0.0400	0.4528	0.1036	0.0002		0.0004	0.0524				0.0000
TRU-P-4	0.0220	0.0781	0.0094	0.0417		0.0026	0.0439	0.0025	0.1092	0.0007	0.0500	0.4481	0.1025	0.0002		0.0004	0.0519				0.0000
TRU-Si-1	0.0255	0.0903	0.0108	0.0483		0.0030	0.0508	0.0029	0.1263	0.0008	0.0097	0.4100	0.1185	0.0002		0.0005	0.0600				0.0000
TRU-Si-2	0.0207	0.0735	0.0088	0.0393		0.0024	0.0413	0.0024	0.1027	0.0006	0.0079	0.5200	0.0964	0.0002		0.0004	0.0488				0.0000
TRU-Si-3	0.0272	0.0964	0.0115	0.0515		0.0032	0.0543	0.0031	0.1348	0.0008	0.0103	0.3700	0.1266	0.0002		0.0005	0.0641				0.0000
TRU-Si-4	0.0186	0.0658	0.0079	0.0352		0.0022	0.0370	0.0021	0.0920	0.0005	0.0070	0.5700	0.0864	0.0002		0.0004	0.0437				0.0000
TRU-Zr-1	0.0237	0.0840	0.0101	0.0449		0.0028	0.0472	0.0027	0.1174	0.0007	0.0090	0.4817	0.0800	0.0002		0.0005	0.0558				0.0000
TRU-Zr-2	0.0226	0.0803	0.0096	0.0429		0.0027	0.0452	0.0026	0.1123	0.0007	0.0086	0.4608	0.1200	0.0002		0.0004	0.0534				0.0000
TRU-Zr-3	0.0221	0.0785	0.0094	0.0419		0.0026	0.0442	0.0025	0.1097	0.0007	0.0084	0.4503	0.1400	0.0002		0.0004	0.0522				0.0000
TRU-Zr-4	0.0216	0.0767	0.0092	0.0410		0.0025	0.0431	0.0025	0.1072	0.0006	0.0082	0.4398	0.1600	0.0002		0.0004	0.0509				0.0000

Zr Study (Vienna et al. 1999)

Zr-1	0.0450	0.1000	0.0009			0.0042	0.0750		0.1100		0.0021	0.5114	0.1500							0.0002	
Zr-2	0.0450	0.1000	0.0008			0.0038	0.0750		0.1116		0.0019	0.5256	0.1350							0.0002	
Zr-3	0.0450	0.1000	0.0009			0.0047	0.0750		0.1084		0.0023	0.4971	0.1650							0.0002	
Zr-4	0.0300	0.1000	0.0009			0.0042	0.0750		0.1083		0.0021	0.5281	0.1500							0.0002	
Zr-5	0.0600	0.1000	0.0009			0.0042	0.0750		0.1118		0.0021	0.4946	0.1500							0.0002	
Zr-6	0.0450	0.1000	0.0009			0.0042	0.0750		0.1100		0.0021	0.5114	0.1500							0.0002	
Zr-7	0.0450	0.0500	0.0009			0.0042	0.0750		0.1480		0.0021	0.5234	0.1500							0.0002	
Zr-8	0.0450	0.1500	0.0009			0.0042	0.0750		0.0721		0.0021	0.4993	0.1500							0.0002	
Zr-9	0.0450	0.1000	0.0009			0.0042	0.0600		0.1425		0.0021	0.4939	0.1500							0.0002	
Zr-10	0.0450	0.1000	0.0009			0.0042	0.0750		0.1100		0.0021	0.5114	0.1500							0.0002	
Zr-11	0.0450	0.1000	0.0009			0.0042	0.0900		0.0776		0.0021	0.5288	0.1500							0.0002	
Zr-12	0.0600	0.1500	0.0009			0.0047	0.0900		0.0398		0.0023	0.4858	0.1650							0.0002	
Zr-13	0.0600	0.1500	0.0009			0.0047	0.0600		0.1046		0.0023	0.4509	0.1650							0.0002	
Zr-14	0.0600	0.0500	0.0009			0.0047	0.0900		0.1157		0.0023	0.5098	0.1650							0.0002	
Zr-15	0.0600	0.0500	0.0009			0.0047	0.0600		0.1805		0.0023	0.4750	0.1650							0.0002	

TRU Study (Crum et al. 1997)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
TRU-B-1			0.0000	0.0039		0.0002		0.0046					0.0118		0.0188					0.0013	
TRU-B-2			0.0000	0.0038		0.0002		0.0045					0.0115		0.0185					0.0012	
TRU-B-3			0.0000	0.0037		0.0002		0.0043					0.0112		0.0179					0.0012	
TRU-B-4			0.0000	0.0034		0.0002		0.0040					0.0103		0.0166					0.0011	
TRU-B-5			0.0000	0.0039		0.0002		0.0045					0.0116		0.0186					0.0012	
TRU-Bi-1			0.0000	0.0038		0.0002		0.0044					0.0114		0.0183					0.0012	
TRU-Bi-2			0.0000	0.0037		0.0002		0.0043					0.0111		0.0178					0.0012	
TRU-Bi-3			0.0000	0.0035		0.0002		0.0041					0.0106		0.0169					0.0011	
TRU-Bi-4			0.0000	0.0034		0.0002		0.0040					0.0103		0.0165					0.0011	
TRU-Ce-1			0.0000	0.0035		0.0002		0.0041					0.0106		0.0170					0.0011	
TRU-Ce-2			0.0000	0.0035		0.0002		0.0041					0.0105		0.0168					0.0011	
TRU-Ce-3			0.0000	0.0034		0.0002		0.0040					0.0103		0.0165					0.0011	
TRU-Li-1			0.0000	0.0038		0.0002		0.0044					0.0113		0.0181					0.0012	
TRU-Li-2			0.0000	0.0037		0.0002		0.0043					0.0111		0.0179					0.0012	
TRU-Li-3			0.0000	0.0037		0.0002		0.0043					0.0110		0.0176					0.0012	
TRU-Li-4			0.0000	0.0035		0.0002		0.0041					0.0106		0.0170					0.0011	
TRU-Na-1			0.0000	0.0039		0.0002		0.0045					0.0116		0.0186					0.0012	
TRU-Na-2			0.0000	0.0038		0.0002		0.0044					0.0113		0.0182					0.0012	
TRU-Na-3			0.0000	0.0037		0.0002		0.0043					0.0110		0.0177					0.0012	
TRU-Na-4			0.0000	0.0035		0.0002		0.0041					0.0106		0.0170					0.0011	
TRU-P-1			0.0000	0.0036		0.0002		0.0042					0.0107		0.0171					0.0011	
TRU-P-2			0.0000	0.0035		0.0002		0.0041					0.0106		0.0169					0.0011	
TRU-P-3			0.0000	0.0035		0.0002		0.0041					0.0105		0.0168					0.0011	
TRU-P-4			0.0000	0.0035		0.0002		0.0040					0.0104		0.0166					0.0011	
TRU-Si-1			0.0000	0.0040		0.0002		0.0047					0.0120		0.0192					0.0013	
TRU-Si-2			0.0000	0.0032		0.0001		0.0038					0.0097		0.0156					0.0010	
TRU-Si-3			0.0000	0.0043		0.0002		0.0050					0.0128		0.0205					0.0014	
TRU-Si-4			0.0000	0.0029		0.0001		0.0034					0.0087		0.0140					0.0009	
TRU-Zr-1			0.0000	0.0037		0.0002		0.0043					0.0111		0.0178					0.0012	
TRU-Zr-2			0.0000	0.0035		0.0002		0.0041					0.0106		0.0170					0.0011	
TRU-Zr-3			0.0000	0.0035		0.0002		0.0040					0.0104		0.0167					0.0011	
TRU-Zr-4			0.0000	0.0034		0.0002		0.0040					0.0102		0.0163					0.0011	

Zr Study (Vienna et al. 1999)

Zr-1					0.0004					0.0007											
Zr-2					0.0004					0.0006											
Zr-3					0.0005					0.0008											
Zr-4					0.0004					0.0007											
Zr-5					0.0004					0.0007											
Zr-6					0.0004					0.0007											
Zr-7					0.0004					0.0007											
Zr-8					0.0004					0.0007											
Zr-9					0.0004					0.0007											
Zr-10					0.0004					0.0007											
Zr-11					0.0004					0.0007											
Zr-12					0.0005					0.0008											
Zr-13					0.0005					0.0008											
Zr-14					0.0005					0.0008											
Zr-15					0.0005					0.0008											

TRU Study (Crum et al. 1997)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
TRU-B-1																	0.0007				
TRU-B-2																	0.0006				
TRU-B-3																	0.0006				
TRU-B-4																	0.0006				
TRU-B-5																	0.0006				
TRU-Bi-1																	0.0006				
TRU-Bi-2																	0.0006				
TRU-Bi-3																	0.0006				
TRU-Bi-4																	0.0006				
TRU-Ce-1																	0.0006				
TRU-Ce-2																	0.0006				
TRU-Ce-3																	0.0006				
TRU-Li-1																	0.0006				
TRU-Li-2																	0.0006				
TRU-Li-3																	0.0006				
TRU-Li-4																	0.0006				
TRU-Na-1																	0.0006				
TRU-Na-2																	0.0006				
TRU-Na-3																	0.0006				
TRU-Na-4																	0.0006				
TRU-P-1																	0.0006				
TRU-P-2																	0.0006				
TRU-P-3																	0.0006				
TRU-P-4																	0.0006				
TRU-Si-1																	0.0007				
TRU-Si-2																	0.0005				
TRU-Si-3																	0.0007				
TRU-Si-4																	0.0005				
TRU-Zr-1																	0.0006				
TRU-Zr-2																	0.0006				
TRU-Zr-3																	0.0006				
TRU-Zr-4																	0.0006				

Zr Study (Vienna et al. 1999)

Zr-1																	0.0001				
Zr-2																	0.0001				
Zr-3																	0.0001				
Zr-4																	0.0001				
Zr-5																	0.0001				
Zr-6																	0.0001				
Zr-7																	0.0001				
Zr-8																	0.0001				
Zr-9																	0.0001				
Zr-10																	0.0001				
Zr-11																	0.0001				
Zr-12																	0.0001				
Zr-13																	0.0001				
Zr-14																	0.0001				
Zr-15																	0.0001				

TRU Study (Crum et al. 1997)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
TRU-B-1								0.0006		1.0000											
TRU-B-2								0.0006		1.0000											
TRU-B-3								0.0005		1.0000											
TRU-B-4								0.0005		1.0000											
TRU-B-5								0.0006		1.0000											
TRU-Bi-1								0.0005		1.0000											
TRU-Bi-2								0.0005		1.0000											
TRU-Bi-3								0.0005		1.0000											
TRU-Bi-4								0.0005		1.0000											
TRU-Ce-1								0.0005		1.0000											
TRU-Ce-2								0.0005		1.0000											
TRU-Ce-3								0.0005		1.0000											
TRU-Li-1								0.0005		1.0000											
TRU-Li-2								0.0005		1.0000											
TRU-Li-3								0.0005		1.0000											
TRU-Li-4								0.0005		1.0000											
TRU-Na-1								0.0006		1.0000											
TRU-Na-2								0.0005		1.0000											
TRU-Na-3								0.0005		1.0000											
TRU-Na-4								0.0005		1.0000											
TRU-P-1								0.0005		1.0000											
TRU-P-2								0.0005		1.0000											
TRU-P-3								0.0005		1.0000											
TRU-P-4								0.0005		1.0000											
TRU-Si-1								0.0006		1.0000											
TRU-Si-2								0.0005		1.0000											
TRU-Si-3								0.0006		1.0000											
TRU-Si-4								0.0004		1.0000											
TRU-Zr-1								0.0005		1.0000											
TRU-Zr-2								0.0005		1.0000											
TRU-Zr-3								0.0005		1.0000											
TRU-Zr-4								0.0005		1.0000											

Zr Study (Vienna et al. 1999)

Zr-1										1.0000											
Zr-2										1.0000											
Zr-3										1.0000											
Zr-4										1.0000											
Zr-5										1.0000											
Zr-6										1.0000											
Zr-7										1.0000											
Zr-8										1.0000											
Zr-9										1.0000											
Zr-10										1.0000											
Zr-11										1.0000											
Zr-12										1.0001											
Zr-13										1.0000											
Zr-14										1.0000											
Zr-15										1.0000											

TRU Study (Crum et al. 1997)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
TRU-B-1																					
TRU-B-2																					
TRU-B-3																					
TRU-B-4																					
TRU-B-5																					
TRU-Bi-1																					
TRU-Bi-2																					
TRU-Bi-3																					
TRU-Bi-4																					
TRU-Ce-1																					
TRU-Ce-2																					
TRU-Ce-3																					
TRU-Li-1																					
TRU-Li-2																					
TRU-Li-3																					
TRU-Li-4																					
TRU-Na-1																					
TRU-Na-2																					
TRU-Na-3																					
TRU-Na-4																					
TRU-P-1																					
TRU-P-2																					
TRU-P-3																					
TRU-P-4																					
TRU-Si-1																					
TRU-Si-2																					
TRU-Si-3																					
TRU-Si-4																					
TRU-Zr-1																					
TRU-Zr-2																					
TRU-Zr-3																					
TRU-Zr-4																					

Zr Study (Vienna et al. 1999)

Zr-1																					
Zr-2																					
Zr-3																					
Zr-4																					
Zr-5																					
Zr-6																					
Zr-7																					
Zr-8																					
Zr-9																					
Zr-10																					
Zr-11																					
Zr-12																					
Zr-13																					
Zr-14																					
Zr-15																					

TRU Study (Crum et al. 1997)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
TRU-B-1																					
TRU-B-2																					
TRU-B-3																					
TRU-B-4																					
TRU-B-5																					
TRU-Bi-1																					
TRU-Bi-2																					
TRU-Bi-3																					
TRU-Bi-4																					
TRU-Ce-1																					
TRU-Ce-2																					
TRU-Ce-3																					
TRU-Li-1																					
TRU-Li-2																					
TRU-Li-3																					
TRU-Li-4																					
TRU-Na-1																					
TRU-Na-2																					
TRU-Na-3																					
TRU-Na-4																					
TRU-P-1																					
TRU-P-2																					
TRU-P-3																					
TRU-P-4																					
TRU-Si-1																					
TRU-Si-2																					
TRU-Si-3																					
TRU-Si-4																					
TRU-Zr-1																					
TRU-Zr-2																					
TRU-Zr-3																					
TRU-Zr-4																					

Zr Study (Vienna et al. 1999)

Zr-1																					
Zr-2																					
Zr-3																					
Zr-4																					
Zr-5																					
Zr-6																					
Zr-7																					
Zr-8																					
Zr-9																					
Zr-10																					
Zr-11																					
Zr-12																					
Zr-13																					
Zr-14																					
Zr-15																					

TRU Study (Crum et al. 1997)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
TRU-B-1																				
TRU-B-2																				
TRU-B-3																				
TRU-B-4																				
TRU-B-5																				
TRU-Bi-1																				
TRU-Bi-2																				
TRU-Bi-3																				
TRU-Bi-4																				
TRU-Ce-1																				
TRU-Ce-2																				
TRU-Ce-3																				
TRU-Li-1																				
TRU-Li-2																				
TRU-Li-3																				
TRU-Li-4																				
TRU-Na-1																				
TRU-Na-2																				
TRU-Na-3																				
TRU-Na-4																				
TRU-P-1																				
TRU-P-2																				
TRU-P-3																				
TRU-P-4																				
TRU-Si-1																				
TRU-Si-2																				
TRU-Si-3																				
TRU-Si-4																				
TRU-Zr-1																				
TRU-Zr-2																				
TRU-Zr-3																				
TRU-Zr-4																				

Zr Study (Vienna et al. 1999)

Zr-1																				
Zr-2																				
Zr-3																				
Zr-4																				
Zr-5																				
Zr-6																				
Zr-7																				
Zr-8																				
Zr-9																				
Zr-10																				
Zr-11																				
Zr-12																				
Zr-13																				
Zr-14																				
Zr-15																				

TRU Study (Crum et al. 1997)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
TRU-B-1			1155	ZrO2				
TRU-B-2			1031	Zircon				
TRU-B-3			1030	Zircon				
TRU-B-4			992	Zircon				
TRU-B-5			1116	ZrO2				
TRU-Bi-1			1015	Zircon				
TRU-Bi-2			1017	Zircon				
TRU-Bi-3			1009	Zircon				
TRU-Bi-4			1023	Zircon				
TRU-Ce-1			1019	Zircon				
TRU-Ce-2			1062	Zircon				
TRU-Ce-3			1120	CeO2				
TRU-Li-1			1271	ZrO2				
TRU-Li-2			1155	Zircon				
TRU-Li-3			1074	Zircon				
TRU-Li-4			982	Zircon				
TRU-Na-1			1350	Zircon				
TRU-Na-2			1223	Zircon				
TRU-Na-3			1110	Zircon				
TRU-Na-4			930	Zircon				
TRU-P-1			1042	Zircon				
TRU-P-2			1052	Zircon				
TRU-P-3			1057	Zircon				
TRU-P-4			1070	Zircon				
TRU-Si-1			1012	Zircon				
TRU-Si-2			1022	Zircon				
TRU-Si-3				Zircon				
TRU-Si-4			1022	Zircon				
TRU-Zr-1			937	Zircon				
TRU-Zr-2			1074	Zircon				
TRU-Zr-3			1182	ZrO2				
TRU-Zr-4				ZrO2				

Zr Study (Vienna et al. 1999)

Zr-1	1150		1064	Zircon				
Zr-2	1150		964	Zircon				
Zr-3	1150		1110	Baddeleyite				
Zr-4	1150		1038	Baddeleyite				
Zr-5	1150		1085	Baddeleyite				
Zr-6	1150		1064	Zircon				
Zr-7	1150		1005	Parakeldyshite				
Zr-8	1200		1177	Zircon				
Zr-9	1150		913	Parakeldyshite				
Zr-10	1150		1064	Zircon				
Zr-11	1150		1140	Zircon				
Zr-12	1400		1250	Zircon				
Zr-13	1350		1189	Baddeleyite				
Zr-14	1350		1314	Baddeleyite				
Zr-15	1350		1336	Baddeleyite				

TRU Study (Crum et al. 1997)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
TRU-B-1					
TRU-B-2					
TRU-B-3					
TRU-B-4					
TRU-B-5					
TRU-Bi-1					
TRU-Bi-2					
TRU-Bi-3					
TRU-Bi-4					
TRU-Ce-1					
TRU-Ce-2					
TRU-Ce-3					
TRU-Li-1					
TRU-Li-2					
TRU-Li-3					
TRU-Li-4					
TRU-Na-1					
TRU-Na-2					
TRU-Na-3					
TRU-Na-4					
TRU-P-1					
TRU-P-2					
TRU-P-3					
TRU-P-4					
TRU-Si-1					
TRU-Si-2					
TRU-Si-3					
TRU-Si-4					
TRU-Zr-1					
TRU-Zr-2					
TRU-Zr-3					
TRU-Zr-4					

Zr Study (Vienna et al. 1999)

Zr-1					
Zr-2					
Zr-3					
Zr-4					
Zr-5					
Zr-6					
Zr-7					
Zr-8					
Zr-9					
Zr-10					
Zr-11					
Zr-12					
Zr-13					
Zr-14					
Zr-15					

TRU Study (Crum et al. 1997)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
TRU-B-1															
TRU-B-2															
TRU-B-3															
TRU-B-4															
TRU-B-5															
TRU-Bi-1															
TRU-Bi-2															
TRU-Bi-3															
TRU-Bi-4															
TRU-Ce-1															
TRU-Ce-2															
TRU-Ce-3															
TRU-Li-1															
TRU-Li-2															
TRU-Li-3															
TRU-Li-4															
TRU-Na-1															
TRU-Na-2															
TRU-Na-3															
TRU-Na-4															
TRU-P-1															
TRU-P-2															
TRU-P-3															
TRU-P-4															
TRU-Si-1															
TRU-Si-2															
TRU-Si-3															
TRU-Si-4															
TRU-Zr-1															
TRU-Zr-2															
TRU-Zr-3															
TRU-Zr-4															

Zr Study (Vienna et al. 1999)

Zr-1															
Zr-2															
Zr-3															
Zr-4															
Zr-5															
Zr-6															
Zr-7															
Zr-8															
Zr-9															
Zr-10															
Zr-11															
Zr-12															
Zr-13															
Zr-14															
Zr-15															

TRU Study (Crum et al. 1997)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
TRU-B-1																					
TRU-B-2																					
TRU-B-3																					
TRU-B-4																					
TRU-B-5																					
TRU-Bi-1																					
TRU-Bi-2																					
TRU-Bi-3																					
TRU-Bi-4																					
TRU-Ce-1																					
TRU-Ce-2																					
TRU-Ce-3																					
TRU-Li-1																					
TRU-Li-2																					
TRU-Li-3																					
TRU-Li-4																					
TRU-Na-1																					
TRU-Na-2																					
TRU-Na-3																					
TRU-Na-4																					
TRU-P-1																					
TRU-P-2																					
TRU-P-3																					
TRU-P-4																					
TRU-Si-1																					
TRU-Si-2																					
TRU-Si-3																					
TRU-Si-4																					
TRU-Zr-1																					
TRU-Zr-2																					
TRU-Zr-3																					
TRU-Zr-4																					

Zr Study (Vienna et al. 1999)

Zr-1																					
Zr-2																					
Zr-3																					
Zr-4																					
Zr-5																					
Zr-6																					
Zr-7																					
Zr-8																					
Zr-9																					
Zr-10																					
Zr-11																					
Zr-12																					
Zr-13																					
Zr-14																					
Zr-15																					

TRU Study (Crum et al. 1997)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
TRU-B-1																
TRU-B-2																
TRU-B-3																
TRU-B-4																
TRU-B-5																
TRU-Bi-1																
TRU-Bi-2																
TRU-Bi-3																
TRU-Bi-4																
TRU-Ce-1																
TRU-Ce-2																
TRU-Ce-3																
TRU-Li-1																
TRU-Li-2																
TRU-Li-3																
TRU-Li-4																
TRU-Na-1																
TRU-Na-2																
TRU-Na-3																
TRU-Na-4																
TRU-P-1																
TRU-P-2																
TRU-P-3																
TRU-P-4																
TRU-Si-1																
TRU-Si-2																
TRU-Si-3																
TRU-Si-4																
TRU-Zr-1																
TRU-Zr-2																
TRU-Zr-3																
TRU-Zr-4																

Zr Study (Vienna et al. 1999)

Zr-1					0.239	0.338	0.241									
Zr-2					0.277	0.364	0.269									
Zr-3					0.231	0.352	0.242									
Zr-4					0.301	0.383	0.268									
Zr-5					0.228	0.327	0.234									
Zr-6					0.251	0.361	0.259									
Zr-7					0.29	0.492	0.81									
Zr-8					0.434	0.451	0.127									
Zr-9					0.293	0.295	0.383									
Zr-10					0.247	0.336	0.24									
Zr-11					0.237	0.356	0.127									
Zr-12					0.22	0.31	0.02									
Zr-13					0.42	0.485	0.205									
Zr-14																
Zr-15					0.21	0.3	0.97									

TRU Study (Crum et al. 1997)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
TRU-B-1												
TRU-B-2												
TRU-B-3												
TRU-B-4												
TRU-B-5												
TRU-Bi-1												
TRU-Bi-2												
TRU-Bi-3												
TRU-Bi-4												
TRU-Ce-1												
TRU-Ce-2												
TRU-Ce-3												
TRU-Li-1												
TRU-Li-2												
TRU-Li-3												
TRU-Li-4												
TRU-Na-1												
TRU-Na-2												
TRU-Na-3												
TRU-Na-4												
TRU-P-1												
TRU-P-2												
TRU-P-3												
TRU-P-4												
TRU-Si-1												
TRU-Si-2												
TRU-Si-3												
TRU-Si-4												
TRU-Zr-1												
TRU-Zr-2												
TRU-Zr-3												
TRU-Zr-4												

Zr Study (Vienna et al. 1999)

Zr-1												
Zr-2												
Zr-3												
Zr-4												
Zr-5												
Zr-6												
Zr-7												
Zr-8												
Zr-9												
Zr-10												
Zr-11												
Zr-12												
Zr-13												
Zr-14												
Zr-15												

Zr Study (Vienna et al. 1999)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
Zr-16	0.0450	0.1000	0.0009			0.0042	0.0750		0.1100		0.0021	0.5114	0.1500							0.0002	
Zr-17	0.0300	0.1500	0.0009			0.0047	0.0900		0.0362		0.0023	0.5193	0.1650							0.0002	
Zr-18	0.0300	0.1500	0.0009			0.0047	0.0600		0.1011		0.0023	0.4844	0.1650							0.0002	
Zr-19	0.0300	0.0500	0.0009			0.0047	0.0900		0.1122		0.0023	0.5434	0.1650							0.0002	
Zr-20	0.0300	0.0500	0.0009			0.0047	0.0600		0.1770		0.0023	0.5085	0.1650							0.0002	
Zr-21	0.0600	0.1500	0.0008			0.0038	0.0900		0.0430		0.0019	0.5142	0.1350							0.0002	
Zr-22	0.0600	0.1500	0.0008			0.0038	0.0600		0.1079		0.0019	0.4794	0.1350							0.0002	
Zr-23	0.0600	0.0500	0.0008			0.0038	0.0900		0.1189		0.0019	0.5383	0.1350							0.0002	
Zr-24	0.0600	0.0500	0.0008			0.0038	0.0600		0.1838		0.0019	0.5035	0.1350							0.0002	
Zr-25	0.0300	0.1500	0.0008			0.0038	0.0900		0.0395		0.0019	0.5477	0.1350							0.0002	
Zr-26	0.0300	0.1500	0.0008			0.0038	0.0600		0.1044		0.0019	0.5129	0.1350							0.0002	
Zr-27	0.0300	0.0500	0.0008			0.0038	0.0900		0.1154		0.0019	0.5718	0.1350							0.0002	
Zr-28	0.0450	0.1000	0.0009			0.0042	0.0750		0.1100		0.0021	0.5114	0.1500							0.0002	
Zr-29	0.0300	0.0500	0.0008			0.0038	0.0600		0.1803		0.0019	0.5370	0.1350							0.0002	

SP (Mika et al. 1997)

SP-1a	0.0800	0.0700	0.0100	0.1250		0.0028	0.0300	0.0060	0.1573	0.0052	0.0046	0.4600	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-1b	0.0800	0.0700	0.0100	0.1250		0.0028	0.0300	0.0060	0.1573	0.0052	0.0046	0.4600	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-1c	0.0800	0.0700	0.0100	0.1250		0.0028	0.0300	0.0060	0.1573	0.0052	0.0046	0.4600	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-1d	0.0800	0.0700	0.0100	0.1250		0.0028	0.0300	0.0060	0.1573	0.0052	0.0046	0.4600	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-1e	0.0800	0.0700	0.0100	0.1250		0.0028	0.0300	0.0060	0.1573	0.0052	0.0046	0.4600	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-1f	0.0800	0.0700	0.0100	0.1250		0.0028	0.0300	0.0060	0.1573	0.0052	0.0046	0.4600	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-1g	0.0800	0.0700	0.0100	0.1250		0.0028	0.0300	0.0060	0.1573	0.0052	0.0046	0.4600	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-1h	0.0800	0.0700	0.0100	0.1250		0.0028	0.0300	0.0060	0.1573	0.0052	0.0046	0.4600	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-1i	0.0800	0.0700	0.0100	0.1250		0.0028	0.0300	0.0060	0.1573	0.0052	0.0046	0.4600	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-Al-1	0.0400	0.0730	0.0104	0.1304		0.0029	0.0313	0.0063	0.1641	0.0054	0.0048	0.4800	0.0193	0.0007	0.0000	0.0032	0.0000		0.0073		0.0007
SP-Al-2	0.1200	0.0670	0.0096	0.1196		0.0027	0.0287	0.0057	0.1505	0.0050	0.0044	0.4400	0.0177	0.0007	0.0000	0.0029	0.0000		0.0067		0.0007
SP-Al-3	0.1600	0.0639	0.0091	0.1141		0.0026	0.0274	0.0055	0.1436	0.0047	0.0042	0.4200	0.0169	0.0006	0.0000	0.0028	0.0000		0.0064		0.0006
SP-B-1	0.0860	0.0000	0.0108	0.1344		0.0030	0.0323	0.0065	0.1691	0.0056	0.0050	0.4946	0.0199	0.0008	0.0000	0.0033	0.0000		0.0075		0.0008
SP-B-2	0.0852	0.0100	0.0106	0.1331		0.0030	0.0319	0.0064	0.1674	0.0055	0.0049	0.4897	0.0197	0.0008	0.0000	0.0032	0.0000		0.0074		0.0008
SP-B-3	0.0826	0.0400	0.0103	0.1290		0.0029	0.0310	0.0062	0.1624	0.0054	0.0048	0.4748	0.0191	0.0007	0.0000	0.0031	0.0000		0.0072		0.0007
SP-B-4	0.0757	0.1200	0.0095	0.1183		0.0026	0.0284	0.0057	0.1488	0.0049	0.0044	0.4353	0.0175	0.0007	0.0000	0.0029	0.0000		0.0066		0.0007
SP-Cr-1	0.0802	0.0702	0.0100	0.1253		0.0028	0.0301	0.0060	0.1576	0.0052	0.0047	0.4610	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-Cr-2	0.0798	0.0698	0.0100	0.1246		0.0028	0.0299	0.0060	0.1569	0.0052	0.0046	0.4587	0.0184	0.0007	0.0000	0.0030	0.0000		0.0069		0.0007
SP-Cr-3	0.0795	0.0696	0.0099	0.1243		0.0028	0.0298	0.0060	0.1564	0.0052	0.0046	0.4573	0.0184	0.0007	0.0000	0.0030	0.0000		0.0069		0.0007
SP-Cr-4	0.0792	0.0693	0.0099	0.1238		0.0028	0.0297	0.0059	0.1558	0.0051	0.0046	0.4555	0.0183	0.0007	0.0000	0.0030	0.0000		0.0069		0.0007
SP-Fe-1	0.0859	0.0752	0.0107	0.0600		0.0030	0.0322	0.0064	0.1690	0.0056	0.0050	0.4942	0.0198	0.0008	0.0000	0.0033	0.0000		0.0075		0.0008
SP-Fe-2	0.0832	0.0728	0.0104	0.0900		0.0029	0.0312	0.0062	0.1636	0.0054	0.0048	0.4784	0.0192	0.0007	0.0000	0.0031	0.0000		0.0072		0.0007
SP-Fe-3	0.0777	0.0680	0.0097	0.1500		0.0027	0.0291	0.0058	0.1528	0.0051	0.0045	0.4469	0.0179	0.0007	0.0000	0.0029	0.0000		0.0068		0.0007
SP-Li-1	0.0825	0.0722	0.0103	0.1289		0.0029	0.0000	0.0062	0.1622	0.0054	0.0048	0.4742	0.0190	0.0007	0.0000	0.0031	0.0000		0.0072		0.0007
SP-Li-2	0.0816	0.0714	0.0102	0.1276		0.0029	0.0100	0.0061	0.1605	0.0053	0.0047	0.4695	0.0188	0.0007	0.0000	0.0031	0.0000		0.0071		0.0007
SP-Li-3	0.0800	0.0700	0.0100	0.1250		0.0028	0.0300	0.0060	0.1573	0.0052	0.0046	0.4600	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-Mg-1	0.0797	0.0697	0.0100	0.1245		0.0028	0.0299	0.0100	0.1567	0.0052	0.0046	0.4581	0.0184	0.0007	0.0000	0.0030	0.0000		0.0069		0.0007
SP-Mg-2	0.0789	0.0690	0.0099	0.1232		0.0028	0.0296	0.0200	0.1551	0.0051	0.0046	0.4535	0.0182	0.0007	0.0000	0.0030	0.0000		0.0069		0.0007
SP-Mg-3	0.0757	0.0662	0.0095	0.1182		0.0026	0.0284	0.0600	0.1488	0.0049	0.0044	0.4350	0.0175	0.0007	0.0000	0.0029	0.0000		0.0066		0.0007
SP-Mn-1	0.0803	0.0703	0.0100	0.1255		0.0028	0.0301	0.0060	0.1579	0.0052	0.0047	0.4617	0.0185	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-Mn-2	0.0795	0.0696	0.0099	0.1242		0.0028	0.0298	0.0060	0.1563	0.0052	0.0046	0.4570	0.0183	0.0007	0.0000	0.0030	0.0000		0.0069		0.0007
SP-Mn-3	0.0771	0.0674	0.0096	0.1204		0.0027	0.0289	0.0058	0.1516	0.0050	0.0045	0.4432	0.0178	0.0007	0.0000	0.0029	0.0000		0.0067		0.0007
SP-Na-1	0.0873	0.0764	0.0109	0.1365		0.0031	0.0328	0.0066	0.0800	0.0057	0.0051	0.5022	0.0202	0.0008	0.0000	0.0033	0.0000		0.0076		0.0008

Zr Study (Vienna et al. 1999)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
Zr-16					0.0004					0.0007											
Zr-17					0.0005					0.0008											
Zr-18					0.0005					0.0008											
Zr-19					0.0005					0.0008											
Zr-20					0.0005					0.0008											
Zr-21					0.0005					0.0006											
Zr-22					0.0004					0.0006											
Zr-23					0.0004					0.0006											
Zr-24					0.0004					0.0006											
Zr-25					0.0004					0.0006											
Zr-26					0.0004					0.0006											
Zr-27					0.0004					0.0006											
Zr-28					0.0004					0.0007											
Zr-29					0.0004					0.0006											

SP (Mika et al. 1997)

SP-1a	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-1b	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-1c	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-1d	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-1e	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-1f	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-1g	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-1h	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-1i	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Al-1	0.0001		0.0009	0.0023	0.0000	0.0003		0.0006					0.0028		0.0038		0.0001		0.0019	0.0018	
SP-Al-2	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0034		0.0001		0.0017	0.0016	
SP-Al-3	0.0001		0.0008	0.0020	0.0000	0.0003		0.0006					0.0025		0.0033		0.0001		0.0017	0.0016	
SP-B-1	0.0001		0.0010	0.0024	0.0000	0.0003		0.0007					0.0029		0.0039		0.0001		0.0020	0.0018	
SP-B-2	0.0001		0.0010	0.0023	0.0000	0.0003		0.0006					0.0029		0.0038		0.0001		0.0019	0.0018	
SP-B-3	0.0001		0.0009	0.0023	0.0000	0.0003		0.0006					0.0028		0.0037		0.0001		0.0019	0.0018	
SP-B-4	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0034		0.0001		0.0017	0.0016	
SP-Cr-1	0.0001		0.0009	0.0000	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Cr-2	0.0001		0.0009	0.0050	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Cr-3	0.0001		0.0009	0.0080	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Cr-4	0.0001		0.0009	0.0120	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Fe-1	0.0001		0.0010	0.0024	0.0000	0.0003		0.0007					0.0029		0.0039		0.0001		0.0020	0.0018	
SP-Fe-2	0.0001		0.0009	0.0023	0.0000	0.0003		0.0006					0.0028		0.0037		0.0001		0.0019	0.0018	
SP-Fe-3	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0035		0.0001		0.0018	0.0017	
SP-Li-1	0.0001		0.0009	0.0023	0.0000	0.0003		0.0006					0.0028		0.0037		0.0001		0.0019	0.0018	
SP-Li-2	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0028		0.0037		0.0001		0.0019	0.0018	
SP-Li-3	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Mg-1	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Mg-2	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0035		0.0001		0.0018	0.0017	
SP-Mg-3	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0034		0.0001		0.0017	0.0016	
SP-Mn-1	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0000		0.0001		0.0018	0.0017	
SP-Mn-2	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0100		0.0001		0.0018	0.0017	
SP-Mn-3	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0400		0.0001		0.0018	0.0017	
SP-Na-1	0.0001		0.0010	0.0024	0.0000	0.0003		0.0007					0.0030		0.0039		0.0001		0.0020	0.0019	

Zr Study (Vienna et al. 1999)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
Zr-16																	0.0001				
Zr-17																	0.0001				
Zr-18																	0.0001				
Zr-19																	0.0001				
Zr-20																	0.0001				
Zr-21																	0.0001				
Zr-22																	0.0001				
Zr-23																	0.0001				
Zr-24																	0.0001				
Zr-25																	0.0001				
Zr-26																	0.0001				
Zr-27																	0.0001				
Zr-28																	0.0001				
Zr-29																	0.0001				

SP (Mika et al. 1997)

SP-1a	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-1b	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-1c	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-1d	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-1e	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-1f	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-1g	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-1h	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-1i	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Al-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0020	0.0003		0.0000		0.0003
SP-Al-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0018	0.0003		0.0000		0.0003
SP-Al-3	0.0000		0.0000	0.0000			0.0003		0.0003	0.0006		0.0008	0.0000			0.0017	0.0003		0.0000		0.0003
SP-B-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0008		0.0010	0.0000			0.0021	0.0003		0.0000		0.0003
SP-B-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0008		0.0010	0.0000			0.0020	0.0003		0.0000		0.0003
SP-B-3	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0020	0.0003		0.0000		0.0003
SP-B-4	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0018	0.0003		0.0000		0.0003
SP-Cr-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Cr-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Cr-3	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Cr-4	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Fe-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0008		0.0010	0.0000			0.0021	0.0003		0.0000		0.0003
SP-Fe-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0020	0.0003		0.0000		0.0003
SP-Fe-3	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Li-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0020	0.0003		0.0000		0.0003
SP-Li-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0020	0.0003		0.0000		0.0003
SP-Li-3	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Mg-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Mg-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Mg-3	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0018	0.0003		0.0000		0.0003
SP-Mn-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Mn-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Mn-3	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0018	0.0003		0.0000		0.0003
SP-Na-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0008		0.0010	0.0000			0.0021	0.0003		0.0000		0.0003

Zr Study (Vienna et al. 1999)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
Zr-16										1.0000											
Zr-17										1.0000											
Zr-18										1.0000											
Zr-19										1.0001											
Zr-20										1.0000											
Zr-21										1.0001											
Zr-22										1.0001											
Zr-23										1.0000											
Zr-24										1.0001											
Zr-25										1.0000											
Zr-26										1.0001											
Zr-27										1.0000											
Zr-28										1.0000											
Zr-29										1.0001											

SP (Mika et al. 1997)

SP-1a		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-1b		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-1c		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-1d		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-1e		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-1f		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-1g		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-1h		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-1i		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Al-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Al-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Al-3		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-B-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-B-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-B-3		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-B-4		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Cr-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Cr-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Cr-3		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Cr-4		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Fe-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Fe-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Fe-3		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Li-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Li-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Li-3		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Mg-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Mg-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Mg-3		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Mn-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Mn-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Mn-3		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Na-1		0.0000				0.0000	0.0000	0.0004		1.0000											

Zr Study (Vienna et al. 1999)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
Zr-16																					
Zr-17																					
Zr-18																					
Zr-19																					
Zr-20																					
Zr-21																					
Zr-22																					
Zr-23																					
Zr-24																					
Zr-25																					
Zr-26																					
Zr-27																					
Zr-28																					
Zr-29																					

SP (Mika et al. 1997)

SP-1a																					
SP-1b																					
SP-1c																					
SP-1d																					
SP-1e																					
SP-1f																					
SP-1g																					
SP-1h																					
SP-1i																					
SP-Al-1																					
SP-Al-2																					
SP-Al-3																					
SP-B-1																					
SP-B-2																					
SP-B-3																					
SP-B-4																					
SP-Cr-1																					
SP-Cr-2																					
SP-Cr-3																					
SP-Cr-4																					
SP-Fe-1																					
SP-Fe-2																					
SP-Fe-3																					
SP-Li-1																					
SP-Li-2																					
SP-Li-3																					
SP-Mg-1																					
SP-Mg-2																					
SP-Mg-3																					
SP-Mn-1																					
SP-Mn-2																					
SP-Mn-3																					
SP-Na-1																					

Zr Study (Vienna et al. 1999)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
Zr-16																					
Zr-17																					
Zr-18																					
Zr-19																					
Zr-20																					
Zr-21																					
Zr-22																					
Zr-23																					
Zr-24																					
Zr-25																					
Zr-26																					
Zr-27																					
Zr-28																					
Zr-29																					

SP (Mika et al. 1997)

SP-1a																					
SP-1b																					
SP-1c																					
SP-1d																					
SP-1e																					
SP-1f																					
SP-1g																					
SP-1h																					
SP-1i																					
SP-Al-1																					
SP-Al-2																					
SP-Al-3																					
SP-B-1																					
SP-B-2																					
SP-B-3																					
SP-B-4																					
SP-Cr-1																					
SP-Cr-2																					
SP-Cr-3																					
SP-Cr-4																					
SP-Fe-1																					
SP-Fe-2																					
SP-Fe-3																					
SP-Li-1																					
SP-Li-2																					
SP-Li-3																					
SP-Mg-1																					
SP-Mg-2																					
SP-Mg-3																					
SP-Mn-1																					
SP-Mn-2																					
SP-Mn-3																					
SP-Na-1																					

Zr Study (Vienna et al. 1999)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
Zr-16																				
Zr-17																				
Zr-18																				
Zr-19																				
Zr-20																				
Zr-21																				
Zr-22																				
Zr-23																				
Zr-24																				
Zr-25																				
Zr-26																				
Zr-27																				
Zr-28																				
Zr-29																				

SP (Mika et al. 1997)

SP-1a																				
SP-1b																				
SP-1c																				
SP-1d																				
SP-1e																				
SP-1f																				
SP-1g																				
SP-1h																				
SP-1i																				
SP-Al-1																				
SP-Al-2																				
SP-Al-3																				
SP-B-1																				
SP-B-2																				
SP-B-3																				
SP-B-4																				
SP-Cr-1																				
SP-Cr-2																				
SP-Cr-3																				
SP-Cr-4																				
SP-Fe-1																				
SP-Fe-2																				
SP-Fe-3																				
SP-Li-1																				
SP-Li-2																				
SP-Li-3																				
SP-Mg-1																				
SP-Mg-2																				
SP-Mg-3																				
SP-Mn-1																				
SP-Mn-2																				
SP-Mn-3																				
SP-Na-1																				

Zr Study (Vienna et al. 1999)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
Zr-16	1150		1067	Zircon				
Zr-17	1450		1228	Baddeleyite				
Zr-18	1350		1125	Zircon				
Zr-19	1250		1034	Zircon				
Zr-20	1150		1113	Parakeldyshite				
Zr-21	1350		1180	Zircon				
Zr-22	1150		1087	Parakeldyshite				
Zr-23	1150		1003	Zircon				
Zr-24	1150		1105	Parakeldyshite				
Zr-25	1150		1137	Zircon				
Zr-26	1150		1070	Zircon				
Zr-27	1150		1081	Zircon				
Zr-28	1150		1064	Zircon				
Zr-29	1150		1059	Parakeldyshite				

SP (Mika et al. 1997)

SP-1a			1048	spinel				
SP-1b			1040	spinel				
SP-1c			1039	spinel				
SP-1d			1034	spinel				
SP-1e			1036	spinel				
SP-1f			1037	spinel				
SP-1g			1041	spinel				
SP-1h			1043	spinel				
SP-1i			1039	spinel				
SP-Al-1			1007	spinel				
SP-Al-2			1148	spinel				
SP-Al-3			1275	spinel				
SP-B-1			1117	spinel				
SP-B-2			1085	spinel				
SP-B-3			1058	spinel				
SP-B-4			1020	spinel				
SP-Cr-1			1018	spinel				
SP-Cr-2			1058	spinel				
SP-Cr-3			1141	spinel				
SP-Cr-4			1248	spinel				
SP-Fe-1			948	spinel				
SP-Fe-2			966	spinel				
SP-Fe-3			1106	spinel				
SP-Li-1			1142	spinel				
SP-Li-2			1084	spinel				
SP-Li-3			1042	spinel				
SP-Mg-1			1031	spinel				
SP-Mg-2			1075	spinel				
SP-Mg-3			1150	spinel				
SP-Mn-1			1043	spinel				
SP-Mn-2			1060	spinel				
SP-Mn-3			1080	spinel				
SP-Na-1			1350	spinel				

Zr Study (Vienna et al. 1999)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
Zr-16					
Zr-17					
Zr-18					
Zr-19					
Zr-20					
Zr-21					
Zr-22					
Zr-23					
Zr-24					
Zr-25					
Zr-26					
Zr-27					
Zr-28					
Zr-29					

SP (Mika et al. 1997)

SP-1a					
SP-1b					
SP-1c					
SP-1d					
SP-1e					
SP-1f					
SP-1g					
SP-1h					
SP-1i					
SP-Al-1					
SP-Al-2					
SP-Al-3					
SP-B-1					
SP-B-2					
SP-B-3					
SP-B-4					
SP-Cr-1					
SP-Cr-2					
SP-Cr-3					
SP-Cr-4					
SP-Fe-1					
SP-Fe-2					
SP-Fe-3					
SP-Li-1					
SP-Li-2					
SP-Li-3					
SP-Mg-1					
SP-Mg-2					
SP-Mg-3					
SP-Mn-1					
SP-Mn-2					
SP-Mn-3					
SP-Na-1					

Zr Study (Vienna et al. 1999)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
Zr-16															
Zr-17															
Zr-18															
Zr-19															
Zr-20															
Zr-21															
Zr-22															
Zr-23															
Zr-24															
Zr-25															
Zr-26															
Zr-27															
Zr-28															
Zr-29															

SP (Mika et al. 1997)

SP-1a															
SP-1b															
SP-1c															
SP-1d															
SP-1e															
SP-1f															
SP-1g															
SP-1h															
SP-1i															
SP-Al-1															
SP-Al-2															
SP-Al-3															
SP-B-1															
SP-B-2															
SP-B-3															
SP-B-4															
SP-Cr-1															
SP-Cr-2															
SP-Cr-3															
SP-Cr-4															
SP-Fe-1															
SP-Fe-2															
SP-Fe-3															
SP-Li-1															
SP-Li-2															
SP-Li-3															
SP-Mg-1															
SP-Mg-2															
SP-Mg-3															
SP-Mn-1															
SP-Mn-2															
SP-Mn-3															
SP-Na-1															

Zr Study (Vienna et al. 1999)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
Zr-16																					
Zr-17																					
Zr-18																					
Zr-19																					
Zr-20																					
Zr-21																					
Zr-22																					
Zr-23																					
Zr-24																					
Zr-25																					
Zr-26																					
Zr-27																					
Zr-28																					
Zr-29																					

SP (Mika et al. 1997)

SP-1a																					
SP-1b																					
SP-1c																					
SP-1d																					
SP-1e																					
SP-1f																					
SP-1g																					
SP-1h																					
SP-1i																					
SP-Al-1																					
SP-Al-2																					
SP-Al-3																					
SP-B-1																					
SP-B-2																					
SP-B-3																					
SP-B-4																					
SP-Cr-1																					
SP-Cr-2																					
SP-Cr-3																					
SP-Cr-4																					
SP-Fe-1																					
SP-Fe-2																					
SP-Fe-3																					
SP-Li-1																					
SP-Li-2																					
SP-Li-3																					
SP-Mg-1																					
SP-Mg-2																					
SP-Mg-3																					
SP-Mn-1																					
SP-Mn-2																					
SP-Mn-3																					
SP-Na-1																					

Zr Study (Vienna et al. 1999)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
Zr-16					0.185	0.34	0.23									
Zr-17					0.265	0.33	0.02									
Zr-18					0.66	0.75	0.335									
Zr-19					0.275	0.54	0.495									
Zr-20					0.49	0.505	1.175									
Zr-21					0.3	0.36	0.035									
Zr-22					1.03	0.965	0.525									
Zr-23					0.255	0.515	0.545									
Zr-24					0.295	0.41	1.16									
Zr-25					0.405	0.45	0.065									
Zr-26					0.61	0.62	0.315									
Zr-27					0.595	0.735	0.71									
Zr-28					0.24	0.34	0.26									
Zr-29					3.89	2.715	3.085									

SP (Mika et al. 1997)

SP-1a																
SP-1b																
SP-1c																
SP-1d																
SP-1e																
SP-1f																
SP-1g																
SP-1h																
SP-1i																
SP-Al-1																
SP-Al-2																
SP-Al-3																
SP-B-1																
SP-B-2																
SP-B-3																
SP-B-4																
SP-Cr-1																
SP-Cr-2																
SP-Cr-3																
SP-Cr-4																
SP-Fe-1																
SP-Fe-2																
SP-Fe-3																
SP-Li-1																
SP-Li-2																
SP-Li-3																
SP-Mg-1																
SP-Mg-2																
SP-Mg-3																
SP-Mn-1																
SP-Mn-2																
SP-Mn-3																
SP-Na-1																

Zr Study (Vienna et al. 1999)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
Zr-16												
Zr-17												
Zr-18												
Zr-19												
Zr-20												
Zr-21												
Zr-22												
Zr-23												
Zr-24												
Zr-25												
Zr-26												
Zr-27												
Zr-28												
Zr-29												

SP (Mika et al. 1997)

SP-1a												
SP-1b												
SP-1c												
SP-1d												
SP-1e												
SP-1f												
SP-1g												
SP-1h												
SP-1i												
SP-Al-1												
SP-Al-2												
SP-Al-3												
SP-B-1												
SP-B-2												
SP-B-3												
SP-B-4												
SP-Cr-1												
SP-Cr-2												
SP-Cr-3												
SP-Cr-4												
SP-Fe-1												
SP-Fe-2												
SP-Fe-3												
SP-Li-1												
SP-Li-2												
SP-Li-3												
SP-Mg-1												
SP-Mg-2												
SP-Mg-3												
SP-Mn-1												
SP-Mn-2												
SP-Mn-3												
SP-Na-1												

SP (Mika et al. 1997)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
SP-Na-2	0.0835	0.0731	0.0104	0.1305		0.0029	0.0313	0.0063	0.1200	0.0054	0.0049	0.4804	0.0193	0.0007	0.0000	0.0032	0.0000		0.0073		0.0007
SP-Na-3	0.0759	0.0665	0.0095	0.1187		0.0027	0.0285	0.0057	0.2000	0.0049	0.0044	0.4367	0.0175	0.0007	0.0000	0.0029	0.0000		0.0066		0.0007
SP-Ni-1	0.0804	0.0704	0.0101	0.1257		0.0028	0.0302	0.0060	0.1581	0.0000	0.0047	0.4624	0.0186	0.0007	0.0000	0.0030	0.0000		0.0070		0.0007
SP-Ni-2	0.0796	0.0697	0.0100	0.1244		0.0028	0.0299	0.0060	0.1565	0.0100	0.0046	0.4578	0.0184	0.0007	0.0000	0.0030	0.0000		0.0069		0.0007
SP-Ni-3	0.0780	0.0683	0.0098	0.1219		0.0027	0.0293	0.0059	0.1534	0.0300	0.0045	0.4485	0.0180	0.0007	0.0000	0.0030	0.0000		0.0068		0.0007
SP-Si-1	0.0919	0.0804	0.0115	0.1435		0.0032	0.0344	0.0069	0.1806	0.0060	0.0053	0.3800	0.0212	0.0008	0.0000	0.0035	0.0000		0.0080		0.0008
SP-Si-2	0.0711	0.0622	0.0089	0.1111		0.0025	0.0267	0.0053	0.1398	0.0046	0.0041	0.5200	0.0164	0.0006	0.0000	0.0027	0.0000		0.0062		0.0006
SP-Si-3	0.0593	0.0519	0.0074	0.0926		0.0021	0.0222	0.0044	0.1165	0.0039	0.0034	0.6000	0.0137	0.0005	0.0000	0.0022	0.0000		0.0052		0.0005

MS (Hrma 1999)

MS-1a	0.0800	0.0700		0.1300			0.0450	0.0060	0.1570	0.0200		0.4500	0.0300								
MS-1b	0.0800	0.0700		0.1300			0.0450	0.0060	0.1570	0.0200		0.4500	0.0300								
MS-2a	0.0800	0.0700		0.1450			0.0400	0.0060	0.1530	0.0120		0.4240	0.0600								
MS-2b	0.0800	0.0700		0.1450			0.0400	0.0060	0.1530	0.0120		0.4240	0.0600								
MS-3a	0.0800	0.0700		0.1150			0.0400	0.0060	0.1530	0.0120		0.4540	0.0600								
MS-3b	0.0800	0.0700		0.1150			0.0400	0.0060	0.1530	0.0120		0.4540	0.0600								
MS-4a	0.0800	0.0700		0.0889			0.0454	0.0060	0.1530	0.0120		0.4746	0.0600								
MS-4b	0.0800	0.0700		0.0889			0.0454	0.0060	0.1530	0.0120		0.4746	0.0600								
MS-5	0.0800	0.0700		0.1150			0.0410	0.0060	0.1530	0.0074		0.4576	0.0600								
MS-6	0.0800	0.0700		0.1250			0.0300	0.0060	0.1573	0.0140		0.4600	0.0506								
MS-7	0.0800	0.0700		0.1150			0.0454	0.0060	0.1530	0.0095		0.4531	0.0600								
MS-8	0.0800	0.0700		0.1250			0.0300	0.0060	0.1573	0.0075		0.4600	0.0571								
MS-9	0.0800	0.0700		0.1100			0.0400	0.0060	0.1573	0.0100		0.4531	0.0600								
MS-7 H-Al	0.1100	0.0677		0.1113			0.0439	0.0058	0.1480	0.0092		0.4383	0.0580								
MS-7 L-Al	0.0500	0.0723		0.1180			0.0469	0.0062	0.1580	0.0098		0.4679	0.0620								
MS-7 H-Cr	0.0789	0.0699		0.1148			0.0453	0.0060	0.1527	0.0095		0.4522	0.0599								
MS-7 L-Cr	0.0802	0.0701		0.1152			0.0455	0.0060	0.1533	0.0095		0.4540	0.0601								
MS-7 H-Fe	0.0768	0.0672		0.1500			0.0436	0.0058	0.1469	0.0091		0.4352	0.0576								
MS-7 L-Fe	0.0832	0.0728		0.0800			0.0472	0.0062	0.1591	0.0099		0.4710	0.0624								
MS-7 H-Li	0.0788	0.0689		0.1132			0.0600	0.0059	0.1507	0.0094		0.4462	0.0591								
MS-7 L-Li	0.0813	0.0711		0.1169			0.0300	0.0061	0.1555	0.0097		0.4604	0.0610								
MS-7 H-Mg	0.0781	0.0683		0.1122			0.0443	0.0300	0.1493	0.0093		0.4422	0.0586								
MS-7 L-Mg	0.0805	0.0704		0.1157			0.0457	0.0000	0.1539	0.0096		0.4558	0.0604								
MS-7 H-Na	0.0774	0.0678		0.1113			0.0440	0.0058	0.1800	0.0092		0.4387	0.0581								
MS-7 L-Na	0.0831	0.0727		0.1195			0.0472	0.0062	0.1200	0.0099		0.4708	0.0623								
MS-7 VH-Ni	0.0783	0.0685		0.1126			0.0445	0.0059	0.1498	0.0300		0.4438	0.0588								
MS-7 H-Ni	0.0793	0.0694		0.1140			0.0450	0.0059	0.1517	0.0180		0.4492	0.0595								
MS-7 L-Ni	0.0805	0.0705		0.1158			0.0457	0.0060	0.1540	0.0030		0.4561	0.0604								

SG (Hrma et al. 1999)

SG01	0.0250	0.0999	0.0200	0.1499		0.0380	0.0599	0.0050	0.0599	0.0200	0.0000	0.4496	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG02	0.0250	0.0500	0.0200	0.0599		0.0380	0.0599	0.0250	0.1099	0.0005	0.0000	0.5785	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG03	0.0390	0.0876	0.0158	0.1202		0.0208	0.0375	0.0200	0.0976	0.0151	0.0000	0.4741	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG04	0.0799	0.0500	0.0030	0.1499		0.0150	0.0599	0.0250	0.0599	0.0200	0.0000	0.5240	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG05	0.0530	0.0752	0.0115	0.1052		0.0266	0.0450	0.0150	0.0852	0.0102	0.0000	0.5186	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG06	0.0799	0.0500	0.0200	0.1499		0.0380	0.0300	0.0050	0.1099	0.0005	0.0000	0.4991	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG07	0.0799	0.0999	0.0030	0.0599		0.0380	0.0599	0.0250	0.0599	0.0005	0.0000	0.5385	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG08	0.0390	0.0626	0.0158	0.1275		0.0323	0.0375	0.0200	0.0726	0.0054	0.0000	0.5397	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000

SP (Mika et al. 1997)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
SP-Na-2	0.0001		0.0009	0.0023	0.0000	0.0003		0.0006					0.0028		0.0038		0.0001		0.0019	0.0018	
SP-Na-3	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0034		0.0001		0.0017	0.0016	
SP-Ni-1	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Ni-2	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Ni-3	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0027		0.0035		0.0001		0.0018	0.0017	
SP-Si-1	0.0001		0.0010	0.0025	0.0000	0.0003		0.0007					0.0031		0.0041		0.0001		0.0021	0.0020	
SP-Si-2	0.0001		0.0008	0.0020	0.0000	0.0003		0.0005					0.0024		0.0032		0.0001		0.0016	0.0015	
SP-Si-3	0.0001		0.0007	0.0016	0.0000	0.0002		0.0004					0.0020		0.0027		0.0001		0.0013	0.0013	

MS (Hrma 1999)

MS-1a				0.0070											0.0050						
MS-1b				0.0070											0.0050						
MS-2a				0.0050											0.0050						
MS-2b				0.0050											0.0050						
MS-3a				0.0050											0.0050						
MS-3b				0.0050											0.0050						
MS-4a				0.0050											0.0050						
MS-4b				0.0050											0.0050						
MS-5				0.0050											0.0050						
MS-6				0.0035											0.0036						
MS-7				0.0030											0.0050						
MS-8				0.0035											0.0036						
MS-9				0.0100											0.0036						
MS-7 H-Al				0.0029											0.0048						
MS-7 L-Al				0.0031											0.0052						
MS-7 H-Cr				0.0050											0.0050						
MS-7 L-Cr				0.0010											0.0050						
MS-7 H-Fe				0.0029											0.0048						
MS-7 L-Fe				0.0031											0.0052						
MS-7 H-Li				0.0030											0.0049						
MS-7 L-Li				0.0030											0.0051						
MS-7 H-Mg				0.0029											0.0049						
MS-7 L-Mg				0.0030											0.0050						
MS-7 H-Na				0.0029											0.0048						
MS-7 L-Na				0.0031											0.0052						
MS-7 VH-Ni				0.0029											0.0049						
MS-7 H-Ni				0.0030											0.0050						
MS-7 L-Ni				0.0030											0.0050						

SG (Hrma et al. 1999)

SG01	0.0000		0.0000	0.0010	0.0000	0.0000		0.0000					0.0000		0.0100		0.0000		0.0000	0.0000	
SG02	0.0000		0.0000	0.0010	0.0000	0.0000		0.0000					0.0000		0.0300		0.0000		0.0000	0.0000	
SG03	0.0000		0.0000	0.0025	0.0000	0.0000		0.0000					0.0000		0.0250		0.0000		0.0000	0.0000	
SG04	0.0000		0.0000	0.0010	0.0000	0.0000		0.0000					0.0000		0.0100		0.0000		0.0000	0.0000	
SG05	0.0000		0.0000	0.0020	0.0000	0.0000		0.0000					0.0000		0.0200		0.0000		0.0000	0.0000	
SG06	0.0000		0.0000	0.0010	0.0000	0.0000		0.0000					0.0000		0.0100		0.0000		0.0000	0.0000	
SG07	0.0000		0.0000	0.0030	0.0000	0.0000		0.0000					0.0000		0.0300		0.0000		0.0000	0.0000	
SG08	0.0000		0.0000	0.0015	0.0000	0.0000		0.0000					0.0000		0.0250		0.0000		0.0000	0.0000	

SP (Mika et al. 1997)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
SP-Na-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0020	0.0003		0.0000		0.0003
SP-Na-3	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0018	0.0003		0.0000		0.0003
SP-Ni-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Ni-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Ni-3	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Si-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0008		0.0010	0.0000			0.0022	0.0003		0.0000		0.0003
SP-Si-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0006		0.0008	0.0000			0.0017	0.0003		0.0000		0.0003
SP-Si-3	0.0000		0.0000	0.0000			0.0002		0.0002	0.0005		0.0007	0.0000			0.0014	0.0002		0.0000		0.0002

MS (Hrma 1999)

MS-1a																					
MS-1b																					
MS-2a																					
MS-2b																					
MS-3a																					
MS-3b																					
MS-4a																					
MS-4b																					
MS-5																					
MS-6																					
MS-7																					
MS-8																					
MS-9																					
MS-7 H-Al																					
MS-7 L-Al																					
MS-7 H-Cr																					
MS-7 L-Cr																					
MS-7 H-Fe																					
MS-7 L-Fe																					
MS-7 H-Li																					
MS-7 L-Li																					
MS-7 H-Mg																					
MS-7 L-Mg																					
MS-7 H-Na																					
MS-7 L-Na																					
MS-7 VH-Ni																					
MS-7 H-Ni																					
MS-7 L-Ni																					

SG (Hrma et al. 1999)

SG01	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG02	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG03	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0026
SG04	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG05	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0037
SG06	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG07	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG08	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0026

SP (Mika et al. 1997)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
SP-Na-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Na-3		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Ni-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Ni-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Ni-3		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Si-1		0.0000				0.0000	0.0000	0.0005		1.0000											
SP-Si-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Si-3		0.0000				0.0000	0.0000	0.0003		1.0000											

MS (Hrma 1999)

MS-1a										1.0000											
MS-1b										1.0000											
MS-2a										1.0000											
MS-2b										1.0000											
MS-3a										1.0000											
MS-3b										1.0000											
MS-4a										1.0000											
MS-4b										1.0000											
MS-5										1.0000											
MS-6										1.0000											
MS-7										1.0000											
MS-8										1.0000											
MS-9										1.0000											
MS-7 H-Al										0.9999											
MS-7 L-Al										0.9994											
MS-7 H-Cr										0.9992											
MS-7 L-Cr										0.9999											
MS-7 H-Fe										1.0000											
MS-7 L-Fe										1.0000											
MS-7 H-Li										1.0001											
MS-7 L-Li										1.0001											
MS-7 H-Mg										1.0000											
MS-7 L-Mg										1.0000											
MS-7 H-Na										1.0000											
MS-7 L-Na										1.0000											
MS-7 VH-Ni										1.0000											
MS-7 H-Ni										1.0000											
MS-7 L-Ni										1.0000											

SG (Hrma et al. 1999)

SG01		0.0550				0.0000	0.0000	0.0000		1.0000											
SG02		0.0000				0.0000	0.0000	0.0000		1.0001											
SG03		0.0415				0.0000	0.0000	0.0000		1.0000											
SG04		0.0000				0.0000	0.0000	0.0000		1.0000											
SG05		0.0280				0.0000	0.0000	0.0000		1.0000											
SG06		0.0000				0.0000	0.0000	0.0000		1.0000											
SG07		0.0000				0.0000	0.0000	0.0000		1.0000											
SG08		0.0177				0.0000	0.0000	0.0000		1.0000											

SP (Mika et al. 1997)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
SP-Na-2																					
SP-Na-3																					
SP-Ni-1																					
SP-Ni-2																					
SP-Ni-3																					
SP-Si-1																					
SP-Si-2																					
SP-Si-3																					

MS (Hrma 1999)

MS-1a																					
MS-1b																					
MS-2a																					
MS-2b																					
MS-3a																					
MS-3b																					
MS-4a																					
MS-4b																					
MS-5																					
MS-6																					
MS-7																					
MS-8																					
MS-9																					
MS-7 H-Al																					
MS-7 L-Al																					
MS-7 H-Cr																					
MS-7 L-Cr																					
MS-7 H-Fe																					
MS-7 L-Fe																					
MS-7 H-Li																					
MS-7 L-Li																					
MS-7 H-Mg																					
MS-7 L-Mg																					
MS-7 H-Na																					
MS-7 L-Na																					
MS-7 VH-Ni																					
MS-7 H-Ni																					
MS-7 L-Ni																					

SG (Hrma et al. 1999)

SG01																					
SG02																					
SG03																					
SG04																					
SG05																					
SG06																					
SG07																					
SG08																					

SP (Mika et al. 1997)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
SP-Na-2																					
SP-Na-3																					
SP-Ni-1																					
SP-Ni-2																					
SP-Ni-3																					
SP-Si-1																					
SP-Si-2																					
SP-Si-3																					

MS (Hrma 1999)

MS-1a																					
MS-1b																					
MS-2a																					
MS-2b																					
MS-3a																					
MS-3b																					
MS-4a																					
MS-4b																					
MS-5																					
MS-6																					
MS-7																					
MS-8																					
MS-9																					
MS-7 H-Al																					
MS-7 L-Al																					
MS-7 H-Cr																					
MS-7 L-Cr																					
MS-7 H-Fe																					
MS-7 L-Fe																					
MS-7 H-Li																					
MS-7 L-Li																					
MS-7 H-Mg																					
MS-7 L-Mg																					
MS-7 H-Na																					
MS-7 L-Na																					
MS-7 VH-Ni																					
MS-7 H-Ni																					
MS-7 L-Ni																					

SG (Hrma et al. 1999)

SG01																					
SG02																					
SG03																					
SG04																					
SG05																					
SG06																					
SG07																					
SG08																					

SP (Mika et al. 1997)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
SP-Na-2																				
SP-Na-3																				
SP-Ni-1																				
SP-Ni-2																				
SP-Ni-3																				
SP-Si-1																				
SP-Si-2																				
SP-Si-3																				

MS (Hrma 1999)

MS-1a																				
MS-1b																				
MS-2a																				
MS-2b																				
MS-3a																				
MS-3b																				
MS-4a																				
MS-4b																				
MS-5																				
MS-6																				
MS-7																				
MS-8																				
MS-9																				
MS-7 H-Al																				
MS-7 L-Al																				
MS-7 H-Cr																				
MS-7 L-Cr																				
MS-7 H-Fe																				
MS-7 L-Fe																				
MS-7 H-Li																				
MS-7 L-Li																				
MS-7 H-Mg																				
MS-7 L-Mg																				
MS-7 H-Na																				
MS-7 L-Na																				
MS-7 VH-Ni																				
MS-7 H-Ni																				
MS-7 L-Ni																				

SG (Hrma et al. 1999)

SG01																				
SG02																				
SG03																				
SG04																				
SG05																				
SG06																				
SG07																				
SG08																				

SP (Mika et al. 1997)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
SP-Na-2			1147	spinel				
SP-Na-3			941	spinel				
SP-Ni-1			970	spinel				
SP-Ni-2			1078	spinel				
SP-Ni-3			1222	spinel				
SP-Si-1			1107	spinel				
SP-Si-2			1007	spinel				
SP-Si-3			1017	spinel				

MS (Hrma 1999)

MS-1a			1247	spinel				
MS-1b			1221	spinel				
MS-2a			1215	spinel				
MS-2b			1223	spinel				
MS-3a			1185	spinel				
MS-3b			1188	spinel				
MS-4a			1139	spinel				
MS-4b			1144	spinel				
MS-5			1171	spinel				
MS-6			1225	spinel				
MS-7			1078	spinel				
MS-8			1125	spinel				
MS-9			1199	spinel				
MS-7 H-Al			1136	spinel				
MS-7 L-Al			1018	spinel				
MS-7 H-Cr			1115	spinel				
MS-7 L-Cr			1039	spinel				
MS-7 H-Fe			1141	spinel				
MS-7 L-Fe			1015	spinel				
MS-7 H-Li			1042	spinel				
MS-7 L-Li			1117	spinel				
MS-7 H-Mg			1144	spinel				
MS-7 L-Mg			1062	spinel				
MS-7 H-Na			987	spinel				
MS-7 L-Na			1188	spinel				
MS-7 VH-Ni			1252	spinel				
MS-7 H-Ni			1151	spinel				
MS-7 L-Ni			1022	spinel				

SG (Hrma et al. 1999)

SG01	1107		1124	spinel				
SG02	1150		775	RuO2, clinopyroxene				
SG03	1200		1164	spinel				
SG04	1250		1261	spinel				
SG05	1250		1084	spinel				
SG06	1322		911	RuO2, spinel				
SG07	1294		950	spinel				
SG08	1330		1114	RuO2, spinel				

SP (Mika et al. 1997)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
SP-Na-2					
SP-Na-3					
SP-Ni-1					
SP-Ni-2					
SP-Ni-3					
SP-Si-1					
SP-Si-2					
SP-Si-3					

MS (Hrma 1999)

MS-1a					
MS-1b					
MS-2a					
MS-2b					
MS-3a					
MS-3b					
MS-4a					
MS-4b					
MS-5					
MS-6					
MS-7					
MS-8					
MS-9					
MS-7 H-Al					
MS-7 L-Al					
MS-7 H-Cr					
MS-7 L-Cr					
MS-7 H-Fe					
MS-7 L-Fe					
MS-7 H-Li					
MS-7 L-Li					
MS-7 H-Mg					
MS-7 L-Mg					
MS-7 H-Na					
MS-7 L-Na					
MS-7 VH-Ni					
MS-7 H-Ni					
MS-7 L-Ni					

SG (Hrma et al. 1999)

SG01					
SG02					
SG03					
SG04					
SG05					
SG06					
SG07					
SG08					

SP (Mika et al. 1997)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
SP-Na-2															
SP-Na-3															
SP-Ni-1															
SP-Ni-2															
SP-Ni-3															
SP-Si-1															
SP-Si-2															
SP-Si-3															

MS (Hrma 1999)

MS-1a															
MS-1b															
MS-2a															
MS-2b															
MS-3a															
MS-3b															
MS-4a															
MS-4b															
MS-5															
MS-6															
MS-7															
MS-8															
MS-9															
MS-7 H-Al															
MS-7 L-Al															
MS-7 H-Cr															
MS-7 L-Cr															
MS-7 H-Fe															
MS-7 L-Fe															
MS-7 H-Li															
MS-7 L-Li															
MS-7 H-Mg															
MS-7 L-Mg															
MS-7 H-Na															
MS-7 L-Na															
MS-7 VH-Ni															
MS-7 H-Ni															
MS-7 L-Ni															

SG (Hrma et al. 1999)

SG01															
SG02															
SG03															
SG04															
SG05															
SG06															
SG07															
SG08															

SP (Mika et al. 1997)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
SP-Na-2																					
SP-Na-3																					
SP-Ni-1																					
SP-Ni-2																					
SP-Ni-3																					
SP-Si-1																					
SP-Si-2																					
SP-Si-3																					

MS (Hrma 1999)

MS-1a																					
MS-1b																					
MS-2a																					
MS-2b																					
MS-3a																					
MS-3b																					
MS-4a																					
MS-4b																					
MS-5																					
MS-6																					
MS-7																					
MS-8																					
MS-9																					
MS-7 H-Al																					
MS-7 L-Al																					
MS-7 H-Cr																					
MS-7 L-Cr																					
MS-7 H-Fe																					
MS-7 L-Fe																					
MS-7 H-Li																					
MS-7 L-Li																					
MS-7 H-Mg																					
MS-7 L-Mg																					
MS-7 H-Na																					
MS-7 L-Na																					
MS-7 VH-Ni																					
MS-7 H-Ni																					
MS-7 L-Ni																					

SG (Hrma et al. 1999)

SG01																					
SG02																					
SG03																					
SG04																					
SG05																					
SG06																					
SG07																					
SG08																					

SP (Mika et al. 1997)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
SP-Na-2																
SP-Na-3																
SP-Ni-1																
SP-Ni-2																
SP-Ni-3																
SP-Si-1																
SP-Si-2																
SP-Si-3																

MS (Hrma 1999)

MS-1a																
MS-1b																
MS-2a																
MS-2b																
MS-3a																
MS-3b																
MS-4a																
MS-4b																
MS-5																
MS-6																
MS-7																
MS-8																
MS-9																
MS-7 H-Al																
MS-7 L-Al																
MS-7 H-Cr																
MS-7 L-Cr																
MS-7 H-Fe																
MS-7 L-Fe																
MS-7 H-Li																
MS-7 L-Li																
MS-7 H-Mg																
MS-7 L-Mg																
MS-7 H-Na																
MS-7 L-Na																
MS-7 VH-Ni																
MS-7 H-Ni																
MS-7 L-Ni																

SG (Hrma et al. 1999)

SG01																
SG02																
SG03																
SG04																
SG05																
SG06																
SG07																
SG08																

SP (Mika et al. 1997)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
SP-Na-2												
SP-Na-3												
SP-Ni-1												
SP-Ni-2												
SP-Ni-3												
SP-Si-1												
SP-Si-2												
SP-Si-3												

MS (Hrma 1999)

MS-1a												
MS-1b												
MS-2a												
MS-2b												
MS-3a												
MS-3b												
MS-4a												
MS-4b												
MS-5												
MS-6												
MS-7												
MS-8												
MS-9												
MS-7 H-Al												
MS-7 L-Al												
MS-7 H-Cr												
MS-7 L-Cr												
MS-7 H-Fe												
MS-7 L-Fe												
MS-7 H-Li												
MS-7 L-Li												
MS-7 H-Mg												
MS-7 L-Mg												
MS-7 H-Na												
MS-7 L-Na												
MS-7 VH-Ni												
MS-7 H-Ni												
MS-7 L-Ni												

SG (Hrma et al. 1999)

SG01												
SG02												
SG03												
SG04												
SG05												
SG06												
SG07												
SG08												

SG (Hrma et al. 1999)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
SG09	0.0799	0.0999	0.0200	0.1499		0.0150	0.0599	0.0050	0.0599	0.0005	0.0000	0.4396	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG10	0.0390	0.0626	0.0073	0.0825		0.0323	0.0525	0.0200	0.0726	0.0151	0.0000	0.5437	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG11	0.0390	0.0876	0.0073	0.0825		0.0208	0.0525	0.0200	0.0976	0.0054	0.0000	0.5497	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG12	0.0250	0.0500	0.0030	0.1499		0.0150	0.0300	0.0250	0.1099	0.0005	0.0000	0.5765	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG13	0.0250	0.0999	0.0030	0.0874		0.0150	0.0599	0.0050	0.0599	0.0200	0.0000	0.5895	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG14	0.0250	0.0999	0.0030	0.1499		0.0380	0.0300	0.0250	0.1099	0.0005	0.0000	0.4306	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG15	0.0250	0.0999	0.0200	0.0599		0.0150	0.0599	0.0250	0.0599	0.0200	0.0000	0.5895	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG16	0.0664	0.0626	0.0158	0.0825		0.0208	0.0525	0.0200	0.0976	0.0054	0.0000	0.5026	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG17	0.0390	0.0725	0.0158	0.1275		0.0323	0.0525	0.0100	0.0976	0.0151	0.0000	0.4741	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG18a	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG18b	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG18c	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG18d	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG18e	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG18f	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG18g	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG19	0.0799	0.0999	0.0030	0.0599		0.0380	0.0599	0.0050	0.1099	0.0200	0.0000	0.4541	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG20	0.0799	0.0500	0.0200	0.0599		0.0150	0.0599	0.0250	0.1099	0.0005	0.0000	0.5070	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG21	0.0390	0.0876	0.0158	0.0825		0.0208	0.0525	0.0100	0.0726	0.0151	0.0000	0.5540	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG22	0.0664	0.0626	0.0158	0.1275		0.0208	0.0525	0.0100	0.0976	0.0151	0.0000	0.4931	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG23	0.0417	0.0626	0.0158	0.0825		0.0323	0.0375	0.0200	0.0976	0.0151	0.0000	0.5540	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG24	0.0250	0.0500	0.0030	0.1194		0.0150	0.0599	0.0050	0.0599	0.0005	0.0000	0.5895	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG25	0.0799	0.0999	0.0030	0.1499		0.0380	0.0300	0.0250	0.0599	0.0200	0.0000	0.4811	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG26	0.0390	0.0626	0.0073	0.1275		0.0208	0.0375	0.0100	0.0976	0.0054	0.0000	0.5276	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG27	0.0664	0.0876	0.0158	0.1109		0.0323	0.0525	0.0200	0.0726	0.0054	0.0000	0.4741	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG28	0.0250	0.0999	0.0200	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.5015	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG29	0.0799	0.0500	0.0030	0.0599		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.5240	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG30	0.0799	0.0500	0.0200	0.0599		0.0380	0.0599	0.0250	0.1099	0.0200	0.0000	0.4491	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG31	0.0799	0.0999	0.0200	0.1494		0.0380	0.0599	0.0250	0.0599	0.0005	0.0000	0.4296	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG32	0.0799	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0200	0.0000	0.4396	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG33	0.0799	0.0999	0.0200	0.0599		0.0380	0.0599	0.0050	0.1099	0.0200	0.0000	0.4676	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG34	0.0799	0.0999	0.0200	0.1454		0.0150	0.0300	0.0250	0.0599	0.0005	0.0000	0.4296	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG35	0.0799	0.0500	0.0030	0.1449		0.0380	0.0599	0.0250	0.1099	0.0200	0.0000	0.4296	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG36	0.0250	0.0999	0.0200	0.0599		0.0380	0.0300	0.0050	0.1099	0.0005	0.0000	0.5415	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG37	0.0250	0.0999	0.0200	0.0599		0.0380	0.0599	0.0250	0.0599	0.0030	0.0000	0.5895	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG38	0.0250	0.0999	0.0030	0.1464		0.0380	0.0300	0.0250	0.1099	0.0005	0.0000	0.4296	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG39	0.0250	0.0500	0.0200	0.1499		0.0150	0.0300	0.0050	0.1099	0.0200	0.0000	0.5355	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG40	0.0799	0.0999	0.0030	0.0599		0.0150	0.0300	0.0250	0.1099	0.0200	0.0000	0.4826	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG41	0.0799	0.0999	0.0200	0.1499		0.0150	0.0300	0.0050	0.0599	0.0200	0.0000	0.4321	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG42	0.0449	0.0876	0.0073	0.1275		0.0323	0.0525	0.0200	0.0976	0.0054	0.0000	0.4741	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG43	0.0664	0.0876	0.0073	0.0825		0.0323	0.0375	0.0100	0.0976	0.0054	0.0000	0.5257	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG44	0.0664	0.0876	0.0073	0.1275		0.0208	0.0375	0.0200	0.0726	0.0151	0.0000	0.5052	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG45	0.0250	0.0999	0.0200	0.0599		0.0150	0.0300	0.0250	0.1099	0.0200	0.0000	0.5620	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000

SG (Hrma et al. 1999)

Glass ID	Cl		CoO		Co2O3		Cr2O3		Cs2O		CuO		Eu2O3		F		Ga2O3		Gd2O3		HgO		I		La2O3		MnO2		MnO		MoO		MoO3		Nb2O5		Nd2O3		PbO		PdO2
	-t		-t		-t		-t		-t		-t		-t		-t		-t		-t		-t		-t		-t		-t		-t		-t		-t		-t		-t		-t	
SG09	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG10	0.0000				0.0000		0.0025		0.0000		0.0000				0.0000										0.0000				0.0250				0.0000				0.0000		0.0000	
SG11	0.0000				0.0000		0.0015		0.0000		0.0000				0.0000										0.0000				0.0150				0.0000				0.0000		0.0000	
SG12	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG13	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG14	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG15	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG16	0.0000				0.0000		0.0015		0.0000		0.0000				0.0000										0.0000				0.0250				0.0000				0.0000		0.0000	
SG17	0.0000				0.0000		0.0015		0.0000		0.0000				0.0000										0.0000				0.0150				0.0000				0.0000		0.0000	
SG18a	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG18b	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG18c	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG18d	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG18e	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG18f	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG18g	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG19	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG20	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG21	0.0000				0.0000		0.0025		0.0000		0.0000				0.0000										0.0000				0.0242				0.0000				0.0000		0.0000	
SG22	0.0000				0.0000		0.0025		0.0000		0.0000				0.0000										0.0000				0.0150				0.0000				0.0000		0.0000	
SG23	0.0000				0.0000		0.0025		0.0000		0.0000				0.0000										0.0000				0.0150				0.0000				0.0000		0.0000	
SG24	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG25	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG26	0.0000				0.0000		0.0025		0.0000		0.0000				0.0000										0.0000				0.0150				0.0000				0.0000		0.0000	
SG27	0.0000				0.0000		0.0025		0.0000		0.0000				0.0000										0.0000				0.0150				0.0000				0.0000		0.0000	
SG28	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG29	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG30	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG31	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG32	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG33	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG34	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG35	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG36	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG37	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG38	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG39	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG40	0.0000				0.0000		0.0030		0.0000		0.0000				0.0000										0.0000				0.0100				0.0000				0.0000		0.0000	
SG41	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	
SG42	0.0000				0.0000		0.0025		0.0000		0.0000				0.0000										0.0000				0.0250				0.0000				0.0000		0.0000	
SG43	0.0000				0.0000		0.0015		0.0000		0.0000				0.0000										0.0000				0.0250				0.0000				0.0000		0.0000	
SG44	0.0000				0.0000		0.0015		0.0000		0.0000				0.0000										0.0000				0.0150				0.0000				0.0000		0.0000	
SG45	0.0000				0.0000		0.0010		0.0000		0.0000				0.0000										0.0000				0.0300				0.0000				0.0000		0.0000	

SG (Hrma et al. 1999)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
SG09	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG10	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0026
SG11	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0026
SG12	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG13	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG14	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG15	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG16	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0049
SG17	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0049
SG18a	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG18b	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG18c	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG18d	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG18e	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG18f	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG18g	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG19	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG20	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG21	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0049
SG22	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0026
SG23	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0049
SG24	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG25	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG26	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0049
SG27	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0026
SG28	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG29	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG30	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG31	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG32	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG33	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG34	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG35	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG36	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG37	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG38	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG39	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG40	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG41	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG42	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0049
SG43	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0026
SG44	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0049
SG45	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015

SG (Hrma et al. 1999)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
SG09		0.0550				0.0000	0.0000	0.0000		1.0000											
SG10		0.0415				0.0000	0.0000	0.0000		1.0000											
SG11		0.0177				0.0000	0.0000	0.0000		1.0000											
SG12		0.0000				0.0000	0.0000	0.0000		1.0000											
SG13		0.0000				0.0000	0.0000	0.0000		1.0000											
SG14		0.0550				0.0000	0.0000	0.0000		1.0000											
SG15		0.0080				0.0000	0.0000	0.0000		1.0000											
SG16		0.0415				0.0000	0.0000	0.0000		1.0000											
SG17		0.0415				0.0000	0.0000	0.0000		1.0000											
SG18a		0.0000				0.0000	0.0000	0.0000		1.0000											
SG18b		0.0000				0.0000	0.0000	0.0000		1.0000											
SG18c		0.0000				0.0000	0.0000	0.0000		1.0000											
SG18d		0.0000				0.0000	0.0000	0.0000		1.0000											
SG18e		0.0000				0.0000	0.0000	0.0000		1.0000											
SG18f		0.0000				0.0000	0.0000	0.0000		1.0000											
SG18g		0.0000				0.0000	0.0000	0.0000		1.0000											
SG19		0.0550				0.0000	0.0000	0.0000		1.0000											
SG20		0.0550				0.0000	0.0000	0.0000		1.0000											
SG21		0.0177				0.0000	0.0000	0.0000		1.0000											
SG22		0.0177				0.0000	0.0000	0.0000		1.0000											
SG23		0.0177				0.0000	0.0000	0.0000		1.0000											
SG24		0.0550				0.0000	0.0000	0.0000		1.0001											
SG25		0.0000				0.0000	0.0000	0.0000		1.0000											
SG26		0.0415				0.0000	0.0000	0.0000		1.0000											
SG27		0.0415				0.0000	0.0000	0.0000		1.0000											
SG28		0.0000				0.0000	0.0000	0.0000		1.0000											
SG29		0.0550				0.0000	0.0000	0.0000		1.0000											
SG30		0.0550				0.0000	0.0000	0.0000		1.0000											
SG31		0.0000				0.0000	0.0000	0.0000		1.0000											
SG32		0.0000				0.0000	0.0000	0.0000		1.0000											
SG33		0.0000				0.0000	0.0000	0.0000		1.0000											
SG34		0.0550				0.0000	0.0000	0.0000		1.0000											
SG35		0.0000				0.0000	0.0000	0.0000		1.0000											
SG36		0.0550				0.0000	0.0000	0.0000		1.0001											
SG37		0.0000				0.0000	0.0000	0.0000		1.0000											
SG38		0.0550				0.0000	0.0000	0.0000		1.0000											
SG39		0.0000				0.0000	0.0000	0.0000		1.0000											
SG40		0.0550				0.0000	0.0000	0.0000		1.0000											
SG41		0.0550				0.0000	0.0000	0.0000		1.0000											
SG42		0.0177				0.0000	0.0000	0.0000		1.0000											
SG43		0.0177				0.0000	0.0000	0.0000		1.0000											
SG44		0.0177				0.0000	0.0000	0.0000		1.0000											
SG45		0.0000				0.0000	0.0000	0.0000		1.0000											

SG (Hrma et al. 1999)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
SG09																					
SG10																					
SG11																					
SG12																					
SG13																					
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SG41																					
SG42																					
SG43																					
SG44																					
SG45																					

SG (Hrma et al. 1999)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
SG09																					
SG10																					
SG11																					
SG12																					
SG13																					
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SG18a																					
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SG40																					
SG41																					
SG42																					
SG43																					
SG44																					
SG45																					

SG (Hrma et al. 1999)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
SG09																				
SG10																				
SG11																				
SG12																				
SG13																				
SG14																				
SG15																				
SG16																				
SG17																				
SG18a																				
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SG40																				
SG41																				
SG42																				
SG43																				
SG44																				
SG45																				

SG (Hrma et al. 1999)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
SG09	1200		1173	spinel				
SG10	1275		1098	RuO2, spinel				
SG11	1264		895	RuO2, spinel				
SG12	1384		1030	RuO2, spinel				
SG13	1319		1063	RuO2, spinel				
SG14	1160		951	spinel				
SG15	1285		935	RuO2, clinopyroxene				
SG16	1250		995	RuO2, spinel				
SG17	1160		1075	spinel				
SG18a	1142		879	spinel				
SG18b	1142		887	spinel				
SG18c	1142		859	spinel				
SG18d	1142		883	spinel				
SG18e	1142		883	spinel				
SG18f	1142		891	spinel				
SG18g	1142		882	spinel				
SG19	1140		929	spinel				
SG20	1240		799	RuO2, spinel, clinopyroxene				
SG21	1284		987	RuO2, spinel				
SG22	1246		1145	spinel				
SG23	1304		1069	RuO2, spinel				
SG24	1345		995	RuO2, clinopyroxene				
SG25	1333		1310	spinel				
SG26	1304		1071	spinel				
SG27	1211		1086	spinel				
SG28	1150		833	RuO2, clinopyroxene				
SG29	1280		811	spinel				
SG30	1157		1031	spinel				
SG31	1149		1081	spinel				
SG32	1250		1132	spinel				
SG33	1145		943	spinel				
SG34	1285		1282	spinel				
SG35	1134		1231	spinel				
SG36	1265		813	RuO2, clinopyroxene				
SG37	1268		944	RuO2, spinel				
SG38	1151		897	spinel				
SG39	1322		1164	spinel				
SG40	1300		1173	spinel				
SG41	1300		1304	spinel				
SG42	1160		990	spinel				
SG43	1317		924	spinel				
SG44	1330		1244	RuO2, spinel				
SG45	1317		936	RuO2, spinel, clinopyroxene				

SG (Hrma et al. 1999)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
SG09					
SG10					
SG11					
SG12					
SG13					
SG14					
SG15					
SG16					
SG17					
SG18a					
SG18b					
SG18c					
SG18d					
SG18e					
SG18f					
SG18g					
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SG40					
SG41					
SG42					
SG43					
SG44					
SG45					

SG (Hrma et al. 1999)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
SG09															
SG10															
SG11															
SG12															
SG13															
SG14															
SG15															
SG16															
SG17															
SG18a															
SG18b															
SG18c															
SG18d															
SG18e															
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SG39															
SG40															
SG41															
SG42															
SG43															
SG44															
SG45															

SG (Hrma et al. 1999)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
SG09																					
SG10																					
SG11																					
SG12																					
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SG14																					
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SG18a																					
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SG44																					
SG45																					

SG (Hrma et al. 1999)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
SG09																
SG10																
SG11																
SG12																
SG13																
SG14																
SG15																
SG16																
SG17																
SG18a																
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SG41																
SG42																
SG43																
SG44																
SG45																

SG (Hrma et al. 1999)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
SG09												
SG10												
SG11												
SG12												
SG13												
SG14												
SG15												
SG16												
SG17												
SG18a												
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SG39												
SG40												
SG41												
SG42												
SG43												
SG44												
SG45												

SG (Hrma et al. 1999)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
SG46	0.0250	0.0500	0.0030	0.1499		0.0380	0.0599	0.0250	0.0599	0.0200	0.0000	0.4946	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG47	0.0250	0.0500	0.0200	0.1499		0.0150	0.0599	0.0250	0.1099	0.0200	0.0000	0.4551	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG48	0.0270	0.0999	0.0030	0.0599		0.0380	0.0300	0.0050	0.1099	0.0200	0.0000	0.5895	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG49	0.0250	0.0500	0.0030	0.0809		0.0380	0.0599	0.0050	0.0599	0.0005	0.0000	0.5895	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG50	0.0250	0.0500	0.0200	0.1499		0.0380	0.0300	0.0050	0.0599	0.0200	0.0000	0.5075	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG51	0.0799	0.0500	0.0200	0.1499		0.0380	0.0300	0.0050	0.1099	0.0005	0.0000	0.5015	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG52a	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG52b	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG52c	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG52d	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG52e	0.0250	0.0999	0.0030	0.1499		0.0150	0.0599	0.0050	0.1099	0.0005	0.0000	0.4921	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SG53	0.0530	0.0752	0.0115	0.1052		0.0266	0.0450	0.0150	0.0852	0.0102	0.0000	0.5186	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5	0.0688	0.2000	0.0086	0.1075		0.0024	0.0258	0.0052	0.1353	0.0045	0.0040	0.3957	0.0159	0.0006	0.0000	0.0026	0.0000		0.0060		0.0006
SP-Ca-1	0.0784	0.0686	0.0300	0.1225		0.0027	0.0294	0.0059	0.1541	0.0051	0.0045	0.4507	0.0181	0.0007	0.0000	0.0030	0.0000		0.0068		0.0007
SP-Ca-2	0.0768	0.0672	0.0500	0.1199		0.0027	0.0288	0.0058	0.1509	0.0050	0.0044	0.4414	0.0178	0.0007	0.0000	0.0029	0.0000		0.0067		0.0007
SP-Fe-4	0.0704	0.0616	0.0088	0.2300		0.0025	0.0264	0.0053	0.1384	0.0046	0.0041	0.4048	0.0163	0.0006	0.0000	0.0027	0.0000		0.0061		0.0006
SP-K-1	0.0786	0.0688	0.0098	0.1228		0.0200	0.0295	0.0059	0.1546	0.0051	0.0045	0.4521	0.0182	0.0007	0.0000	0.0030	0.0000		0.0068		0.0007
SP-K-2	0.0770	0.0674	0.0096	0.1203		0.0400	0.0289	0.0058	0.1514	0.0050	0.0045	0.4428	0.0178	0.0007	0.0000	0.0029	0.0000		0.0067		0.0007
SP-Li-5	0.0788	0.0689	0.0098	0.1231		0.0028	0.0450	0.0059	0.1549	0.0051	0.0046	0.4529	0.0182	0.0007	0.0000	0.0030	0.0000		0.0068		0.0007
SP-Li-6	0.0763	0.0668	0.0095	0.1192		0.0027	0.0750	0.0057	0.1500	0.0050	0.0044	0.4387	0.0176	0.0007	0.0000	0.0029	0.0000		0.0066		0.0007
SP-Si-4	0.1037	0.0907	0.0130	0.1620		0.0036	0.0389	0.0078	0.2039	0.0067	0.0060	0.3000	0.0240	0.0009	0.0000	0.0039	0.0000		0.0090		0.0009
SP-Ti-1	0.0780	0.0683	0.0098	0.1219		0.0027	0.0293	0.0059	0.1534	0.0051	0.0045	0.4486	0.0180	0.0007	0.0000	0.0029	0.0000		0.0068		0.0007
SP-Ti-2	0.0760	0.0665	0.0095	0.1188		0.0027	0.0285	0.0057	0.1495	0.0049	0.0044	0.4371	0.0176	0.0007	0.0000	0.0029	0.0000		0.0066		0.0007
SP-Zr-1	0.0782	0.0685	0.0098	0.1223		0.0027	0.0293	0.0059	0.1539	0.0051	0.0045	0.4499	0.0400	0.0007	0.0000	0.0030	0.0000		0.0068		0.0007
SP-Ru-1	0.0800	0.0700	0.0000	0.1249		0.0000	0.0300	0.0060	0.1572	0.0052	0.0059	0.4597	0.0234	0.0009	0.0000	0.0038	0.0000		0.0088		0.0009
SP-Ru-2	0.0799	0.0699	0.0000	0.1249		0.0000	0.0300	0.0060	0.1572	0.0052	0.0059	0.4596	0.0234	0.0009	0.0000	0.0038	0.0000		0.0088		0.0009
SP-Others-1	0.0777	0.0680	0.0097	0.1215		0.0027	0.0292	0.0058	0.1529	0.0051	0.0085	0.4470	0.0180	0.0013	0.0000	0.0055	0.0000		0.0127		0.0013
SP3-1(env.D)	0.1014	0.0699	0.0404	0.2297		0.0086	0.0300	0.0011	0.1575	0.0010	0.0079	0.3021	0.0000	0.0012	0.0000	0.0052	0.0000		0.0119		0.0012
SP-MC-1	0.1600	0.1500	0.0000	0.0500		0.0400	0.0600	0.0000	0.1000	0.0300	0.0000	0.3600	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
SP-MC-2	0.0000	0.1500	0.0000	0.0500		0.0400	0.0000	0.0300	0.1700	0.0000	0.0085	0.3600	0.0800	0.0013	0.0000	0.0055	0.0000		0.0127		0.0013
SP-MC-8	0.0057	0.0000	0.0500	0.0500		0.0000	0.0600	0.0300	0.1355	0.0300	0.0085	0.5000	0.0288	0.0013	0.0000	0.0055	0.0000		0.0127		0.0013
SP-MC-9	0.0573	0.1500	0.0500	0.0500		0.0000	0.0527	0.0300	0.0500	0.0000	0.0000	0.5000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000
Sp-LHLL	0.0500	0.0706	0.0000	0.1260		0.0000	0.0302	0.0061	0.1873	0.0010	0.0059	0.4636	0.0236	0.0009	0.0000	0.0039	0.0000		0.0089		0.0009
Sp-LHLH	0.0500	0.0688	0.0000	0.1228		0.0000	0.0295	0.0059	0.1873	0.0200	0.0058	0.4520	0.0231	0.0009	0.0000	0.0038	0.0000		0.0087		0.0009
Sp-LHHL	0.0500	0.0700	0.0000	0.1251		0.0000	0.0300	0.0060	0.1873	0.0010	0.0059	0.4602	0.0234	0.0009	0.0000	0.0038	0.0000		0.0088		0.0009
Sp-LHHH	0.0500	0.0683	0.0000	0.1219		0.0000	0.0293	0.0059	0.1873	0.0200	0.0058	0.4487	0.0229	0.0009	0.0000	0.0037	0.0000		0.0086		0.0009
Sp-LHMM	0.0500	0.0700	0.0000	0.1250		0.0000	0.0300	0.0060	0.1873	0.0052	0.0059	0.4600	0.0234	0.0009	0.0000	0.0038	0.0000		0.0088		0.0009
Sp-MMLL	0.0800	0.0706	0.0000	0.1260		0.0000	0.0302	0.0061	0.1573	0.0010	0.0059	0.4636	0.0236	0.0009	0.0000	0.0039	0.0000		0.0089		0.0009
Sp-MMLH	0.0800	0.0688	0.0000	0.1228		0.0000	0.0295	0.0059	0.1573	0.0200	0.0058	0.4520	0.0231	0.0009	0.0000	0.0038	0.0000		0.0087		0.0009
Sp-MMHL	0.0800	0.0700	0.0000	0.1251		0.0000	0.0300	0.0060	0.1573	0.0010	0.0059	0.4602	0.0234	0.0009	0.0000	0.0038	0.0000		0.0088		0.0009
Sp-MMHH	0.0800	0.0683	0.0000	0.1219		0.0000	0.0293	0.0059	0.1573	0.0200	0.0058	0.4487	0.0229	0.0009	0.0000	0.0037	0.0000		0.0086		0.0009
Sp-MMMM	0.0800	0.0700	0.0000	0.1250		0.0000	0.0300	0.0060	0.1573	0.0052	0.0059	0.4600	0.0234	0.0009	0.0000	0.0038	0.0000		0.0088		0.0009
Sp-HLLL	0.1100	0.0706	0.0000	0.1260		0.0000	0.0302	0.0061	0.1273	0.0010	0.0059	0.4636	0.0236	0.0009	0.0000	0.0039	0.0000		0.0089		0.0009
Sp-HLLH	0.1100	0.0688	0.0000	0.1228		0.0000	0.0295	0.0059	0.1273	0.0200	0.0058	0.4520	0.0231	0.0009	0.0000	0.0038	0.0000		0.0087		0.0009
Sp-HLHL	0.1100	0.0700	0.0000	0.1251		0.0000	0.0300	0.0060	0.1273	0.0010	0.0059	0.4602	0.0234	0.0009	0.0000	0.0038	0.0000		0.0088		0.0009
Sp-HLHH	0.1100	0.0683	0.0000	0.1219		0.0000	0.0293	0.0059	0.1273	0.0200	0.0058	0.4487	0.0229	0.0009	0.0000	0.0037	0.0000		0.0086		0.0009
Sp-HLMM	0.1100	0.0700	0.0000	0.1250		0.0000	0.0300	0.0060	0.1273	0.0052	0.0059	0.4600	0.0234	0.0009	0.0000	0.0038	0.0000		0.0088		0.0009

SG (Hrma et al. 1999)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
SG46	0.0000		0.0000	0.0030	0.0000	0.0000		0.0000					0.0000		0.0100		0.0000		0.0000	0.0000	
SG47	0.0000		0.0000	0.0030	0.0000	0.0000		0.0000					0.0000		0.0100		0.0000		0.0000	0.0000	
SG48	0.0000		0.0000	0.0010	0.0000	0.0000		0.0000					0.0000		0.0100		0.0000		0.0000	0.0000	
SG49	0.0000		0.0000	0.0010	0.0000	0.0000		0.0000					0.0000		0.0300		0.0000		0.0000	0.0000	
SG50	0.0000		0.0000	0.0030	0.0000	0.0000		0.0000					0.0000		0.0300		0.0000		0.0000	0.0000	
SG51	0.0000		0.0000	0.0030	0.0000	0.0000		0.0000					0.0000		0.0100		0.0000		0.0000	0.0000	
SG52a	0.0000		0.0000	0.0030	0.0000	0.0000		0.0000					0.0000		0.0300		0.0000		0.0000	0.0000	
SG52b	0.0000		0.0000	0.0030	0.0000	0.0000		0.0000					0.0000		0.0300		0.0000		0.0000	0.0000	
SG52c	0.0000		0.0000	0.0030	0.0000	0.0000		0.0000					0.0000		0.0300		0.0000		0.0000	0.0000	
SG52d	0.0000		0.0000	0.0030	0.0000	0.0000		0.0000					0.0000		0.0300		0.0000		0.0000	0.0000	
SG52e	0.0000		0.0000	0.0030	0.0000	0.0000		0.0000					0.0000		0.0300		0.0000		0.0000	0.0000	
SG53	0.0000		0.0000	0.0020	0.0000	0.0000		0.0000					0.0000		0.0200		0.0000		0.0000	0.0000	

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5	0.0001		0.0008	0.0019	0.0000	0.0003		0.0005					0.0023		0.0031		0.0001		0.0016	0.0015	
SP-Ca-1	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Ca-2	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0035		0.0001		0.0017	0.0016	
SP-Fe-4	0.0001		0.0008	0.0019	0.0000	0.0003		0.0005					0.0024		0.0032		0.0001		0.0016	0.0015	
SP-K-1	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-K-2	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0035		0.0001		0.0017	0.0016	
SP-Li-5	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Li-6	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0035		0.0001		0.0017	0.0016	
SP-Si-4	0.0001		0.0012	0.0029	0.0000	0.0004		0.0008					0.0035		0.0047		0.0001		0.0023	0.0022	
SP-Ti-1	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0035		0.0001		0.0018	0.0017	
SP-Ti-2	0.0001		0.0009	0.0021	0.0000	0.0003		0.0006					0.0026		0.0034		0.0001		0.0017	0.0016	
SP-Zr-1	0.0001		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0036		0.0001		0.0018	0.0017	
SP-Ru-1	0.0001		0.0011	0.0022	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
SP-Ru-2	0.0001		0.0011	0.0022	0.0000	0.0004		0.0008					0.0034		0.0036		0.0001		0.0023	0.0022	
SP-Others-1	0.0002		0.0017	0.0021	0.0000	0.0006		0.0011					0.0050		0.0067		0.0002		0.0033	0.0031	
SP3-1(env.D)	0.0002		0.0016	0.0004	0.0000	0.0005		0.0010					0.0047		0.0062		0.0002		0.0031	0.0029	
SP-MC-1	0.0000		0.0000	0.0000	0.0000	0.0000		0.0000					0.0000		0.0000		0.0000		0.0000	0.0000	
SP-MC-2	0.0002		0.0017	0.0100	0.0000	0.0006		0.0011					0.0050		0.0067		0.0002		0.0033	0.0031	
SP-MC-8	0.0002		0.0017	0.0000	0.0000	0.0006		0.0011					0.0050		0.0067		0.0002		0.0033	0.0031	
SP-MC-9	0.0000		0.0000	0.0100	0.0000	0.0000		0.0000					0.0000		0.0000		0.0000		0.0000	0.0000	
Sp-LHLL	0.0001		0.0012	0.0005	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
Sp-LHLH	0.0001		0.0011	0.0005	0.0000	0.0004		0.0008					0.0034		0.0035		0.0001		0.0023	0.0021	
Sp-LHHL	0.0001		0.0011	0.0060	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
Sp-LHHH	0.0001		0.0011	0.0060	0.0000	0.0004		0.0007					0.0034		0.0035		0.0001		0.0022	0.0021	
Sp-LHMM	0.0001		0.0011	0.0022	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
Sp-MMLL	0.0001		0.0012	0.0005	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
Sp-MMLH	0.0001		0.0011	0.0005	0.0000	0.0004		0.0008					0.0034		0.0035		0.0001		0.0023	0.0021	
Sp-MMHL	0.0001		0.0011	0.0060	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
Sp-MMHH	0.0001		0.0011	0.0060	0.0000	0.0004		0.0007					0.0034		0.0035		0.0001		0.0022	0.0021	
Sp-MMMM	0.0001		0.0011	0.0022	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
Sp-HLLL	0.0001		0.0012	0.0005	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
Sp-HLLH	0.0001		0.0011	0.0005	0.0000	0.0004		0.0008					0.0034		0.0035		0.0001		0.0023	0.0021	
Sp-HLHL	0.0001		0.0011	0.0060	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
Sp-HLHH	0.0001		0.0011	0.0060	0.0000	0.0004		0.0007					0.0034		0.0035		0.0001		0.0022	0.0021	
Sp-HLMM	0.0001		0.0011	0.0022	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	

SG (Hrma et al. 1999)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
SG46	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG47	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG48	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG49	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG50	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG51	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0015
SG52a	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG52b	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG52c	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG52d	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG52e	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0060
SG53	0.0000		0.0000	0.0000			0.0000		0.0009	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0037

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5	0.0000		0.0000	0.0000			0.0003		0.0003	0.0006		0.0008	0.0000			0.0016	0.0003		0.0000		0.0003
SP-Ca-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Ca-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0018	0.0003		0.0000		0.0003
SP-Fe-4	0.0000		0.0000	0.0000			0.0003		0.0003	0.0006		0.0008	0.0000			0.0017	0.0003		0.0000		0.0003
SP-K-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-K-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0018	0.0003		0.0000		0.0003
SP-Li-5	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Li-6	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0018	0.0003		0.0000		0.0003
SP-Si-4	0.0000		0.0000	0.0000			0.0004		0.0004	0.0009		0.0012	0.0000			0.0025	0.0004		0.0000		0.0004
SP-Ti-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0250
SP-Ti-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0018	0.0003		0.0000		0.0500
SP-Zr-1	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0000		0.0003
SP-Ru-1	0.0000		0.0000	0.0000			0.0004		0.0009	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
SP-Ru-2	0.0000		0.0000	0.0000			0.0004		0.0012	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
SP-Others-1	0.0000		0.0000	0.0000			0.0006		0.0005	0.0013		0.0017	0.0000			0.0035	0.0006		0.0000		0.0003
SP3-1(env.D)	0.0000		0.0000	0.0000			0.0005		0.0005	0.0012		0.0016	0.0000			0.0033	0.0005		0.0000		0.0019
SP-MC-1	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0500
SP-MC-2	0.0000		0.0000	0.0000			0.0006		0.0005	0.0013		0.0017	0.0000			0.0035	0.0006		0.0000		0.0500
SP-MC-8	0.0000		0.0000	0.0000			0.0006		0.0005	0.0013		0.0017	0.0000			0.0035	0.0006		0.0000		0.0500
SP-MC-9	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0000	0.0000		0.0000		0.0500
Sp-LHLL	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0012	0.0000			0.0025	0.0004		0.0000		0.0003
Sp-LHLH	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-LHHL	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-LHHH	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-LHMM	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-MMLL	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0012	0.0000			0.0025	0.0004		0.0000		0.0003
Sp-MMLH	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-MMHL	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-MMHH	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-MMMM	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-HLLL	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0012	0.0000			0.0025	0.0004		0.0000		0.0003
Sp-HLLH	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-HLHL	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-HLHH	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-HLMM	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003

SG (Hrma et al. 1999)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
SG46		0.0550				0.0000	0.0000	0.0000		1.0000											
SG47		0.0550				0.0000	0.0000	0.0000		1.0000											
SG48		0.0000				0.0000	0.0000	0.0000		1.0001											
SG49		0.0550				0.0000	0.0000	0.0000		1.0001											
SG50		0.0550				0.0000	0.0000	0.0000		1.0000											
SG51		0.0000				0.0000	0.0000	0.0000		1.0000											
SG52a		0.0000				0.0000	0.0000	0.0000		1.0000											
SG52b		0.0000				0.0000	0.0000	0.0000		1.0000											
SG52c		0.0000				0.0000	0.0000	0.0000		1.0000											
SG52d		0.0000				0.0000	0.0000	0.0000		1.0000											
SG52e		0.0000				0.0000	0.0000	0.0000		1.0000											
SG53		0.0280				0.0000	0.0000	0.0000		1.0000											

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5		0.0000				0.0000	0.0000	0.0003		1.0000											
SP-Ca-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Ca-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Fe-4		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-K-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-K-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Li-5		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Li-6		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Si-4		0.0000				0.0000	0.0000	0.0005		1.0000											
SP-Ti-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Ti-2		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Zr-1		0.0000				0.0000	0.0000	0.0004		1.0000											
SP-Ru-1		0.0000				0.0000	0.0000	0.0005		0.9999											
SP-Ru-2		0.0000				0.0000	0.0000	0.0005		0.9999											
SP-Others-1		0.0000				0.0000	0.0000	0.0007		1.0000											
SP3-1(env.D)		0.0000				0.0000	0.0000	0.0007		1.0000											
SP-MC-1		0.0000				0.0000	0.0000	0.0000		1.0000											
SP-MC-2		0.0000				0.0000	0.0000	0.0007		1.0000											
SP-MC-8		0.0000				0.0000	0.0000	0.0007		1.0000											
SP-MC-9		0.0000				0.0000	0.0000	0.0000		1.0000											
Sp-LHLL		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-LHLH		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-LHHL		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-LHHH		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-LHMM		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-MMLL		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-MMLH		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-MMHL		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-MMHH		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-MMMM		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-HLLL		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-HLLH		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-HLHL		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-HLHH		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-HLMM		0.0000				0.0000	0.0000	0.0005		0.9999											

SG (Hrma et al. 1999)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
SG46																					
SG47																					
SG48																					
SG49																					
SG50																					
SG51																					
SG52a																					
SG52b																					
SG52c																					
SG52d																					
SG52e																					
SG53																					

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5																					
SP-Ca-1																					
SP-Ca-2																					
SP-Fe-4																					
SP-K-1																					
SP-K-2																					
SP-Li-5																					
SP-Li-6																					
SP-Si-4																					
SP-Ti-1																					
SP-Ti-2																					
SP-Zr-1																					
SP-Ru-1																					
SP-Ru-2																					
SP-Others-1																					
SP3-1(env.D)																					
SP-MC-1																					
SP-MC-2																					
SP-MC-8																					
SP-MC-9																					
Sp-LHLL																					
Sp-LHLH																					
Sp-LHHL																					
Sp-LHHH																					
Sp-LHMM																					
Sp-MMLL																					
Sp-MMLH																					
Sp-MMHL																					
Sp-MMHH																					
Sp-MMMM																					
Sp-HLLL																					
Sp-HLLH																					
Sp-HLHL																					
Sp-HLHH																					
Sp-HLMM																					

SG (Hrma et al. 1999)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
SG46																					
SG47																					
SG48																					
SG49																					
SG50																					
SG51																					
SG52a																					
SG52b																					
SG52c																					
SG52d																					
SG52e																					
SG53																					

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5																					
SP-Ca-1																					
SP-Ca-2																					
SP-Fe-4																					
SP-K-1																					
SP-K-2																					
SP-Li-5																					
SP-Li-6																					
SP-Si-4																					
SP-Ti-1																					
SP-Ti-2																					
SP-Zr-1																					
SP-Ru-1																					
SP-Ru-2																					
SP-Others-1																					
SP3-1(env.D)																					
SP-MC-1																					
SP-MC-2																					
SP-MC-8																					
SP-MC-9																					
Sp-LHLL																					
Sp-LHLH																					
Sp-LHHL																					
Sp-LHHH																					
Sp-LHMM																					
Sp-MMLL																					
Sp-MMLH																					
Sp-MMHL																					
Sp-MMHH																					
Sp-MMMM																					
Sp-HLLL																					
Sp-HLLH																					
Sp-HLHL																					
Sp-HLHH																					
Sp-HLMM																					

SG (Hrma et al. 1999)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
SG46																				
SG47																				
SG48																				
SG49																				
SG50																				
SG51																				
SG52a																				
SG52b																				
SG52c																				
SG52d																				
SG52e																				
SG53																				

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5																				
SP-Ca-1																				
SP-Ca-2																				
SP-Fe-4																				
SP-K-1																				
SP-K-2																				
SP-Li-5																				
SP-Li-6																				
SP-Si-4																				
SP-Ti-1																				
SP-Ti-2																				
SP-Zr-1																				
SP-Ru-1																				
SP-Ru-2																				
SP-Others-1																				
SP3-1(env.D)																				
SP-MC-1																				
SP-MC-2																				
SP-MC-8																				
SP-MC-9																				
Sp-LHLL																				
Sp-LHLH																				
Sp-LHHL																				
Sp-LHHH																				
Sp-LHMM																				
Sp-MMLL																				
Sp-MMLH																				
Sp-MMHL																				
Sp-MMHH																				
Sp-MMMM																				
Sp-HLLL																				
Sp-HLLH																				
Sp-HLHL																				
Sp-HLHH																				
Sp-HLMM																				

SG (Hrma et al. 1999)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
SG46	1257		1247	spinel				
SG47	1193		1144	spinel				
SG48	1356		862	clinopyroxene				
SG49	1315		877	clinopyroxene				
SG50	1320		1285	spinel				
SG51	1326		1033	RuO2, spinel				
SG52a	1142		869	RuO2, spinel				
SG52b	1142		883	RuO2, spinel				
SG52c	1142		882	RuO2, spinel				
SG52d	1142		883	RuO2, spinel				
SG52e	1142		891	RuO2, spinel				
SG53	1284		1082	spinel				

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5			1029	spinel				
SP-Ca-1			1039	spinel				
SP-Ca-2			1035	spinel				
SP-Fe-4			1268	spinel				
SP-K-1			1021	spinel				
SP-K-2			997	spinel				
SP-Li-5			1035					
SP-Li-6			1032					
SP-Si-4			1265	spinel				
SP-Ti-1			1061	spinel				
SP-Ti-2			1070	spinel				
SP-Zr-1			1070	spinel				
SP-Ru-1			1065	spinel				
SP-Ru-2			1076	spinel				
SP-Others-1			1090	spinel				
SP3-1(env.D)			1093	spinel				
SP-MC-1			1133	spinel				
SP-MC-2			1008	spinel				
SP-MC-8			1197	spinel				
SP-MC-9			1304	spinel				
Sp-LHLL			893	spinel				
Sp-LHLH			1063	spinel				
Sp-LHHL			914	spinel				
Sp-LHHH			1085	spinel				
Sp-LHMM			935	spinel				
Sp-MMLL			1036	spinel				
Sp-MMLH			1129	spinel				
Sp-MMHL			1066	spinel				
Sp-MMHH			1295	spinel				
Sp-MMMM			1038	spinel				
Sp-HLLL			1068	spinel				
Sp-HLLH			1232	spinel				
Sp-HLHL			1273	spinel				
Sp-HLHH			1366	spinel				
Sp-HLMM			1228	spinel				

SG (Hrma et al. 1999)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
SG46					
SG47					
SG48					
SG49					
SG50					
SG51					
SG52a					
SG52b					
SG52c					
SG52d					
SG52e					
SG53					

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5					
SP-Ca-1					
SP-Ca-2					
SP-Fe-4					
SP-K-1					
SP-K-2					
SP-Li-5					
SP-Li-6					
SP-Si-4					
SP-Ti-1					
SP-Ti-2					
SP-Zr-1					
SP-Ru-1					
SP-Ru-2					
SP-Others-1					
SP3-1(env.D)					
SP-MC-1					
SP-MC-2					
SP-MC-8					
SP-MC-9					
Sp-LHLL					
Sp-LHLH					
Sp-LHHL					
Sp-LHHH					
Sp-LHMM					
Sp-MMLL					
Sp-MMLH					
Sp-MMHL					
Sp-MMHH					
Sp-MMMM					
Sp-HLLL					
Sp-HLLH					
Sp-HLHL					
Sp-HLHH					
Sp-HLMM					

SG (Hrma et al. 1999)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
SG46															
SG47															
SG48															
SG49															
SG50															
SG51															
SG52a															
SG52b															
SG52c															
SG52d															
SG52e															
SG53															

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5															
SP-Ca-1															
SP-Ca-2															
SP-Fe-4															
SP-K-1															
SP-K-2															
SP-Li-5															
SP-Li-6															
SP-Si-4															
SP-Ti-1															
SP-Ti-2															
SP-Zr-1															
SP-Ru-1															
SP-Ru-2															
SP-Others-1															
SP3-1(env.D)															
SP-MC-1															
SP-MC-2															
SP-MC-8															
SP-MC-9															
Sp-LHLL															
Sp-LHLH															
Sp-LHHL															
Sp-LHHH															
Sp-LHMM															
Sp-MMLL															
Sp-MMLH															
Sp-MMHL															
Sp-MMHH															
Sp-MMMM															
Sp-HLLL															
Sp-HLLH															
Sp-HLHL															
Sp-HLHH															
Sp-HLMM															

SG (Hrma et al. 1999)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
SG46																					
SG47																					
SG48																					
SG49																					
SG50																					
SG51																					
SG52a																					
SG52b																					
SG52c																					
SG52d																					
SG52e																					
SG53																					

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5																					
SP-Ca-1																					
SP-Ca-2																					
SP-Fe-4																					
SP-K-1																					
SP-K-2																					
SP-Li-5																					
SP-Li-6																					
SP-Si-4																					
SP-Ti-1																					
SP-Ti-2																					
SP-Zr-1																					
SP-Ru-1																					
SP-Ru-2																					
SP-Others-1																					
SP3-1(env.D)																					
SP-MC-1																					
SP-MC-2																					
SP-MC-8																					
SP-MC-9																					
Sp-LHLL																					
Sp-LHLH																					
Sp-LHHL																					
Sp-LHHH																					
Sp-LHMM																					
Sp-MMLL																					
Sp-MMLH																					
Sp-MMHL																					
Sp-MMHH																					
Sp-MMMM																					
Sp-HLLL																					
Sp-HLLH																					
Sp-HLHL																					
Sp-HLHH																					
Sp-HLMM																					

SG (Hrma et al. 1999)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
SG46																
SG47																
SG48																
SG49																
SG50																
SG51																
SG52a																
SG52b																
SG52c																
SG52d																
SG52e																
SG53																

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5																
SP-Ca-1																
SP-Ca-2																
SP-Fe-4																
SP-K-1																
SP-K-2																
SP-Li-5																
SP-Li-6																
SP-Si-4																
SP-Ti-1																
SP-Ti-2																
SP-Zr-1																
SP-Ru-1																
SP-Ru-2																
SP-Others-1																
SP3-1(env.D)																
SP-MC-1																
SP-MC-2																
SP-MC-8																
SP-MC-9																
Sp-LHLL																
Sp-LHLH																
Sp-LHHL																
Sp-LHHH																
Sp-LHMM																
Sp-MMLL																
Sp-MMLH																
Sp-MMHL																
Sp-MMHH																
Sp-MMMM																
Sp-HLLL																
Sp-HLLH																
Sp-HLHL																
Sp-HLHH																
Sp-HLMM																

SG (Hrma et al. 1999)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
SG46												
SG47												
SG48												
SG49												
SG50												
SG51												
SG52a												
SG52b												
SG52c												
SG52d												
SG52e												
SG53												

SP3, SPx4, Misc. (Vienna et al. 2001)

SP-B-5												
SP-Ca-1												
SP-Ca-2												
SP-Fe-4												
SP-K-1												
SP-K-2												
SP-Li-5												
SP-Li-6												
SP-Si-4												
SP-Ti-1												
SP-Ti-2												
SP-Zr-1												
SP-Ru-1												
SP-Ru-2												
SP-Others-1												
SP3-1(env.D)												
SP-MC-1												
SP-MC-2												
SP-MC-8												
SP-MC-9												
Sp-LHLL												
Sp-LHLH												
Sp-LHHL												
Sp-LHHH												
Sp-LHMM												
Sp-MMLL												
Sp-MMLH												
Sp-MMHL												
Sp-MMHH												
Sp-MMMM												
Sp-HLLL												
Sp-HLLH												
Sp-HLHL												
Sp-HLHH												
Sp-HLMM												

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
Sp-LHLH(b)	0.0500	0.0688	0.0000	0.1228		0.0000	0.0295	0.0059	0.1873	0.0200	0.0058	0.4520	0.0231	0.0009	0.0000	0.0038	0.0000		0.0087		0.0009
Sp-MMLL(b)	0.0800	0.0706	0.0000	0.1260		0.0000	0.0302	0.0061	0.1573	0.0010	0.0059	0.4636	0.0236	0.0009	0.0000	0.0039	0.0000		0.0089		0.0009
Sp-MMHH(b)	0.0800	0.0683	0.0000	0.1219		0.0000	0.0293	0.0059	0.1573	0.0200	0.0058	0.4487	0.0229	0.0009	0.0000	0.0037	0.0000		0.0086		0.0009
Sp-HLLL(b)	0.1100	0.0706	0.0000	0.1260		0.0000	0.0302	0.0061	0.1273	0.0010	0.0059	0.4636	0.0236	0.0009	0.0000	0.0039	0.0000		0.0089		0.0009
nom-2	0.0681	0.0982	0.0086	0.1076	0.0000	0.0024	0.0600	0.0051	0.0913	0.0045	0.0039	0.5011	0.0155	0.0006	0.0003	0.0025	0.0000		0.0057	0.0000	0.0005
nom-3	0.0808	0.1093	0.0102	0.1278	0.0000	0.0029	0.0100	0.0060	0.1733	0.0053	0.0046	0.4113	0.0184	0.0007	0.0004	0.0030	0.0000		0.0068	0.0000	0.0007
nomc-1	0.0493	0.0500	0.0119	0.1500	0.0000	0.0034	0.0100	0.0071	0.1883	0.0062	0.0019	0.4535	0.0216	0.0008	0.0005	0.0035	0.0000		0.0080	0.0000	0.0008
nomc-2	0.0412	0.0588	0.0100	0.1254	0.0000	0.0028	0.0521	0.0059	0.1177	0.0052	0.0015	0.5221	0.0181	0.0007	0.0004	0.0029	0.0000		0.0067	0.0000	0.0006
c106a-2	0.1295	0.0500	0.0278	0.1248	0.0000	0.0027	0.0000	0.0182	0.2209	0.0020	0.0095	0.3849	0.0046	0.0010	0.0000	0.0091	0.0000		0.0007	0.0000	0.0000
c106a-3	0.1214	0.0500	0.0261	0.1170	0.0000	0.0025	0.0252	0.0171	0.1886	0.0019	0.0089	0.4135	0.0044	0.0009	0.0000	0.0086	0.0000		0.0006	0.0000	0.0000
c106a-4	0.0940	0.0831	0.0202	0.0906	0.0000	0.0019	0.0402	0.0132	0.1461	0.0015	0.0069	0.4806	0.0034	0.0007	0.0000	0.0066	0.0000		0.0005	0.0000	0.0000
c106b-1	0.1604	0.1853	0.0020	0.0871	0.0000	0.0000	0.0351	0.0005	0.1316	0.0000	0.0105	0.3700	0.0006	0.0017	0.0004	0.0003	0.0000		0.0000	0.0000	0.0000
c106b-2	0.1440	0.1094	0.0018	0.0781	0.0000	0.0000	0.0599	0.0005	0.1311	0.0000	0.0094	0.4501	0.0005	0.0015	0.0003	0.0003	0.0000		0.0000	0.0000	0.0000
az-3	0.0664	0.0500	0.0031	0.1397	0.0000	0.0032	0.0100	0.0011	0.2114	0.0079	0.0027	0.4296	0.0264	0.0005	0.0006	0.0006	0.0000		0.0102	0.0000	0.0010
az-5	0.0554	0.0974	0.0026	0.1164	0.0000	0.0027	0.0149	0.0009	0.1796	0.0060	0.0023	0.4588	0.0220	0.0004	0.0005	0.0005	0.0000		0.0085	0.0000	0.0008

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7	0.0535	0.0690	0.0130	0.1271	0.0004	0.0263	0.0434	0.0151	0.0902	0.0084	0.0000	0.5132	0.0015			0.0012				0.0000	
HG-1-2-7	0.0499	0.0672	0.0104	0.1160	0.0004	0.0297	0.0448	0.0147	0.0849	0.0076	0.0004	0.5349	0.0009			0.0007				0.0000	
HG-1-3-7	0.0489	0.0681	0.0108	0.1149	0.0014	0.0254	0.0453	0.0148	0.0866	0.0073	0.0004	0.5394	0.0000			0.0007				0.0000	
HG-2-1-7	0.0502	0.0665	0.0106	0.1183	0.0007	0.0240	0.0449	0.0147	0.0862	0.0076	0.0004	0.5386	0.0000			0.0007				0.0000	
HG-2-2-7	0.0535	0.0594	0.0108	0.1254	0.0007	0.0177	0.0432	0.0135	0.1015	0.0075	0.0007	0.5255	0.0021			0.0009				0.0000	
HG-2-3-7	0.0527	0.0592	0.0108	0.1235	0.0007	0.0177	0.0436	0.0135	0.1021	0.0075	0.0000	0.5308	0.0008			0.0007				0.0000	
HG-3-1-7	0.0549	0.0602	0.0112	0.1226	0.0051	0.0197	0.0426	0.0134	0.0988	0.0078	0.0004	0.5221	0.0017			0.0007				0.0000	
HG-3-2-7	0.0558	0.0611	0.0115	0.1248	0.0074	0.0218	0.0418	0.0132	0.0959	0.0076	0.0002	0.5171	0.0017			0.0009				0.0000	
HG-3-3-7	0.0561	0.0623	0.0120	0.1211	0.0102	0.0227	0.0422	0.0134	0.0941	0.0076	0.0002	0.5182	0.0015			0.0009				0.0000	
AH-165 Al-7	0.1351	0.0740	0.0052	0.0462	0.0024	0.0000	0.0424	0.0067	0.1068	0.0068	0.0000	0.5403	0.0079			0.0000				0.0000	
AH-165 AV-7	0.0519	0.0660	0.0105	0.1111	0.0047	0.0000	0.0504	0.0066	0.1000	0.0102	0.0000	0.5551	0.0077			0.0000				0.0000	
AH-165 FE-7	0.0144	0.0738	0.0142	0.0920	0.0725	0.0000	0.0411	0.0066	0.1085	0.0301	0.0000	0.5275	0.0085			0.0000				0.0000	
AH-131 Al-7	0.1351	0.1082	0.0038	0.0459	0.0009	0.0000	0.0409	0.0138	0.1412	0.0063	0.0000	0.4645	0.0034			0.0000				0.0000	
AH-131 AV-7	0.0444	0.0768	0.0077	0.1124	0.0070	0.0000	0.0430	0.0068	0.0997	0.0106	0.0000	0.5561	0.0088			0.0000				0.0000	
AH-131 FE-7	0.0229	0.0745	0.0103	0.0774	0.0895	0.0000	0.0412	0.0067	0.1108	0.0261	0.0000	0.5224	0.0088			0.0000				0.0000	
AH-168 Al-7	0.0673	0.1374	0.0014	0.0231	0.0013	0.0000	0.0536	0.0089	0.1183	0.0033	0.0000	0.5657	0.0087			0.0000				0.0000	
AH-168 AV-7	0.0563	0.1070	0.0069	0.1062	0.0062	0.0000	0.0428	0.0075	0.1020	0.0103	0.0000	0.5210	0.0071			0.0000				0.0000	
AH-168 FE-7	0.0248	0.1149	0.0136	0.0947	0.0627	0.0000	0.0415	0.0072	0.1089	0.0284	0.0000	0.4867	0.0067			0.0000				0.0000	
AH-200 Al-7	0.1347	0.1026	0.0055	0.0441	0.0007	0.0313	0.0266	0.0125	0.1066	0.0061	0.0000	0.4867	0.0004			0.0000				0.0000	
AH-200 AV-7	0.0517	0.1037	0.0063	0.1155	0.0039	0.0321	0.0270	0.0125	0.0984	0.0103	0.0000	0.4986	0.0002			0.0000				0.0000	
AH-200 FE-7	0.0209	0.1019	0.0093	0.0988	0.0600	0.0318	0.0262	0.0122	0.1070	0.0259	0.0000	0.4784	0.0002			0.0000				0.0000	
AH-202 Al-7	0.1397	0.0746	0.0041	0.0433	0.0009	0.0334	0.0420	0.0129	0.0737	0.0062	0.0000	0.5265	0.0002			0.0000				0.0000	
AH-202-AV-7	0.0498	0.0748	0.0072	0.1161	0.0031	0.0334	0.0429	0.0131	0.0658	0.0101	0.0000	0.5437	0.0002			0.0000				0.0000	
AH-202 FE-7	0.0137	0.0710	0.0096	0.0966	0.0630	0.0328	0.0428	0.0127	0.0764	0.0274	0.0000	0.5270	0.0002			0.0000				0.0000	
AH-1-7	0.0697	0.1029	0.0096	0.1200	0.0000	0.0331	0.0447	0.0066	0.1189	0.0094	0.0000	0.4406	0.0067			0.0000				0.0000	
AH-2-7	0.0657	0.1332	0.0065	0.1143	0.0000	0.0311	0.0377	0.0058	0.1031	0.0093	0.0000	0.4463	0.0063			0.0000				0.0000	
AH-4-7	0.0471	0.0709	0.0100	0.1103	0.0000	0.0317	0.0411	0.0073	0.0993	0.0098	0.0000	0.5368	0.0000			0.0000				0.0000	
AH-5-7	0.0552	0.0700	0.0067	0.1149	0.0000	0.0318	0.0380	0.0061	0.0931	0.0097	0.0000	0.5346	0.0002			0.0000				0.0000	
AH-6-7	0.0560	0.0940	0.0068	0.1188	0.0000	0.0316	0.0462	0.0061	0.1058	0.0094	0.0000	0.4763	0.0067			0.0000				0.0000	
AH-7-7	0.0629	0.1153	0.0064	0.1133	0.0000	0.0316	0.0316	0.0059	0.0927	0.0095	0.0000	0.4915	0.0002			0.0000				0.0000	
AH-8-7	0.0590	0.1015	0.0069	0.1165	0.0000	0.0309	0.0319	0.0121	0.0981	0.0098	0.0000	0.4922	0.0000			0.0000				0.0000	

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
Sp-LHLH(b)	0.0001		0.0011	0.0005	0.0000	0.0004		0.0008					0.0034		0.0035		0.0001		0.0023	0.0021	
Sp-MMLL(b)	0.0001		0.0012	0.0005	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
Sp-MMHH(b)	0.0001		0.0011	0.0060	0.0000	0.0004		0.0007					0.0034		0.0035		0.0001		0.0022	0.0021	
Sp-HLLL(b)	0.0001		0.0012	0.0005	0.0000	0.0004		0.0008					0.0035		0.0036		0.0001		0.0023	0.0022	
nom-2	0.0000		0.0008	0.0018	0.0000	0.0003		0.0005					0.0023		0.0028		0.0001		0.0015	0.0000	
nom-3	0.0000		0.0009	0.0022	0.0000	0.0003		0.0006					0.0027		0.0033		0.0001		0.0018	0.0000	
nomc-1	0.0000		0.0011	0.0023	0.0000	0.0004		0.0007					0.0032		0.0039		0.0001		0.0021	0.0000	
nomc-2	0.0000		0.0009	0.0019	0.0000	0.0003		0.0005					0.0027		0.0033		0.0001		0.0018	0.0000	
c106a-2	0.0000		0.0000	0.0024	0.0000	0.0003		0.0000					0.0000		0.0040		0.0000		0.0000	0.0000	
c106a-3	0.0000		0.0000	0.0023	0.0000	0.0003		0.0000					0.0000		0.0037		0.0000		0.0000	0.0000	
c106a-4	0.0000		0.0000	0.0017	0.0000	0.0002		0.0000					0.0000		0.0029		0.0000		0.0000	0.0000	
c106b-1	0.0000		0.0000	0.0019	0.0000	0.0003		0.0000					0.0000		0.0043		0.0000		0.0000	0.0000	
c106b-2	0.0000		0.0000	0.0017	0.0000	0.0002		0.0000					0.0000		0.0039		0.0000		0.0000	0.0000	
az-3	0.0000		0.0014	0.0022	0.0000	0.0004		0.0007					0.0041		0.0031		0.0001		0.0027	0.0008	
az-5	0.0000		0.0012	0.0018	0.0000	0.0003		0.0006					0.0034		0.0026		0.0001		0.0023	0.0006	

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7				0.0035	0.0009	0.0032							0.0000		0.0213		0.0000		0.0000	0.0010	
HG-1-2-7				0.0033	0.0009	0.0021							0.0000		0.0222		0.0000		0.0000	0.0021	
HG-1-3-7				0.0028	0.0009	0.0021							0.0000		0.0219		0.0000		0.0000	0.0017	
HG-2-1-7				0.0033	0.0004	0.0021							0.0000		0.0224		0.0000		0.0000	0.0017	
HG-2-2-7				0.0028	0.0004	0.0015							0.0000		0.0239		0.0000		0.0000	0.0024	
HG-2-3-7				0.0030	0.0009	0.0013							0.0000		0.0236		0.0000		0.0000	0.0017	
HG-3-1-7				0.0033	0.0004	0.0017							0.0000		0.0242		0.0000		0.0000	0.0024	
HG-3-2-7				0.0028	0.0004	0.0018							0.0000		0.0252		0.0000		0.0000	0.0024	
HG-3-3-7				0.0023	0.0000	0.0018							0.0000		0.0243		0.0000		0.0000	0.0020	
AH-165 Al-7				0.0000	0.0000	0.0000							0.0000		0.0264		0.0000		0.0000	0.0000	
AH-165 AV-7				0.0000	0.0000	0.0000							0.0000		0.0258		0.0000		0.0000	0.0000	
AH-165 FE-7				0.0000	0.0000	0.0000							0.0000		0.0108		0.0000		0.0000	0.0000	
AH-131 Al-7				0.0000	0.0000	0.0000							0.0035		0.0251		0.0000		0.0000	0.0000	
AH-131 AV-7				0.0000	0.0000	0.0000							0.0000		0.0262		0.0000		0.0000	0.0000	
AH-131 FE-7				0.0000	0.0000	0.0000							0.0000		0.0094		0.0000		0.0000	0.0000	
AH-168 Al-7				0.0000	0.0000	0.0000							0.0000		0.0110		0.0000		0.0000	0.0000	
AH-168 AV-7				0.0000	0.0000	0.0000							0.0000		0.0267		0.0000		0.0000	0.0000	
AH-168 FE-7				0.0000	0.0000	0.0000							0.0000		0.0098		0.0000		0.0000	0.0000	
AH-200 Al-7				0.0000	0.0000	0.0000							0.0000		0.0250		0.0000		0.0000	0.0000	
AH-200 AV-7				0.0000	0.0000	0.0000							0.0000		0.0257		0.0000		0.0000	0.0000	
AH-200 FE-7				0.0000	0.0000	0.0000							0.0000		0.0096		0.0000		0.0000	0.0000	
AH-202 Al-7				0.0000	0.0000	0.0000							0.0000		0.0253		0.0000		0.0000	0.0000	
AH-202-AV-7				0.0000	0.0000	0.0000							0.0000		0.0261		0.0000		0.0000	0.0000	
AH-202 FE-7				0.0000	0.0000	0.0000							0.0000		0.0095		0.0000		0.0000	0.0000	
AH-1-7				0.0002	0.0008	0.0000							0.0000		0.0231		0.0000		0.0000	0.0000	
AH-2-7				0.0002	0.0004	0.0000							0.0000		0.0267		0.0000		0.0000	0.0000	
AH-4-7				0.0005	0.0004	0.0000							0.0000		0.0213		0.0000		0.0000	0.0000	
AH-5-7				0.0000	0.0000	0.0000							0.0000		0.0265		0.0000		0.0000	0.0000	
AH-6-7				0.0000	0.0004	0.0000							0.0000		0.0274		0.0000		0.0000	0.0000	
AH-7-7				0.0000	0.0000	0.0000							0.0000		0.0262		0.0000		0.0000	0.0000	
AH-8-7				0.0002	0.0004	0.0000							0.0000		0.0269		0.0000		0.0000	0.0000	

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
Sp-LHLH(b)	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-MMLL(b)	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0012	0.0000			0.0025	0.0004		0.0000		0.0003
Sp-MMHH(b)	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0011	0.0000			0.0024	0.0004		0.0000		0.0003
Sp-HLLL(b)	0.0000		0.0000	0.0000			0.0004		0.0003	0.0009		0.0012	0.0000			0.0025	0.0004		0.0000		0.0003
nom-2	0.0000		0.0000	0.0000			0.0002		0.0003	0.0006		0.0008	0.0000			0.0016	0.0003		0.0006		0.0002
nom-3	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0007		0.0003
nomc-1	0.0000		0.0000	0.0000			0.0003		0.0004	0.0008		0.0011	0.0000			0.0022	0.0004		0.0008		0.0003
nomc-2	0.0000		0.0000	0.0000			0.0003		0.0003	0.0007		0.0009	0.0000			0.0019	0.0003		0.0007		0.0003
c106a-2	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0000	0.0002		0.0000		0.0000
c106a-3	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0000	0.0002		0.0000		0.0000
c106a-4	0.0000		0.0000	0.0000			0.0000		0.0000	0.0000		0.0000	0.0000			0.0000	0.0001		0.0000		0.0000
c106b-1	0.0000		0.0000	0.0000			0.0000		0.0000	0.0026		0.0013	0.0000			0.0000	0.0001		0.0000		0.0004
c106b-2	0.0000		0.0000	0.0000			0.0000		0.0000	0.0023		0.0012	0.0000			0.0000	0.0001		0.0000		0.0004
az-3	0.0000		0.0000	0.0000			0.0004		0.0005	0.0000		0.0000	0.0000			0.0029	0.0004		0.0010		0.0004
az-5	0.0000		0.0000	0.0000			0.0004		0.0004	0.0000		0.0000	0.0000			0.0025	0.0003		0.0008		0.0004

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7																	0.0002				0.0045
HG-1-2-7																	0.0003				0.0027
HG-1-3-7																	0.0003				0.0026
HG-2-1-7																	0.0003				0.0026
HG-2-2-7																	0.0003				0.0022
HG-2-3-7																	0.0003				0.0021
HG-3-1-7																	0.0003				0.0022
HG-3-2-7																	0.0003				0.0023
HG-3-3-7																	0.0003				0.0024
AH-165 Al-7																	0.0000				0.0000
AH-165 AV-7																	0.0000				0.0000
AH-165 FE-7																	0.0000				0.0000
AH-131 Al-7																	0.0000				0.0072
AH-131 AV-7																	0.0000				0.0006
AH-131 FE-7																	0.0000				0.0001
AH-168 Al-7																	0.0000				0.0000
AH-168 AV-7																	0.0000				0.0000
AH-168 FE-7																	0.0000				0.0000
AH-200 Al-7																	0.0000				0.0171
AH-200 AV-7																	0.0000				0.0141
AH-200 FE-7																	0.0000				0.0180
AH-202 Al-7																	0.0000				0.0172
AH-202-AV-7																	0.0000				0.0138
AH-202 FE-7																	0.0000				0.0172
AH-1-7																	0.0003				0.0133
AH-2-7																	0.0005				0.0130
AH-4-7																	0.0005				0.0130
AH-5-7																	0.0000				0.0132
AH-6-7																	0.0005				0.0141
AH-7-7																	0.0000				0.0129
AH-8-7																	0.0005				0.0132

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
Sp-LHLH(b)		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-MMLL(b)		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-MMHH(b)		0.0000				0.0000	0.0000	0.0005		0.9999											
Sp-HLLL(b)		0.0000				0.0000	0.0000	0.0005		0.9999											
nom-2		0.0000				0.0000	0.0000	0.0002		0.9908											
nom-3		0.0000				0.0000	0.0000	0.0002		0.9891											
nomc-1		0.0000				0.0000	0.0000	0.0002		0.9871											
nomc-2		0.0000				0.0000	0.0000	0.0002		0.9892											
c106a-2		0.0000				0.0000	0.0000	0.0001		0.9926											
c106a-3		0.0000				0.0000	0.0000	0.0001		0.9931											
c106a-4		0.0000				0.0000	0.0000	0.0001		0.9946											
c106b-1		0.0000				0.0000	0.0000	0.0001		0.9964											
c106b-2		0.0000				0.0000	0.0000	0.0001		0.9967											
az-3		0.0000				0.0000	0.0000	0.0003		0.9858											
az-5		0.0000				0.0000	0.0000	0.0002		0.9876											

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7							0.0000	0.0031		1.0000	0.0544	0.0702	0.0132	0.0905	0.0003	0.0267	0.0442	0.0154	0.0918	0.0086	0.0001
HG-1-2-7							0.0000	0.0038		1.0000	0.0516	0.0695	0.0108	0.1200	0.0005	0.0307	0.0463	0.0152	0.0878	0.0079	0.0005
HG-1-3-7							0.0000	0.0037		1.0000	0.0501	0.0697	0.0111	0.1175	0.0015	0.0260	0.0464	0.0151	0.0886	0.0075	0.0005
HG-2-1-7							0.0000	0.0038		1.0000	0.0515	0.0683	0.0109	0.1215	0.0007	0.0246	0.0462	0.0151	0.0885	0.0078	0.0004
HG-2-2-7							0.0000	0.0040		1.0000	0.0559	0.0619	0.0113	0.1308	0.0007	0.0185	0.0451	0.0140	0.1059	0.0079	0.0006
HG-2-3-7							0.0000	0.0038		1.0000	0.0542	0.0610	0.0111	0.1273	0.0007	0.0182	0.0449	0.0139	0.1052	0.0077	
HG-3-1-7							0.0000	0.0044		1.0000	0.0562	0.0615	0.0114	0.1254	0.0052	0.0202	0.0436	0.0137	0.1010	0.0080	0.0004
HG-3-2-7							0.0000	0.0038		1.0000	0.0573	0.0628	0.0118	0.1285	0.0077	0.0224	0.0430	0.0136	0.0986	0.0079	0.0002
HG-3-3-7							0.0000	0.0042		1.0000	0.0579	0.0643	0.0124	0.1248	0.0105	0.0235	0.0435	0.0138	0.0970	0.0079	0.0002
AH-165 Al-7							0.0000	0.0000		1.0000	0.1340	0.0734	0.0051	0.0457	0.0024		0.0420	0.0066	0.1060	0.0067	
AH-165 AV-7							0.0000	0.0000		1.0000	0.0517	0.0657	0.0104	0.1108	0.0047		0.0502	0.0066	0.0996	0.0101	
AH-165 FE-7							0.0000	0.0000		1.0000	0.0142	0.0728	0.0140	0.0907	0.0714		0.0405	0.0065	0.1070	0.0297	
AH-131 Al-7							0.0000	0.0000		1.0000	0.1350	0.1080	0.0038	0.0457	0.0009		0.0409	0.0138	0.1410	0.0063	
AH-131 AV-7							0.0000	0.0000		1.0000	0.0439	0.0760	0.0076	0.1113	0.0070		0.0425	0.0067	0.0986	0.0104	
AH-131 FE-7							0.0000	0.0000		1.0000	0.0225	0.0733	0.0101	0.0761	0.0881		0.0406	0.0066	0.1090	0.0256	
AH-168 Al-7							0.0000	0.0000		1.0000	0.0672	0.1370	0.0014	0.0231	0.0014		0.0534	0.0089	0.1180	0.0033	
AH-168 AV-7							0.0000	0.0000		1.0000	0.0558	0.1060	0.0068	0.1051	0.0061		0.0424	0.0074	0.1010	0.0102	
AH-168 FE-7							0.0000	0.0000		1.0000	0.0247	0.1140	0.0135	0.0939	0.0622		0.0412	0.0071	0.1080	0.0282	
AH-200 Al-7							0.0000	0.0000		1.0000	0.1340	0.1020	0.0054	0.0439	0.0007	0.0312	0.0265	0.0125	0.1060	0.0061	
AH-200 AV-7							0.0000	0.0000		1.0000	0.0514	0.1030	0.0063	0.1147	0.0039	0.0318	0.0268	0.0124	0.0977	0.0102	
AH-200 FE-7							0.0000	0.0000		1.0000	0.0207	0.1010	0.0092	0.0980	0.0594	0.0315	0.0259	0.0121	0.1060	0.0257	
AH-202 Al-7							0.0000	0.0000		1.0000	0.1390	0.0742	0.0041	0.0431	0.0008	0.0332	0.0418	0.0128	0.0734	0.0062	
AH-202-AV-7							0.0000	0.0000		1.0000	0.0496	0.0744	0.0072	0.1156	0.0031	0.0333	0.0427	0.0130	0.0655	0.0100	
AH-202 FE-7							0.0000	0.0000		1.0000	0.0136	0.0708	0.0096	0.0962	0.0628	0.0328	0.0427	0.0126	0.0762	0.0273	
AH-1-7							0.0000	0.0000		1.0000	0.0698	0.1030	0.0096	0.1200		0.0331	0.0447	0.0066	0.1190	0.0094	
AH-2-7							0.0000	0.0000		1.0000	0.0655	0.1330	0.0064	0.1140		0.0311	0.0376	0.0058	0.1030	0.0093	
AH-4-7							0.0000	0.0000		1.0000	0.0469	0.0706	0.0100	0.1100		0.0316	0.0410	0.0073	0.0989	0.0097	
AH-5-7							0.0000	0.0000		1.0000	0.0548	0.0695	0.0066	0.1140		0.0316	0.0377	0.0060	0.0924	0.0096	
AH-6-7							0.0000	0.0000		1.0000	0.0556	0.0933	0.0068	0.1180		0.0314	0.0459	0.0060	0.1050	0.0094	
AH-7-7							0.0000	0.0000		1.0000	0.0627	0.1150	0.0064	0.1130		0.0315	0.0315	0.0059	0.0924	0.0095	
AH-8-7							0.0000	0.0000		1.0000	0.0588	0.1010	0.0069	0.1160		0.0308	0.0317	0.0120	0.0976	0.0097	

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
Sp-LHLH(b)																					
Sp-MMLL(b)																					
Sp-MMHH(b)																					
Sp-HLLL(b)																					
nom-2																					
nom-3																					
nomc-1																					
nomc-2																					
c106a-2																					
c106a-3																					
c106a-4																					
c106b-1																					
c106b-2																					
az-3																					
az-5																					

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7	0.5224	0.0016			0.0011									0.0035	0.0007	0.0030					
HG-1-2-7	0.5532	0.0009			0.0008									0.0035	0.0007	0.0021					
HG-1-3-7	0.5520				0.0007									0.0028	0.0007	0.0021					
HG-2-1-7	0.5535				0.0007									0.0034	0.0005	0.0020					
HG-2-2-7	0.5482	0.0021			0.0009									0.0030	0.0004	0.0014					
HG-2-3-7	0.5469	0.0007			0.0008									0.0031	0.0007	0.0013					
HG-3-1-7	0.5339	0.0018			0.0008									0.0033	0.0003	0.0017					
HG-3-2-7	0.5318	0.0017			0.0009									0.0029	0.0004	0.0019					
HG-3-3-7	0.5345	0.0016			0.0009									0.0025	0.0001	0.0019					
AH-165 Al-7	0.5360	0.0079																			
AH-165 AV-7	0.5530	0.0076																			
AH-165 FE-7	0.5200	0.0085																			
AH-131 Al-7	0.4640	0.0034																			
AH-131 AV-7	0.5500	0.0088																			
AH-131 FE-7	0.5140	0.0087																			
AH-168 Al-7	0.5640	0.0087																			
AH-168 AV-7	0.5160	0.0069																			
AH-168 FE-7	0.4830	0.0067																			
AH-200 Al-7	0.4840	0.0003																			
AH-200 AV-7	0.4950	0.0002																			
AH-200 FE-7	0.4740	0.0002																			
AH-202 Al-7	0.5240	0.0003																			
AH-202-AV-7	0.5410	0.0003																			
AH-202 FE-7	0.5255	0.0002																			
AH-1-7	0.4408	0.0066												0.0003	0.0007						
AH-2-7	0.4455	0.0063												0.0002	0.0005						
AH-4-7	0.5348	0.0001												0.0005	0.0006						
AH-5-7	0.5308	0.0001																			
AH-6-7	0.4730	0.0067													0.0006						
AH-7-7	0.4900	0.0002																			
AH-8-7	0.4900	0.0001												0.0002	0.0004						

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
Sp-LHLH(b)																					
Sp-MMLL(b)																					
Sp-MMHH(b)																					
Sp-HLLL(b)																					
nom-2																					
nom-3																					
nomc-1																					
nomc-2																					
c106a-2																					
c106a-3																					
c106a-4																					
c106b-1																					
c106b-2																					
az-3																					
az-5																					

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7				0.0217					0.0011												
HG-1-2-7				0.0229					0.0020												
HG-1-3-7				0.0225					0.0018												
HG-2-1-7				0.0230					0.0019												
HG-2-2-7				0.0249					0.0025												
HG-2-3-7				0.0243					0.0019												
HG-3-1-7				0.0248					0.0023												
HG-3-2-7				0.0259					0.0023												
HG-3-3-7				0.0250					0.0022												
AH-165 Al-7				0.0262																	
AH-165 AV-7				0.0257																	
AH-165 FE-7				0.0107																	
AH-131 Al-7		0.0036		0.0251																	
AH-131 AV-7				0.0259																	
AH-131 FE-7				0.0093																	
AH-168 Al-7				0.0109																	
AH-168 AV-7				0.0264																	
AH-168 FE-7				0.0098																	
AH-200 Al-7				0.0249																	
AH-200 AV-7				0.0255																	
AH-200 FE-7				0.0095																	
AH-202 Al-7				0.0251																	
AH-202-AV-7				0.0259																	
AH-202 FE-7				0.0095																	
AH-1-7				0.0231																	
AH-2-7				0.0267																	
AH-4-7				0.0212																	
AH-5-7				0.0264																	
AH-6-7				0.0272																	
AH-7-7				0.0262																	
AH-8-7				0.0268																	

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
Sp-LHLH(b)																				
Sp-MMLL(b)																				
Sp-MMHH(b)																				
Sp-HLLL(b)																				
nom-2																				
nom-3																				
nomc-1																				
nomc-2																				
c106a-2																				
c106a-3																				
c106a-4																				
c106b-1																				
c106b-2																				
az-3																				
az-5																				

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7						0.0001				0.0046								0.0031		0.9783
HG-1-2-7						0.0003				0.0028								0.0039		1.0339
HG-1-3-7						0.0003				0.0026								0.0037		1.0232
HG-2-1-7						0.0003				0.0026								0.0039		1.0273
HG-2-2-7						0.0003				0.0023								0.0042		1.0428
HG-2-3-7						0.0003				0.0022								0.0039		1.0303
HG-3-1-7						0.0003				0.0023								0.0044		1.0225
HG-3-2-7						0.0003				0.0024								0.0040		1.0283
HG-3-3-7						0.0003				0.0025								0.0043		1.0316
AH-165 Al-7																				0.9920
AH-165 AV-7																				0.9961
AH-165 FE-7																				0.9860
AH-131 Al-7										0.0072										0.9987
AH-131 AV-7										0.0006										0.9893
AH-131 FE-7										0.0001										0.9840
AH-168 Al-7																				0.9973
AH-168 AV-7																				0.9901
AH-168 FE-7																				0.9923
AH-200 Al-7										0.0170										0.9945
AH-200 AV-7										0.0141										0.9930
AH-200 FE-7										0.0178										0.9910
AH-202 Al-7										0.0171										0.9951
AH-202-AV-7										0.0137										0.9953
AH-202 FE-7										0.0172										0.9970
AH-1-7						0.0004				0.0133										1.0004
AH-2-7						0.0004				0.0130										0.9983
AH-4-7						0.0005				0.0130										0.9967
AH-5-7										0.0131										0.9926
AH-6-7						0.0004				0.0140										0.9933
AH-7-7										0.0129										0.9972
AH-8-7						0.0005				0.0132										0.9957

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
Sp-LHLH(b)			1102	triangle shaped spinels				
Sp-MMLL(b)			1033	spinel				
Sp-MMHH(b)			1288	spinel				
Sp-HLLL(b)			1089	spinel				
nom-2			1009	spinel				
nom-3			1047	spinel				
nomc-1			1005	spinel				
nomc-2			998	spinel				
c106a-2			1004	spinel				
c106a-3			1029	spinel				
c106a-4			885	spinel				
c106b-1			986	spinel				
c106b-2			894	spinel				
az-3			1048	spinel				
az-5			953	spinel				

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7								
HG-1-2-7								
HG-1-3-7								
HG-2-1-7								
HG-2-2-7								
HG-2-3-7								
HG-3-1-7								
HG-3-2-7								
HG-3-3-7								
AH-165 Al-7								
AH-165 AV-7								
AH-165 FE-7								
AH-131 Al-7								
AH-131 AV-7								
AH-131 FE-7								
AH-168 Al-7								
AH-168 AV-7								
AH-168 FE-7								
AH-200 Al-7								
AH-200 AV-7								
AH-200 FE-7								
AH-202 Al-7								
AH-202-AV-7								
AH-202 FE-7								
AH-1-7								
AH-2-7								
AH-4-7								
AH-5-7								
AH-6-7								
AH-7-7								
AH-8-7								

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
Sp-LHLH(b)					
Sp-MMLL(b)					
Sp-MMHH(b)					
Sp-HLLL(b)					
nom-2					
nom-3					
nomc-1					
nomc-2					
c106a-2					
c106a-3					
c106a-4					
c106b-1					
c106b-2					
az-3					
az-5					

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7					
HG-1-2-7					
HG-1-3-7					
HG-2-1-7					
HG-2-2-7					
HG-2-3-7					
HG-3-1-7					
HG-3-2-7					
HG-3-3-7					
AH-165 Al-7					
AH-165 AV-7					
AH-165 FE-7					
AH-131 Al-7					
AH-131 AV-7					
AH-131 FE-7					
AH-168 Al-7					
AH-168 AV-7					
AH-168 FE-7					
AH-200 Al-7					
AH-200 AV-7					
AH-200 FE-7					
AH-202 Al-7					
AH-202-AV-7					
AH-202 FE-7					
AH-1-7					
AH-2-7					
AH-4-7					
AH-5-7					
AH-6-7					
AH-7-7					
AH-8-7					

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
Sp-LHLH(b)															
Sp-MMLL(b)															
Sp-MMHH(b)															
Sp-HLLL(b)															
nom-2															
nom-3															
nomc-1															
nomc-2															
c106a-2															
c106a-3															
c106a-4															
c106b-1															
c106b-2															
az-3															
az-5															

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7															
HG-1-2-7															
HG-1-3-7															
HG-2-1-7															
HG-2-2-7															
HG-2-3-7															
HG-3-1-7															
HG-3-2-7															
HG-3-3-7															
AH-165 Al-7															
AH-165 AV-7															
AH-165 FE-7															
AH-131 Al-7															
AH-131 AV-7															
AH-131 FE-7															
AH-168 Al-7															
AH-168 AV-7															
AH-168 FE-7															
AH-200 Al-7															
AH-200 AV-7															
AH-200 FE-7															
AH-202 Al-7															
AH-202-AV-7															
AH-202 FE-7															
AH-1-7															
AH-2-7															
AH-4-7															
AH-5-7															
AH-6-7															
AH-7-7															
AH-8-7															

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
Sp-LHLH(b)																					
Sp-MMLL(b)																					
Sp-MMHH(b)																					
Sp-HLLL(b)																					
nom-2																					
nom-3																					
nomc-1																					
nomc-2																					
c106a-2																					
c106a-3																					
c106a-4																					
c106b-1																					
c106b-2																					
az-3																					
az-5																					

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7																					
HG-1-2-7																					
HG-1-3-7																					
HG-2-1-7																					
HG-2-2-7																					
HG-2-3-7																					
HG-3-1-7																					
HG-3-2-7																					
HG-3-3-7																					
AH-165 Al-7																					
AH-165 AV-7																					
AH-165 FE-7																					
AH-131 Al-7																					
AH-131 AV-7																					
AH-131 FE-7																					
AH-168 Al-7																					
AH-168 AV-7																					
AH-168 FE-7																					
AH-200 Al-7																					
AH-200 AV-7																					
AH-200 FE-7																					
AH-202 Al-7																					
AH-202-AV-7																					
AH-202 FE-7																					
AH-1-7																					
AH-2-7																					
AH-4-7																					
AH-5-7																					
AH-6-7																					
AH-7-7																					
AH-8-7																					

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
Sp-LHLH(b)																
Sp-MMLL(b)																
Sp-MMHH(b)																
Sp-HLLL(b)																
nom-2																
nom-3																
nomc-1																
nomc-2																
c106a-2																
c106a-3																
c106a-4																
c106b-1																
c106b-2																
az-3																
az-5																

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7					0.340	0.330	0.335	0.190	10.43							
HG-1-2-7					0.365	0.335	0.345	0.195	10.39							
HG-1-3-7					0.340	0.310	0.325	0.185	10.39							
HG-2-1-7					0.345	0.320	0.335	0.185	10.44							
HG-2-2-7					0.385	0.365	0.400	0.205	10.73							
HG-2-3-7					0.395	0.360	0.395	0.210	10.71							
HG-3-1-7					0.375	0.360	0.385	0.200	10.73							
HG-3-2-7					0.390	0.365	0.385	0.200	10.71							
HG-3-3-7					0.365	0.340	0.370	0.190	10.68							
AH-165 Al-7					0.260	0.315	0.180	0.145	9.92							
AH-165 AV-7					0.320	0.330	0.265	0.185	10.05							
AH-165 FE-7					2.380	1.965	2.090	0.840	10.53							
AH-131 Al-7					0.360	0.350	0.345	0.180	10.21							
AH-131 AV-7					0.340	0.365	0.305	0.195	9.85							
AH-131 FE-7					1.790	1.600	1.545	0.770	10.22							
AH-168 Al-7					5.125	4.320	3.350	0.980	10.27							
AH-168 AV-7					0.400	0.375	0.295	0.175	9.72							
AH-168 FE-7					2.565	2.210	1.950	0.630	10.11							
AH-200 Al-7					0.230	0.285	0.220	0.300	9.68							
AH-200 AV-7					0.290	0.310	0.295	0.140	9.62							
AH-200 FE-7					2.550	2.190	2.190	0.615	10.15							
AH-202 Al-7					0.175	0.240	0.145	0.120	9.69							
AH-202-AV-7					0.260	0.295	0.255	0.165	9.68							
AH-202 FE-7					1.580	1.275	1.355	0.555	10.12							
AH-1-7					0.29	0.355	0.365	0.22	10.61							
AH-2-7					0.475	0.475	0.435	0.120	9.95							
AH-4-7					0.265	0.305	0.315	0.190	10.43							
AH-5-7					0.21	0.26	0.245	0.150	10.35							
AH-6-7					0.345	0.365	0.35	0.195	10.61							
AH-7-7					0.22	0.245	0.225	0.125	9.97							
AH-8-7					0.25	0.275	0.245	0.150	10.05							

SP3, SPx4, Misc. (Vienna et al. 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
Sp-LHLH(b)												
Sp-MMLL(b)												
Sp-MMHH(b)												
Sp-HLLL(b)												
nom-2												
nom-3												
nomc-1												
nomc-2												
c106a-2												
c106a-3												
c106a-4												
c106b-1												
c106b-2												
az-3												
az-5												

DWPF PCT Model (Jantzen et al. 1995)

HG-1-1-7												
HG-1-2-7												
HG-1-3-7												
HG-2-1-7												
HG-2-2-7												
HG-2-3-7												
HG-3-1-7												
HG-3-2-7												
HG-3-3-7												
AH-165 Al-7												
AH-165 AV-7												
AH-165 FE-7												
AH-131 Al-7												
AH-131 AV-7												
AH-131 FE-7												
AH-168 Al-7												
AH-168 AV-7												
AH-168 FE-7												
AH-200 Al-7												
AH-200 AV-7												
AH-200 FE-7												
AH-202 Al-7												
AH-202-AV-7												
AH-202 FE-7												
AH-1-7												
AH-2-7												
AH-4-7												
AH-5-7												
AH-6-7												
AH-7-7												
AH-8-7												

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
AH-9-7	0.0608	0.0881	0.0069	0.1166	0.0000	0.0315	0.0349	0.0058	0.0926	0.0098	0.0000	0.5120	0.0000			0.0000				0.0000	
AH-10-7	0.0517	0.0764	0.0068	0.1136	0.0000	0.0311	0.0447	0.0112	0.0687	0.0097	0.0000	0.5453	0.0000			0.0000				0.0000	
AH-11-7	0.0576	0.1214	0.0065	0.1113	0.0000	0.0303	0.0366	0.0112	0.0649	0.0094	0.0000	0.5099	0.0000			0.0000				0.0000	
AH-12-7	0.0608	0.0881	0.0069	0.1166	0.0000	0.0315	0.0349	0.0058	0.0926	0.0098	0.0000	0.5121	0.0000			0.0000				0.0000	
AH-13-7	0.0660	0.0653	0.0127	0.1386	0.0000	0.0311	0.0338	0.0050	0.0896	0.0116	0.0000	0.4989	0.0002			0.0000				0.0000	
AH-14-7	0.0715	0.0832	0.0126	0.1402	0.0000	0.0311	0.0398	0.0054	0.0985	0.0114	0.0000	0.4521	0.0058			0.0000				0.0000	
AH-15-7	0.0696	0.0932	0.0128	0.1378	0.0000	0.0314	0.0284	0.0104	0.0953	0.0114	0.0000	0.4619	0.0000			0.0000				0.0000	
AH-16-7	0.0643	0.0728	0.0127	0.1354	0.0000	0.0310	0.0411	0.0101	0.0661	0.0111	0.0000	0.5077	0.0000			0.0000				0.0000	
AH-17-7	0.0578	0.0820	0.0066	0.1151	0.0000	0.0309	0.0473	0.0058	0.0667	0.0092	0.0000	0.5298	0.0066			0.0000				0.0000	
SFRIT1	0.0462	0.0855	0.0148	0.1428	0.0000	0.0271	0.0326	0.0085	0.1158	0.0111	0.0000	0.4813	0.0011			0.0009				0.0000	
SFRIT2	0.0462	0.0855	0.0148	0.1428	0.0000	0.0271	0.0326	0.0085	0.1158	0.0111	0.0000	0.4813	0.0011			0.0009				0.0000	
SFRIT3	0.0462	0.0855	0.0148	0.1428	0.0000	0.0271	0.0326	0.0085	0.1158	0.0111	0.0000	0.4813	0.0011			0.0009				0.0000	
202P w/o Mn-7	0.0429	0.0858	0.0121	0.1068	0.0000	0.0571	0.0341	0.0291	0.0917	0.0070	0.0000	0.5106	0.0000			0.0019				0.0000	
202G w/o Mn-7	0.0461	0.0603	0.0130	0.1209	0.0000	0.0274	0.0377	0.0318	0.0824	0.0067	0.0000	0.5602	0.0000			0.0017				0.0000	
200R-7	0.0478	0.0979	0.0152	0.1272	0.0000	0.0362	0.0311	0.0129	0.1375	0.0055	0.0000	0.4666	0.0000			0.0000				0.0000	
NBS SRM 623-7	0.0630	0.1071	0.0070	0.0000	0.0000	0.0061	0.0000	0.0000	0.0641	0.0000	0.0000	0.7306	0.0000			0.0221				0.0000	
165 CGW STD-7	0.0420	0.0673	0.0154	0.1296	0.0000	0.0000	0.0502	0.0103	0.1047	0.0097	0.0000	0.5401	0.0050			0.0000				0.0000	
ARM-1-7 (4/88)	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
ARM-1-7 (5/89)	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
ARM-1-7 (7/90)	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
ARM-1-7 (12/90)	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
ARM-1-7 (5/91)	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
ARM-1-7 (10/91)	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
ARM-1-7 (10/92)	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
ARM-1-7 (4/93)	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
ARM-1-7 (6/93)	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
ARM-1-7 (8/93)	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
ARM-1-7	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
T-ARM-1	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
SS-ARM-1	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
SS-ARM-1	0.0558	0.1128	0.0223	0.0000	0.0000	0.0000	0.0507	0.0000	0.0966	0.0000	0.0065	0.4645	0.0179			0.0066				0.0273	
EA-1-7	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
EA-1-7	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
EA-2-7	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
EA-7	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
T-EA	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
SS-EA-19	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
SS-EA-15	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
SS-EA-1-7	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
SS-EA-2-7	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
SRS-SEA-A-7	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
SRS-SEA-B-7	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
CUASEA-A-7	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
CUASEA-B-7	0.0370	0.1130	0.0112	0.0738	0.0145	0.0005	0.0426	0.0172	0.1681	0.0057	0.0000	0.4873	0.0045			0.0000				0.0000	
131-TDS-EA-7	0.0571	0.1259	0.0091	0.1418	0.0000	0.0004	0.0479	0.0152	0.1447	0.0143	0.0000	0.3947	0.0043			0.0000				0.0000	
131-TDS-3A-SOPER	0.0548	0.1073	0.0091	0.1133	0.0000	0.0004	0.0418	0.0140	0.1361	0.0153	0.0000	0.4590	0.0034			0.0000				0.0000	
BLEND 1-7	0.0418	0.0809	0.0104	0.1095	0.0000	0.0370	0.0446	0.0142	0.0917	0.0090	0.0000	0.5215	0.0013			0.0019				0.0000	
BLEND 1-7 (2)	0.0418	0.0809	0.0104	0.1095	0.0000	0.0370	0.0446	0.0142	0.0917	0.0090	0.0000	0.5215	0.0013			0.0019				0.0000	
BLEND 1.6-7	0.0418	0.0809	0.0104	0.1095	0.0000	0.0370	0.0446	0.0142	0.0917	0.0090	0.0000	0.5215	0.0013			0.0019				0.0000	

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
AH-9-7				0.0002	0.0004	0.0000							0.0000		0.0266		0.0000		0.0000	0.0000	
AH-10-7				0.0000	0.0004	0.0000							0.0000		0.0269		0.0000		0.0000	0.0000	
AH-11-7				0.0002	0.0004	0.0000							0.0000		0.0266		0.0000		0.0000	0.0000	
AH-12-7				0.0000	0.0004	0.0000							0.0000		0.0266		0.0000		0.0000	0.0000	
AH-13-7				0.0000	0.0004	0.0000							0.0000		0.0331		0.0000		0.0000	0.0000	
AH-14-7				0.0000	0.0008	0.0000							0.0000		0.0337		0.0000		0.0000	0.0000	
AH-15-7				0.0002	0.0004	0.0000							0.0000		0.0330		0.0000		0.0000	0.0000	
AH-16-7				0.0007	0.0004	0.0000							0.0000		0.0326		0.0000		0.0000	0.0000	
AH-17-7				0.0009	0.0004	0.0000							0.0000		0.0273		0.0000		0.0000	0.0000	
SFRIT1				0.0009	0.0000	0.0000							0.0000		0.0195		0.0000		0.0000	0.0000	
SFRIT2				0.0009	0.0000	0.0000							0.0000		0.0195		0.0000		0.0000	0.0000	
SFRIT3				0.0009	0.0000	0.0000							0.0000		0.0195		0.0000		0.0000	0.0000	
202P w/o Mn-7				0.0007	0.0013	0.0066							0.0000		0.0000		0.0000		0.0000	0.0000	
202G w/o Mn-7				0.0007	0.0004	0.0040							0.0000		0.0000		0.0000		0.0000	0.0000	
200R-7				0.0000	0.0000	0.0000							0.0000		0.0220		0.0000		0.0000	0.0000	
NBS SRM 623-7				0.0000	0.0000	0.0000							0.0000		0.0000		0.0000		0.0000	0.0000	
165 CGW STD-7				0.0000	0.0000	0.0000							0.0000		0.0257		0.0000		0.0000	0.0000	
ARM-1-7 (4/88)				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
ARM-1-7 (5/89)				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
ARM-1-7 (7/90)				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
ARM-1-7 (12/90)				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
ARM-1-7 (5/91)				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
ARM-1-7 (10/91)				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
ARM-1-7 (10/92)				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
ARM-1-7 (4/93)				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
ARM-1-7 (6/93)				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
ARM-1-7 (8/93)				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
ARM-1-7				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
T-ARM-1				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
SS-ARM-1				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
SS-ARM-1				0.0000	0.0117	0.0000							0.0000		0.0000		0.0167		0.0594	0.0000	
EA-1-7				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
EA-1-7				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
EA-2-7				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
EA-7				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
T-EA				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
SS-EA-19				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
SS-EA-15				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
SS-EA-1-7				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
SS-EA-2-7				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
SRS-SEA-A-7				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
SRS-SEA-B-7				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
CUASEA-A-7				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
CUASEA-B-7				0.0000	0.0000	0.0000							0.0042		0.0134		0.0000		0.0000	0.0000	
131-TDS-EA-7				0.0005	0.0000	0.0000							0.0034		0.0314		0.0000		0.0000	0.0000	
131-TDS-3A-SOPER-7				0.0012	0.0000	0.0000							0.0035		0.0334		0.0000		0.0000	0.0000	
BLEND 1-7				0.0014	0.0009	0.0044							0.0000		0.0168		0.0016		0.0021	0.0000	
BLEND 1-7 (2)				0.0014	0.0009	0.0044							0.0000		0.0168		0.0016		0.0021	0.0000	
BLEND 1.6-7				0.0014	0.0009	0.0044							0.0000		0.0168		0.0016		0.0021	0.0000	

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
AH-9-7																	0.0005				0.0134
AH-10-7																	0.0005				0.0130
AH-11-7																	0.0005				0.0131
AH-12-7																	0.0005				0.0134
AH-13-7																	0.0006				0.0131
AH-14-7																	0.0006				0.0133
AH-15-7																	0.0006				0.0136
AH-16-7																	0.0008				0.0132
AH-17-7																	0.0003				0.0132
SFRIT1																	0.0000				0.0119
SFRIT2																	0.0000				0.0119
SFRIT3																	0.0000				0.0119
202P w/o Mn-7																	0.0000				0.0124
202G w/o Mn-7																	0.0000				0.0068
200R-7																	0.0000				0.0000
NBS SRM 623-7																	0.0000				0.0000
165 CGW STD-7																	0.0000				0.0000
ARM-1-7 (4/88)																	0.0045				0.0321
ARM-1-7 (5/89)																	0.0045				0.0321
ARM-1-7 (7/90)																	0.0045				0.0321
ARM-1-7 (12/90)																	0.0045				0.0321
ARM-1-7 (5/91)																	0.0045				0.0321
ARM-1-7 (10/91)																	0.0045				0.0321
ARM-1-7 (10/92)																	0.0045				0.0321
ARM-1-7 (4/93)																	0.0045				0.0321
ARM-1-7 (6/93)																	0.0045				0.0321
ARM-1-7 (8/93)																	0.0045				0.0321
ARM-1-7																	0.0045				0.0321
T-ARM-1																	0.0045				0.0321
SS-ARM-1																	0.0045				0.0321
SS-ARM-1																	0.0045				0.0321
EA-1-7																	0.0000				0.0070
EA-1-7																	0.0000				0.0070
EA-2-7																	0.0000				0.0070
EA-7																	0.0000				0.0070
T-EA																	0.0000				0.0070
SS-EA-19																	0.0000				0.0070
SS-EA-15																	0.0000				0.0070
SS-EA-1-7																	0.0000				0.0070
SS-EA-2-7																	0.0000				0.0070
SRS-SEA-A-7																	0.0000				0.0070
SRS-SEA-B-7																	0.0000				0.0070
CUASEA-A-7																	0.0000				0.0070
CUASEA-B-7																	0.0000				0.0070
131-TDS-EA-7																	0.0000				0.0092
131-TDS-3A-SOPER-7																	0.0000				0.0074
BLEND 1-7																	0.0000				0.0090
BLEND 1-7 (2)																	0.0000				0.0090
BLEND 1.6-7																	0.0000				0.0090

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
AH-9-7							0.0000	0.0000		1.0000	0.0604	0.0875	0.0069	0.1160		0.0313	0.0347	0.0058	0.0920	0.0097	
AH-10-7							0.0000	0.0000		1.0000	0.0514	0.0759	0.0068	0.1130		0.0309	0.0444	0.0111	0.0683	0.0096	
AH-11-7							0.0000	0.0000		1.0000	0.0570	0.1200	0.0065	0.1100		0.0299	0.0362	0.0111	0.0642	0.0093	
AH-12-7							0.0000	0.0000		1.0000	0.0604	0.0875	0.0069	0.1160		0.0313	0.0347	0.0058	0.0920	0.0097	
AH-13-7							0.0000	0.0000		1.0000	0.0648	0.0641	0.0125	0.1360		0.0306	0.0332	0.0049	0.0880	0.0114	
AH-14-7							0.0000	0.0000		1.0000	0.0708	0.0825	0.0125	0.1390		0.0308	0.0394	0.0053	0.0976	0.0113	
AH-15-7							0.0000	0.0000		1.0000	0.0687	0.0920	0.0127	0.1360		0.0310	0.0280	0.0102	0.0941	0.0113	
AH-16-7							0.0000	0.0000		1.0000	0.0636	0.0720	0.0126	0.1340		0.0306	0.0406	0.0100	0.0654	0.0110	
AH-17-7							0.0000	0.0000		1.0000	0.0572	0.0812	0.0065	0.1140		0.0306	0.0469	0.0058	0.0661	0.0092	
SFRIT1							0.0000	0.0000		1.0000	0.0460	0.0851	0.0147	0.1420		0.0270	0.0325	0.0084	0.1153	0.0111	
SFRIT2							0.0000	0.0000		1.0000											
SFRIT3							0.0000	0.0000		1.0000											
202P w/o Mn-7							0.0000	0.0000		1.0000	0.0430	0.0860	0.0122	0.1070		0.0573	0.0342	0.0292	0.0920	0.0070	
202G w/o Mn-7							0.0000	0.0000		1.0000	0.0469	0.0613	0.0132	0.1230		0.0278	0.0383	0.0324	0.0838	0.0068	
200R-7							0.0000	0.0000		1.0000	0.0462	0.0946	0.0147	0.1230		0.0349	0.0301	0.0125	0.1329	0.0053	
NBS SRM 623-7							0.0000	0.0000		1.0000	0.0630	0.1070	0.0070			0.0060			0.0640		
165 CGW STD-7							0.0000	0.0000		1.0000	0.0419	0.0671	0.0154	0.1292			0.0500	0.0102	0.1044	0.0097	
ARM-1-7 (4/88)							0.0000	0.0146		1.0000	0.0559	0.1130	0.0223				0.0508		0.0967		0.0065
ARM-1-7 (5/89)							0.0000	0.0146		1.0000											
ARM-1-7 (7/90)							0.0000	0.0146		1.0000											
ARM-1-7 (12/90)							0.0000	0.0146		1.0000											
ARM-1-7 (5/91)							0.0000	0.0146		1.0000											
ARM-1-7 (10/91)							0.0000	0.0146		1.0000											
ARM-1-7 (10/92)							0.0000	0.0146		1.0000											
ARM-1-7 (4/93)							0.0000	0.0146		1.0000											
ARM-1-7 (6/93)							0.0000	0.0146		1.0000											
ARM-1-7 (8/93)							0.0000	0.0146		1.0000											
ARM-1-7							0.0000	0.0146		1.0000											
T-ARM-1							0.0000	0.0146		1.0000											
SS-ARM-1							0.0000	0.0146		1.0000											
SS-ARM-1							0.0000	0.0146		1.0000											
EA-1-7							0.0000	0.0000		1.0000	0.0370	0.1130	0.0112	0.0738	0.0145	0.0004	0.0426	0.0172	0.1680	0.0057	
EA-1-7							0.0000	0.0000		1.0000											
EA-2-7							0.0000	0.0000		1.0000											
EA-7							0.0000	0.0000		1.0000											
T-EA							0.0000	0.0000		1.0000											
SS-EA-19							0.0000	0.0000		1.0000											
SS-EA-15							0.0000	0.0000		1.0000											
SS-EA-1-7							0.0000	0.0000		1.0000											
SS-EA-2-7							0.0000	0.0000		1.0000											
SRS-SEA-A-7							0.0000	0.0000		1.0000											
SRS-SEA-B-7							0.0000	0.0000		1.0000											
CUASEA-A-7							0.0000	0.0000		1.0000											
CUASEA-B-7							0.0000	0.0000		1.0000											
131-TDS-EA-7							0.0000	0.0000		1.0000	0.0577	0.1270	0.0092	0.1430		0.0004	0.0483	0.0153	0.1460	0.0144	
131-TDS-3A-SOPER-7							0.0000	0.0000		1.0000	0.0551	0.1080	0.0092	0.1140		0.0004	0.0421	0.0141	0.1370	0.0153	
BLEND 1-7							0.0000	0.0000		1.0000	0.0416	0.0805	0.0103	0.1091		0.0368	0.0444	0.0141	0.0913	0.0089	
BLEND 1-7 (2)							0.0000	0.0000		1.0000											
BLEND 1.6-7							0.0000	0.0000		1.0000											

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
AH-9-7	0.5088	0.0001												0.0001	0.0006						
AH-10-7	0.5420	0.0001												0.0001	0.0006						
AH-11-7	0.5040	0.0001												0.0001	0.0006						
AH-12-7	0.5090	0.0001													0.0006						
AH-13-7	0.4900	0.0003												0.0001	0.0005						
AH-14-7	0.4480	0.0058												0.0001	0.0006						
AH-15-7	0.4560	0.0001												0.0001	0.0005						
AH-16-7	0.5020	0.0001												0.0008	0.0003						
AH-17-7	0.5250	0.0066												0.0009	0.0006						
SFRIT1	0.4790	0.0011												0.0009							
SFRIT2																					
SFRIT3																					
202P w/o Mn-7	0.5120													0.0007	0.0015	0.0063					
202G w/o Mn-7	0.5700													0.0008	0.0005	0.0038					
200R-7	0.4510																				
NBS SRM 623-7	0.7300				0.0220																
165 CGW STD-7	0.5384	0.0050																			
ARM-1-7 (4/88)	0.4650	0.0180			0.0066				0.0144						0.0116						
ARM-1-7 (5/89)																					
ARM-1-7 (7/90)																					
ARM-1-7 (12/90)																					
ARM-1-7 (5/91)																					
ARM-1-7 (10/91)																					
ARM-1-7 (10/92)																					
ARM-1-7 (4/93)																					
ARM-1-7 (6/93)																					
ARM-1-7 (8/93)																					
ARM-1-7																					
T-ARM-1																					
SS-ARM-1																					
SS-ARM-1																					
EA-1-7	0.4873	0.0046																			
EA-1-7																					
EA-2-7																					
EA-7																					
T-EA																					
SS-EA-19																					
SS-EA-15																					
SS-EA-1-7																					
SS-EA-2-7																					
SRS-SEA-A-7																					
SRS-SEA-B-7																					
CUASEA-A-7																					
CUASEA-B-7																					
131-TDS-EA-7	0.3980	0.0043												0.0004							
131-TDS-3A-SOPER-	0.4620	0.0034												0.0012							
BLEND 1-7	0.5190	0.0014			0.0018									0.0013	0.0008	0.0042					
BLEND 1-7 (2)																					
BLEND 1.6-7																					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
AH-9-7				0.0264																	
AH-10-7				0.0267																	
AH-11-7				0.0263																	
AH-12-7				0.0264																	
AH-13-7				0.0325																	
AH-14-7				0.0334																	
AH-15-7				0.0326																	
AH-16-7				0.0322																	
AH-17-7				0.0271																	
SFRIT1				0.0193					0.0010												
SFRIT2																					
SFRIT3																					
202P w/o Mn-7									0.0020												
202G w/o Mn-7									0.0016												
200R-7				0.0213																	
NBS SRM 623-7																					
165 CGW STD-7				0.0256																	
ARM-1-7 (4/88)						0.0167		0.0596													
ARM-1-7 (5/89)																					
ARM-1-7 (7/90)																					
ARM-1-7 (12/90)																					
ARM-1-7 (5/91)																					
ARM-1-7 (10/91)																					
ARM-1-7 (10/92)																					
ARM-1-7 (4/93)																					
ARM-1-7 (6/93)																					
ARM-1-7 (8/93)																					
ARM-1-7																					
T-ARM-1																					
SS-ARM-1																					
SS-ARM-1																					
EA-1-7		0.0042		0.0134																	
EA-1-7																					
EA-2-7																					
EA-7																					
T-EA																					
SS-EA-19																					
SS-EA-15																					
SS-EA-1-7																					
SS-EA-2-7																					
SRS-SEA-A-7																					
SRS-SEA-B-7																					
CUASEA-A-7																					
CUASEA-B-7																					
131-TDS-EA-7		0.0037		0.0317																	
131-TDS-3A-SOPER-7		0.0035		0.0336																	
BLEND 1-7				0.0167		0.0015		0.0022													
BLEND 1-7 (2)																					
BLEND 1.6-7																					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
AH-9-7						0.0005				0.0133										0.9941
AH-10-7						0.0005				0.0130										0.9944
AH-11-7						0.0004				0.0129										0.9886
AH-12-7						0.0005				0.0133										0.9942
AH-13-7						0.0005				0.0129										0.9823
AH-14-7						0.0007				0.0132										0.9910
AH-15-7						0.0006				0.0134										0.9873
AH-16-7						0.0007				0.0130										0.9889
AH-17-7						0.0003				0.0130										0.9910
SFRIT1										0.0118										0.9952
SFRIT2																				
SFRIT3																				
202P w/o Mn-7										0.0124										1.0028
202G w/o Mn-7										0.0070										1.0172
200R-7												0.0004								0.9669
NBS SRM 623-7																				0.9990
165 CGW STD-7																				0.9969
ARM-1-7 (4/88)						0.0045				0.0321								0.0146		0.9883
ARM-1-7 (5/89)																				
ARM-1-7 (7/90)																				
ARM-1-7 (12/90)																				
ARM-1-7 (5/91)																				
ARM-1-7 (10/91)																				
ARM-1-7 (10/92)																				
ARM-1-7 (4/93)																				
ARM-1-7 (6/93)																				
ARM-1-7 (8/93)																				
ARM-1-7																				
T-ARM-1																				
SS-ARM-1																				
SS-ARM-1																				
EA-1-7										0.0070										0.9999
EA-1-7																				
EA-2-7																				
EA-7																				
T-EA																				
SS-EA-19																				
SS-EA-15																				
SS-EA-1-7																				
SS-EA-2-7																				
SRS-SEA-A-7																				
SRS-SEA-B-7																				
CUASEA-A-7																				
CUASEA-B-7																				
131-TDS-EA-7						0.0001				0.0093										1.0088
131-TDS-3A-SOPER-7										0.0074										1.0063
BLEND 1-7										0.0089										0.9948
BLEND 1-7 (2)																				
BLEND 1.6-7																				

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
AH-9-7								
AH-10-7								
AH-11-7								
AH-12-7								
AH-13-7								
AH-14-7								
AH-15-7								
AH-16-7								
AH-17-7								
SFRIT1								
SFRIT2								
SFRIT3								
202P w/o Mn-7								
202G w/o Mn-7								
200R-7								
NBS SRM 623-7								
165 CGW STD-7								
ARM-1-7 (4/88)								
ARM-1-7 (5/89)								
ARM-1-7 (7/90)								
ARM-1-7 (12/90)								
ARM-1-7 (5/91)								
ARM-1-7 (10/91)								
ARM-1-7 (10/92)								
ARM-1-7 (4/93)								
ARM-1-7 (6/93)								
ARM-1-7 (8/93)								
ARM-1-7								
T-ARM-1								
SS-ARM-1								
SS-ARM-1								
EA-1-7								
EA-1-7								
EA-2-7								
EA-7								
T-EA								
SS-EA-19								
SS-EA-15								
SS-EA-1-7								
SS-EA-2-7								
SRS-SEA-A-7								
SRS-SEA-B-7								
CUASEA-A-7								
CUASEA-B-7								
131-TDS-EA-7								
131-TDS-3A-SOPER-7								
BLEND 1-7								
BLEND 1-7 (2)								
BLEND 1.6-7								

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
AH-9-7					
AH-10-7					
AH-11-7					
AH-12-7					
AH-13-7					
AH-14-7					
AH-15-7					
AH-16-7					
AH-17-7					
SFRIT1					
SFRIT2					
SFRIT3					
202P w/o Mn-7					
202G w/o Mn-7					
200R-7					
NBS SRM 623-7					
165 CGW STD-7					
ARM-1-7 (4/88)					
ARM-1-7 (5/89)					
ARM-1-7 (7/90)					
ARM-1-7 (12/90)					
ARM-1-7 (5/91)					
ARM-1-7 (10/91)					
ARM-1-7 (10/92)					
ARM-1-7 (4/93)					
ARM-1-7 (6/93)					
ARM-1-7 (8/93)					
ARM-1-7					
T-ARM-1					
SS-ARM-1					
SS-ARM-1					
EA-1-7					
EA-1-7					
EA-2-7					
EA-7					
T-EA					
SS-EA-19					
SS-EA-15					
SS-EA-1-7					
SS-EA-2-7					
SRS-SEA-A-7					
SRS-SEA-B-7					
CUASEA-A-7					
CUASEA-B-7					
131-TDS-EA-7					
131-TDS-3A-SOPER-7					
BLEND 1-7					
BLEND 1-7 (2)					
BLEND 1.6-7					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
AH-9-7															
AH-10-7															
AH-11-7															
AH-12-7															
AH-13-7															
AH-14-7															
AH-15-7															
AH-16-7															
AH-17-7															
SFRIT1															
SFRIT2															
SFRIT3															
202P w/o Mn-7															
202G w/o Mn-7															
200R-7															
NBS SRM 623-7															
165 CGW STD-7															
ARM-1-7 (4/88)															
ARM-1-7 (5/89)															
ARM-1-7 (7/90)															
ARM-1-7 (12/90)															
ARM-1-7 (5/91)															
ARM-1-7 (10/91)															
ARM-1-7 (10/92)															
ARM-1-7 (4/93)															
ARM-1-7 (6/93)															
ARM-1-7 (8/93)															
ARM-1-7															
T-ARM-1															
SS-ARM-1															
SS-ARM-1															
EA-1-7															
EA-1-7															
EA-2-7															
EA-7															
T-EA															
SS-EA-19															
SS-EA-15															
SS-EA-1-7															
SS-EA-2-7															
SRS-SEA-A-7															
SRS-SEA-B-7															
CUASEA-A-7															
CUASEA-B-7															
131-TDS-EA-7															
131-TDS-3A-SOPER-7															
BLEND 1-7															
BLEND 1-7 (2)															
BLEND 1.6-7															

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
AH-9-7																					
AH-10-7																					
AH-11-7																					
AH-12-7																					
AH-13-7																					
AH-14-7																					
AH-15-7																					
AH-16-7																					
AH-17-7																					
SFRIT1																					
SFRIT2																					
SFRIT3																					
202P w/o Mn-7																					
202G w/o Mn-7																					
200R-7																					
NBS SRM 623-7																					
165 CGW STD-7																					
ARM-1-7 (4/88)																					
ARM-1-7 (5/89)																					
ARM-1-7 (7/90)																					
ARM-1-7 (12/90)																					
ARM-1-7 (5/91)																					
ARM-1-7 (10/91)																					
ARM-1-7 (10/92)																					
ARM-1-7 (4/93)																					
ARM-1-7 (6/93)																					
ARM-1-7 (8/93)																					
ARM-1-7																					
T-ARM-1																					
SS-ARM-1																					
SS-ARM-1																					
EA-1-7																					
EA-1-7																					
EA-2-7																					
EA-7																					
T-EA																					
SS-EA-19																					
SS-EA-15																					
SS-EA-1-7																					
SS-EA-2-7																					
SRS-SEA-A-7																					
SRS-SEA-B-7																					
CUASEA-A-7																					
CUASEA-B-7																					
131-TDS-EA-7																					
131-TDS-3A-SOPER-7																					
BLEND 1-7																					
BLEND 1-7 (2)																					
BLEND 1.6-7																					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
AH-9-7					0.22	0.255	0.23	0.140	10.19							
AH-10-7					0.215	0.26	0.215	0.155	10.06							
AH-11-7					0.235	0.285	0.225	0.135	9.8							
AH-12-7					0.425	0.305	0.365	0.095	10.12							
AH-13-7					0.215	0.26	0.235	0.145	10.33							
AH-14-7					0.26	0.29	0.305	0.155	10.66							
AH-15-7					0.215	0.24	0.225	0.120	10.18							
AH-16-7					0.21	0.24	0.22	0.140	10.12							
AH-17-7					0.18	0.225	0.185	0.145	10.09							
SFRIT1					0.375	0.345	0.355	0.095	9.74							
SFRIT2					0.365	0.350	0.350	0.175	10.09							
SFRIT3					0.380	0.410	0.435	0.215	10.21							
202P w/o Mn-7					0.320	0.255	0.370	0.195	9.95							
202G w/o Mn-7					0.195	0.195	0.260	0.175	9.79							
200R-7					0.575	0.485	0.505	0.230	10.54							
NBS SRM 623-7					0.055	0.005	0.075	0.045	8.48							
165 CGW STD-7					0.420	0.365	0.410	0.265	10.32							
ARM-1-7 (4/88)					0.290	0.375	0.345	0.175	10.13							
ARM-1-7 (5/89)					0.295	0.280	0.235	0.160	9.64							
ARM-1-7 (7/90)					0.240	0.285	0.255	0.140	10.22							
ARM-1-7 (12/90)					0.250	0.295	0.260	0.140	10.52							
ARM-1-7 (5/91)					0.270	0.315	0.270	0.145	10.42							
ARM-1-7 (10/91)					0.255	0.300	0.270	0.140	10.33							
ARM-1-7 (10/92)					0.220	0.250	0.225	0.130	10.16							
ARM-1-7 (4/93)					0.240	0.290	0.250	0.135	9.9							
ARM-1-7 (6/93)					0.235	0.260	0.240	0.130	9.89							
ARM-1-7 (8/93)					0.205	0.235	0.215	0.120	10.24							
ARM-1-7					0.255	0.300	0.255	0.135	9.38							
T-ARM-1					0.245	0.300	0.265	0.135	10.32							
SS-ARM-1					0.265	0.315	0.275	0.145	10.32							
SS-ARM-1					0.270	0.320	0.280	0.145	10.36							
EA-1-7					7.000	3.925	5.760	2.330	11.8							
EA-1-7					8.395	5.345	7.245	2.330	11.8							
EA-2-7					7.605	4.715	6.39	2.005	11.87							
EA-7					8.86	4.945	6.945	2.040	12.01							
T-EA					7.375	4.26	5.91	1.710	11.89							
SS-EA-19					8.205	4.56	6.545	1.750	11.92							
SS-EA-15					8.395	4.87	6.8	1.855	11.95							
SS-EA-1-7					9.25	5.14	7.165	2.090	11.78							
SS-EA-2-7					8.880	4.885	6.86	2.005	11.75							
SRS-SEA-A-7					8.225	4.67	6.425	1.895	11.78							
SRS-SEA-B-7					8.495	4.56	6.755	1.960	11.78							
CUASEA-A-7					8.425	4.835	6.475	1.935	11.77							
CUASEA-B-7					8.23	4.605	6.71	1.965	11.77							
131-TDS-EA-7					2.215	1.925	2.14	1.190	10.59							
131-TDS-3A-SOPER-7					1.405	1.225	1.15	0.445	10.57							
BLEND 1-7					0.36	0.405	0.39	0.205	10.22							
BLEND 1-7 (2)					0.39	0.4	0.395	0.210	10.45							
BLEND 1.6-7					0.36	0.38	0.375	0.210	10.17							

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
AH-9-7												
AH-10-7												
AH-11-7												
AH-12-7												
AH-13-7												
AH-14-7												
AH-15-7												
AH-16-7												
AH-17-7												
SFRIT1												
SFRIT2												
SFRIT3												
202P w/o Mn-7												
202G w/o Mn-7												
200R-7												
NBS SRM 623-7												
165 CGW STD-7												
ARM-1-7 (4/88)												
ARM-1-7 (5/89)												
ARM-1-7 (7/90)												
ARM-1-7 (12/90)												
ARM-1-7 (5/91)												
ARM-1-7 (10/91)												
ARM-1-7 (10/92)												
ARM-1-7 (4/93)												
ARM-1-7 (6/93)												
ARM-1-7 (8/93)												
ARM-1-7												
T-ARM-1												
SS-ARM-1												
SS-ARM-1												
EA-1-7												
EA-1-7												
EA-2-7												
EA-7												
T-EA												
SS-EA-19												
SS-EA-15												
SS-EA-1-7												
SS-EA-2-7												
SRS-SEA-A-7												
SRS-SEA-B-7												
CUASEA-A-7												
CUASEA-B-7												
131-TDS-EA-7												
131-TDS-3A-SOPER-7												
BLEND 1-7												
BLEND 1-7 (2)												
BLEND 1.6-7												

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
BATCH 1-7	0.0491	0.0784	0.0123	0.1292	0.0000	0.0336	0.0446	0.0143	0.0907	0.0075	0.0000	0.5056	0.0009			0.0014				0.0000	
BATCH 1-7 (2)	0.0491	0.0784	0.0123	0.1292	0.0000	0.0336	0.0446	0.0143	0.0907	0.0075	0.0000	0.5056	0.0009			0.0014				0.0000	
BATCH 1-1.6	0.0491	0.0784	0.0123	0.1292	0.0000	0.0336	0.0446	0.0143	0.0907	0.0075	0.0000	0.5056	0.0009			0.0014				0.0000	
BATCH 2-7	0.0465	0.0791	0.0108	0.1115	0.0000	0.0340	0.0451	0.0142	0.0924	0.0090	0.0000	0.5229	0.0017			0.0017				0.0000	
BATCH 2-7 (2)	0.0465	0.0791	0.0108	0.1115	0.0000	0.0340	0.0451	0.0142	0.0924	0.0090	0.0000	0.5229	0.0017			0.0017				0.0000	
BATCH 2-1.6	0.0465	0.0791	0.0108	0.1115	0.0000	0.0340	0.0451	0.0142	0.0924	0.0090	0.0000	0.5229	0.0017			0.0017				0.0000	
BATCH 3-7	0.0346	0.0775	0.0100	0.1181	0.0000	0.0343	0.0455	0.0143	0.0908	0.0106	0.0000	0.5303	0.0011			0.0019				0.0000	
BATCH 3-7 (2)	0.0346	0.0775	0.0100	0.1181	0.0000	0.0343	0.0455	0.0143	0.0908	0.0106	0.0000	0.5303	0.0011			0.0019				0.0000	
BATCH 3-7 (3)	0.0346	0.0775	0.0100	0.1181	0.0000	0.0343	0.0455	0.0143	0.0908	0.0106	0.0000	0.5303	0.0011			0.0019				0.0000	
BATCH 4-7	0.0345	0.0819	0.0085	0.1180	0.0000	0.0388	0.0432	0.0144	0.0922	0.0107	0.0000	0.5042	0.0023			0.0026				0.0000	
BATCH 4-7 (2)	0.0345	0.0819	0.0085	0.1180	0.0000	0.0388	0.0432	0.0144	0.0922	0.0107	0.0000	0.5042	0.0023			0.0026				0.0000	
BATCH 4-7 (3)	0.0345	0.0819	0.0085	0.1180	0.0000	0.0388	0.0432	0.0144	0.0922	0.0107	0.0000	0.5042	0.0023			0.0026				0.0000	
HM-1-7	0.0715	0.0703	0.0101	0.0779	0.0000	0.0222	0.0462	0.0149	0.0856	0.0041	0.0000	0.5582	0.0033			0.0012				0.0000	
HM-1-7 (2)	0.0715	0.0703	0.0101	0.0779	0.0000	0.0222	0.0462	0.0149	0.0856	0.0041	0.0000	0.5582	0.0033			0.0012				0.0000	
HM-1.6-7	0.0715	0.0703	0.0101	0.0779	0.0000	0.0222	0.0462	0.0149	0.0856	0.0041	0.0000	0.5582	0.0033			0.0012				0.0000	
PUREX 1-7	0.0300	0.1039	0.0110	0.1333	0.0000	0.0343	0.0324	0.0142	0.1270	0.0120	0.0000	0.4681	0.0004			0.0021				0.0000	
PUREX 1-7 (2)	0.0300	0.1039	0.0110	0.1333	0.0000	0.0343	0.0324	0.0142	0.1270	0.0120	0.0000	0.4681	0.0004			0.0021				0.0000	
PUREX 1.6-7	0.0300	0.1039	0.0110	0.1333	0.0000	0.0343	0.0324	0.0142	0.1270	0.0120	0.0000	0.4681	0.0004			0.0021				0.0000	
PUREX SRSS 1.6	0.0300	0.1039	0.0110	0.1333	0.0000	0.0343	0.0324	0.0142	0.1270	0.0120	0.0000	0.4681	0.0004			0.0021				0.0000	
PUREX SRST-4.0	0.0300	0.1039	0.0110	0.1333	0.0000	0.0343	0.0324	0.0142	0.1270	0.0120	0.0000	0.4681	0.0004			0.0021				0.0000	
PUREX CUA	0.0300	0.1039	0.0110	0.1333	0.0000	0.0343	0.0324	0.0142	0.1270	0.0120	0.0000	0.4681	0.0004			0.0021				0.0000	
BLEND 1-3457	0.0539	0.0703	0.0112	0.1290	0.0005	0.0256	0.0429	0.0131	0.1025	0.0084	0.0000	0.5131	0.0000			0.0009				0.0000	
BLEND 1-3479	0.0538	0.0708	0.0109	0.1270	0.0016	0.0262	0.0431	0.0129	0.1016	0.0087	0.0000	0.5140	0.0000			0.0009				0.0000	
BLEND 1-3498	0.0538	0.0711	0.0111	0.1297	0.0009	0.0277	0.0423	0.0128	0.1100	0.0093	0.0000	0.5013	0.0000			0.0009				0.0000	
BLEND 1-3510	0.0544	0.0705	0.0111	0.1313	0.0009	0.0303	0.0421	0.0127	0.1091	0.0091	0.0000	0.4986	0.0000			0.0009				0.0000	
BLEND 1-3526	0.0517	0.0730	0.0109	0.1264	0.0010	0.0298	0.0428	0.0127	0.1105	0.0098	0.0000	0.5025	0.0000			0.0009				0.0000	
BLEND 2-3611	0.0523	0.0684	0.0099	0.1232	0.0000	0.0242	0.0433	0.0134	0.1039	0.0098	0.0000	0.5230	0.0000			0.0009				0.0000	
BLEND 2-3622	0.0508	0.0700	0.0092	0.1201	0.0000	0.0241	0.0438	0.0133	0.1044	0.0097	0.0000	0.5264	0.0000			0.0009				0.0000	
BLEND 2-3635	0.0512	0.0696	0.0093	0.1174	0.0000	0.0247	0.0440	0.0134	0.1051	0.0095	0.0000	0.5276	0.0000			0.0009				0.0000	
BLEND 2-3654	0.0499	0.0694	0.0090	0.1181	0.0000	0.0250	0.0436	0.0132	0.1073	0.0098	0.0000	0.5264	0.0000			0.0009				0.0000	
BLEND 2-3666	0.0502	0.0701	0.0090	0.1191	0.0000	0.0238	0.0442	0.0135	0.1061	0.0097	0.0000	0.5256	0.0000			0.0009				0.0000	
BLEND 2-3676	0.0494	0.0707	0.0087	0.1169	0.0000	0.0235	0.0445	0.0134	0.1058	0.0096	0.0000	0.5296	0.0000			0.0009				0.0000	
BLEND 3-3768	0.0509	0.0710	0.0092	0.1176	0.0011	0.0234	0.0450	0.0141	0.1069	0.0098	0.0000	0.5198	0.0006			0.0012				0.0000	
BLEND 3-3789	0.0542	0.0719	0.0104	0.1254	0.0011	0.0254	0.0438	0.0143	0.1067	0.0101	0.0000	0.5041	0.0004			0.0014				0.0000	
BLEND 3-3793	0.0562	0.0721	0.0111	0.1307	0.0010	0.0267	0.0427	0.0142	0.1069	0.0101	0.0000	0.4946	0.0004			0.0014				0.0000	
BLEND 3-3802B	0.0561	0.0717	0.0108	0.1304	0.0025	0.0277	0.0428	0.0143	0.1032	0.0099	0.0000	0.4971	0.0004			0.0014				0.0000	
HM 1-3824	0.0576	0.0696	0.0094	0.1091	0.0022	0.0194	0.0458	0.0163	0.0993	0.0079	0.0000	0.5327	0.0002			0.0010				0.0000	
HM 1-3829	0.0615	0.0680	0.0092	0.1102	0.0019	0.0170	0.0457	0.0164	0.0953	0.0079	0.0000	0.5348	0.0004			0.0010				0.0000	
HM 1-3851	0.0624	0.0669	0.0094	0.1073	0.0018	0.0145	0.0456	0.0166	0.1012	0.0078	0.0000	0.5342	0.0004			0.0010				0.0000	
HM 1-3855	0.0664	0.0662	0.0086	0.0990	0.0021	0.0139	0.0461	0.0165	0.1021	0.0069	0.0000	0.5397	0.0002			0.0010				0.0000	
HM-2-1 (3979C)	0.0750	0.0664	0.0075	0.0992	0.0000	0.0159	0.0439	0.0154	0.1017	0.0068	0.0000	0.5289	0.0008			0.0009				0.0000	
HM-2-2 (4099A)	0.0769	0.0666	0.0072	0.0989	0.0000	0.0182	0.0435	0.0151	0.1037	0.0066	0.0000	0.5235	0.0006			0.0009				0.0000	
HM-2-3 (4120B)	0.0748	0.0674	0.0070	0.0938	0.0000	0.0194	0.0463	0.0153	0.1052	0.0060	0.0000	0.5270	0.0008			0.0010				0.0000	
HM-3-1 (4176)	0.0774	0.0646	0.0068	0.0951	0.0000	0.0217	0.0416	0.0148	0.1082	0.0058	0.0000	0.5281	0.0006			0.0007				0.0000	
HM-3-2 (4225)	0.0858	0.0669	0.0074	0.1001	0.0000	0.0221	0.0426	0.0154	0.1057	0.0059	0.0000	0.5093	0.0006			0.0009				0.0000	
HM-3-3 (4357)	0.0907	0.0670	0.0078	0.1041	0.0000	0.0226	0.0421	0.0158	0.1008	0.0060	0.0000	0.5027	0.0008			0.0009				0.0000	
HM-4-1 (5260)	0.0528	0.0996	0.0050	0.0845	0.0000	0.0235	0.0446	0.0088	0.0946	0.0062	0.0000	0.5414	0.0119			0.0005				0.0000	
HM-4-2 (5641)	0.0626	0.0919	0.0050	0.0794	0.0000	0.0269	0.0431	0.0105	0.0928	0.0098	0.0002	0.5396	0.0069			0.0005				0.0000	
HM-4-3 (5748)	0.0566	0.0880	0.0049	0.0727	0.0000	0.0279	0.0444	0.0117	0.0934	0.0052	0.0000	0.5631	0.0045			0.0005				0.0000	

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Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
BATCH 1-7				0.0012	0.0004	0.0040							0.0000		0.0173		0.0011		0.0015	0.0000	
BATCH 1-7 (2)				0.0012	0.0004	0.0040							0.0000		0.0173		0.0011		0.0015	0.0000	
BATCH 1-1.6				0.0012	0.0004	0.0040							0.0000		0.0173		0.0011		0.0015	0.0000	
BATCH 2-7				0.0014	0.0000	0.0042							0.0000		0.0141		0.0018		0.0026	0.0000	
BATCH 2-7 (2)				0.0014	0.0000	0.0042							0.0000		0.0141		0.0018		0.0026	0.0000	
BATCH 2-1.6				0.0014	0.0000	0.0042							0.0000		0.0141		0.0018		0.0026	0.0000	
BATCH 3-7				0.0014	0.0004	0.0041							0.0000		0.0153		0.0011		0.0016	0.0000	
BATCH 3-7 (2)				0.0014	0.0004	0.0041							0.0000		0.0153		0.0011		0.0016	0.0000	
BATCH 3-7 (3)				0.0014	0.0004	0.0041							0.0000		0.0153		0.0011		0.0016	0.0000	
BATCH 4-7				0.0014	0.0009	0.0045							0.0000		0.0255		0.0020		0.0041	0.0000	
BATCH 4-7 (2)				0.0014	0.0009	0.0045							0.0000		0.0255		0.0020		0.0041	0.0000	
BATCH 4-7 (3)				0.0014	0.0009	0.0045							0.0000		0.0255		0.0020		0.0041	0.0000	
HM-1-7				0.0010	0.0004	0.0025							0.0000		0.0176		0.0023		0.0053	0.0000	
HM-1-7 (2)				0.0010	0.0004	0.0025							0.0000		0.0176		0.0023		0.0053	0.0000	
HM-1.6-7				0.0010	0.0004	0.0025							0.0000		0.0176		0.0023		0.0053	0.0000	
PUREX 1-7				0.0016	0.0004	0.0042							0.0000		0.0170		0.0009		0.0005	0.0000	
PUREX 1-7 (2)				0.0016	0.0004	0.0042							0.0000		0.0170		0.0009		0.0005	0.0000	
PUREX 1.6-7				0.0016	0.0004	0.0042							0.0000		0.0170		0.0009		0.0005	0.0000	
PUREX SRSS 1.6				0.0016	0.0004	0.0042							0.0000		0.0170		0.0009		0.0005	0.0000	
PUREX SRST-4.0				0.0016	0.0004	0.0042							0.0000		0.0170		0.0009		0.0005	0.0000	
PUREX CUA				0.0016	0.0004	0.0042							0.0000		0.0170		0.0009		0.0005	0.0000	
BLEND 1-3457				0.0023	0.0000	0.0022							0.0000		0.0216		0.0000		0.0000	0.0000	
BLEND 1-3479				0.0023	0.0000	0.0018							0.0000		0.0220		0.0000		0.0000	0.0000	
BLEND 1-3498				0.0023	0.0000	0.0019							0.0000		0.0228		0.0000		0.0000	0.0000	
BLEND 1-3510				0.0023	0.0000	0.0019							0.0000		0.0229		0.0000		0.0000	0.0000	
BLEND 1-3526				0.0021	0.0000	0.0018							0.0000		0.0223		0.0000		0.0000	0.0000	
BLEND 2-3611				0.0026	0.0000	0.0017							0.0000		0.0218		0.0000		0.0000	0.0000	
BLEND 2-3622				0.0023	0.0000	0.0017							0.0000		0.0218		0.0000		0.0000	0.0000	
BLEND 2-3635				0.0023	0.0000	0.0017							0.0000		0.0216		0.0000		0.0000	0.0000	
BLEND 2-3654				0.0023	0.0000	0.0017							0.0000		0.0218		0.0000		0.0000	0.0000	
BLEND 2-3666				0.0026	0.0000	0.0017							0.0000		0.0220		0.0000		0.0000	0.0000	
BLEND 2-3676				0.0024	0.0000	0.0017							0.0000		0.0215		0.0000		0.0000	0.0000	
BLEND 3-3768				0.0031	0.0000	0.0020							0.0000		0.0230		0.0000		0.0000	0.0000	
BLEND 3-3789				0.0026	0.0000	0.0021							0.0000		0.0250		0.0000		0.0000	0.0000	
BLEND 3-3793				0.0025	0.0000	0.0023							0.0000		0.0258		0.0000		0.0000	0.0000	
BLEND 3-3802B				0.0025	0.0000	0.0022							0.0000		0.0258		0.0000		0.0000	0.0000	
HM 1-3824				0.0024	0.0000	0.0015							0.0000		0.0247		0.0000		0.0000	0.0000	
HM 1-3829				0.0024	0.0000	0.0015							0.0000		0.0260		0.0000		0.0000	0.0000	
HM 1-3851				0.0024	0.0000	0.0015							0.0000		0.0261		0.0000		0.0000	0.0000	
HM 1-3855				0.0021	0.0000	0.0014							0.0000		0.0269		0.0000		0.0000	0.0000	
HM-2-1 (3979C)				0.0049	0.0000	0.0014							0.0000		0.0273		0.0000		0.0000	0.0007	
HM-2-2 (4099A)				0.0047	0.0000	0.0015							0.0000		0.0275		0.0000		0.0000	0.0007	
HM-2-3 (4120B)				0.0040	0.0000	0.0014							0.0000		0.0266		0.0000		0.0000	0.0007	
HM-3-1 (4176)				0.0040	0.0000	0.0015							0.0000		0.0256		0.0000		0.0000	0.0003	
HM-3-2 (4225)				0.0040	0.0000	0.0016							0.0000		0.0280		0.0000		0.0000	0.0003	
HM-3-3 (4357)				0.0042	0.0000	0.0016							0.0000		0.0293		0.0000		0.0000	0.0003	
HM-4-1 (5260)				0.0045	0.0000	0.0010							0.0000		0.0150		0.0007		0.0000	0.0010	
HM-4-2 (5641)				0.0066	0.0000	0.0020							0.0000		0.0165		0.0004		0.0000	0.0007	
HM-4-3 (5748)				0.0038	0.0000	0.0019							0.0000		0.0165		0.0002		0.0000	0.0004	

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
BATCH 1-7																	0.0000				0.0068
BATCH 1-7 (2)																	0.0000				0.0068
BATCH 1-1.6																	0.0000				0.0068
BATCH 2-7																	0.0000				0.0069
BATCH 2-7 (2)																	0.0000				0.0069
BATCH 2-1.6																	0.0000				0.0069
BATCH 3-7																	0.0000				0.0069
BATCH 3-7 (2)																	0.0000				0.0069
BATCH 3-7 (3)																	0.0000				0.0069
BATCH 4-7																	0.0000				0.0104
BATCH 4-7 (2)																	0.0000				0.0104
BATCH 4-7 (3)																	0.0000				0.0104
HM-1-7																	0.0000				0.0056
HM-1-7 (2)																	0.0000				0.0056
HM-1.6-7																	0.0000				0.0056
PUREX 1-7																	0.0000				0.0068
PUREX 1-7 (2)																	0.0000				0.0068
PUREX 1.6-7																	0.0000				0.0068
PUREX SRSS 1.6																	0.0000				0.0068
PUREX SRST-4.0																	0.0000				0.0068
PUREX CUA																	0.0000				0.0068
BLEND 1-3457																	0.0000				0.0024
BLEND 1-3479																	0.0000				0.0023
BLEND 1-3498																	0.0000				0.0021
BLEND 1-3510																	0.0000				0.0019
BLEND 1-3526																	0.0000				0.0018
BLEND 2-3611																	0.0000				0.0017
BLEND 2-3622																	0.0000				0.0016
BLEND 2-3635																	0.0000				0.0017
BLEND 2-3654																	0.0000				0.0015
BLEND 2-3666																	0.0000				0.0015
BLEND 2-3676																	0.0000				0.0015
BLEND 3-3768																	0.0000				0.0014
BLEND 3-3789																	0.0000				0.0013
BLEND 3-3793																	0.0000				0.0012
BLEND 3-3802B																	0.0000				0.0012
HM 1-3824																	0.0000				0.0009
HM 1-3829																	0.0000				0.0010
HM 1-3851																	0.0000				0.0009
HM 1-3855																	0.0000				0.0009
HM-2-1 (3979C)																	0.0014				0.0009
HM-2-2 (4099A)																	0.0016				0.0012
HM-2-3 (4120B)																	0.0015				0.0010
HM-3-1 (4176)																	0.0014				0.0010
HM-3-2 (4225)																	0.0014				0.0010
HM-3-3 (4357)																	0.0016				0.0010
HM-4-1 (5260)																	0.0008				0.0025
HM-4-2 (5641)																	0.0008				0.0026
HM-4-3 (5748)																	0.0008				0.0025

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
BATCH 1-7							0.0000	0.0000		1.0000	0.0488	0.0778	0.0122	0.1284		0.0333	0.0443	0.0142	0.0900	0.0075	
BATCH 1-7 (2)							0.0000	0.0000		1.0000											
BATCH 1-1.6							0.0000	0.0000		1.0000											
BATCH 2-7							0.0000	0.0000		1.0000	0.0463	0.0788	0.0108	0.1112		0.0338	0.0450	0.0142	0.0921	0.0090	
BATCH 2-7 (2)							0.0000	0.0000		1.0000											
BATCH 2-1.6							0.0000	0.0000		1.0000											
BATCH 3-7							0.0000	0.0000		1.0000	0.0344	0.0769	0.0099	0.1171		0.0340	0.0451	0.0142	0.0901	0.0105	
BATCH 3-7 (2)							0.0000	0.0000		1.0000											
BATCH 3-7 (3)							0.0000	0.0000		1.0000											
BATCH 4-7							0.0000	0.0000		1.0000	0.0343	0.0814	0.0084	0.1171		0.0386	0.0429	0.0143	0.0916	0.0106	
BATCH 4-7 (2)							0.0000	0.0000		1.0000											
BATCH 4-7 (3)							0.0000	0.0000		1.0000											
HM-1-7							0.0000	0.0000		1.0000	0.0715	0.0703	0.0101	0.0778		0.0221	0.0462	0.0149	0.0856	0.0041	
HM-1-7 (2)							0.0000	0.0000		1.0000											
HM-1.6-7							0.0000	0.0000		1.0000											
PUREX 1-7							0.0000	0.0000		1.0000	0.0299	0.1033	0.0109	0.1325		0.0341	0.0322	0.0141	0.1262	0.0119	
PUREX 1-7 (2)							0.0000	0.0000		1.0000											
PUREX 1.6-7							0.0000	0.0000		1.0000											
PUREX SRSS 1.6							0.0000	0.0000		1.0000											
PUREX SRST-4.0							0.0000	0.0000		1.0000											
PUREX CUA							0.0000	0.0000		1.0000											
BLEND 1-3457							0.0000	0.0000		1.0000	0.0518	0.0676	0.0108	0.1241	0.0006	0.0247	0.0412	0.0126	0.0987	0.0081	
BLEND 1-3479							0.0000	0.0000		1.0000	0.0515	0.0678	0.0104	0.1216	0.0016	0.0251	0.0413	0.0124	0.0974	0.0083	
BLEND 1-3498							0.0000	0.0000		1.0000	0.0516	0.0682	0.0107	0.1243	0.0008	0.0265	0.0406	0.0122	0.1054	0.0089	
BLEND 1-3510							0.0000	0.0000		1.0000	0.0521	0.0674	0.0106	0.1256	0.0008	0.0291	0.0403	0.0122	0.1044	0.0087	
BLEND 1-3526							0.0000	0.0000		1.0000	0.0489	0.0689	0.0103	0.1194	0.0010	0.0281	0.0404	0.0121	0.1043	0.0093	
BLEND 2-3611							0.0000	0.0000		1.0000	0.0502	0.0656	0.0095	0.1182		0.0232	0.0415	0.0128	0.0997	0.0094	
BLEND 2-3622							0.0000	0.0000		1.0000	0.0489	0.0675	0.0089	0.1158		0.0232	0.0422	0.0128	0.1007	0.0093	
BLEND 2-3635							0.0000	0.0000		1.0000	0.0489	0.0666	0.0089	0.1123		0.0236	0.0421	0.0128	0.1005	0.0091	
BLEND 2-3654							0.0000	0.0000		1.0000	0.0472	0.0656	0.0085	0.1115		0.0237	0.0412	0.0125	0.1005	0.0093	
BLEND 2-3666							0.0000	0.0000		1.0000	0.0480	0.0670	0.0086	0.1137		0.0228	0.0422	0.0129	0.1013	0.0092	
BLEND 2-3676							0.0000	0.0000		1.0000	0.0473	0.0676	0.0083	0.1119		0.0225	0.0426	0.0128	0.1012	0.0092	
BLEND 3-3768							0.0000	0.0000		1.0000	0.0489	0.0683	0.0088	0.1131	0.0011	0.0225	0.0433	0.0136	0.1028	0.0094	
BLEND 3-3789							0.0000	0.0000		1.0000	0.0528	0.0702	0.0101	0.1223	0.0011	0.0248	0.0427	0.0139	0.1041	0.0098	
BLEND 3-3793							0.0000	0.0000		1.0000	0.0546	0.0701	0.0108	0.1269	0.0010	0.0260	0.0415	0.0138	0.1039	0.0098	
BLEND 3-3802B							0.0000	0.0000		1.0000	0.0539	0.0688	0.0104	0.1253	0.0024	0.0266	0.0411	0.0137	0.0992	0.0095	
HM 1-3824							0.0000	0.0000		1.0000	0.0558	0.0674	0.0091	0.1057	0.0021	0.0188	0.0444	0.0158	0.0962	0.0077	
HM 1-3829							0.0000	0.0000		1.0000	0.0600	0.0662	0.0090	0.1073	0.0018	0.0166	0.0445	0.0160	0.0929	0.0077	
HM 1-3851							0.0000	0.0000		1.0000	0.0608	0.0651	0.0091	0.1045	0.0017	0.0142	0.0444	0.0162	0.0985	0.0076	
HM 1-3855							0.0000	0.0000		1.0000	0.0650	0.0649	0.0084	0.0971	0.0021	0.0136	0.0452	0.0162	0.1001	0.0068	
HM-2-1 (3979C)							0.0000	0.0010		1.0000	0.0766	0.0677	0.0076	0.1012		0.0162	0.0448	0.0157	0.1038	0.0070	
HM-2-2 (4099A)							0.0000	0.0010		1.0000	0.0782	0.0678	0.0073	0.1008		0.0185	0.0443	0.0154	0.1056	0.0067	
HM-2-3 (4120B)							0.0000	0.0009		1.0000	0.0754	0.0680	0.0071	0.0946		0.0195	0.0467	0.0155	0.1060	0.0061	
HM-3-1 (4176)							0.0000	0.0009		1.0000	0.0749	0.0625	0.0066	0.0920		0.0211	0.0402	0.0144	0.1048	0.0056	
HM-3-2 (4225)							0.0000	0.0009		1.0000	0.0838	0.0653	0.0072	0.0976		0.0217	0.0416	0.0151	0.1032	0.0057	
HM-3-3 (4357)							0.0000	0.0009		1.0000	0.0896	0.0661	0.0077	0.1027		0.0223	0.0415	0.0155	0.0995	0.0059	
HM-4-1 (5260)							0.0000	0.0011		1.0000	0.0533	0.1005	0.0050	0.0854		0.0237	0.0450	0.0090	0.0955	0.0062	
HM-4-2 (5641)							0.0000	0.0011		1.0000	0.0648	0.0952	0.0051	0.0823		0.0280	0.0447	0.0109	0.0962	0.0101	0.0002
HM-4-3 (5748)							0.0000	0.0010		1.0000	0.0587	0.0912	0.0051	0.0753		0.0289	0.0459	0.0121	0.0968	0.0054	

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
BATCH 1-7	0.5020	0.0010			0.0015									0.0011	0.0006	0.0038					
BATCH 1-7 (2)																					
BATCH 1-1.6																					
BATCH 2-7	0.5210	0.0017			0.0016									0.0013	0.0002	0.0040					
BATCH 2-7 (2)																					
BATCH 2-1.6																					
BATCH 3-7	0.5260	0.0012			0.0018									0.0014	0.0006	0.0038					
BATCH 3-7 (2)																					
BATCH 3-7 (3)																					
BATCH 4-7	0.5010	0.0022			0.0025									0.0014	0.0009	0.0043					
BATCH 4-7 (2)																					
BATCH 4-7 (3)																					
HM-1-7	0.5580	0.0033			0.0011									0.0009	0.0006	0.0024					
HM-1-7 (2)																					
HM-1.6-7																					
PUREX 1-7	0.4650	0.0005			0.0020									0.0015	0.0006	0.0040					
PUREX 1-7 (2)																					
PUREX 1.6-7																					
PUREX SRSS 1.6																					
PUREX SRST-4.0																					
PUREX CUA																					
BLEND 1-3457	0.4935				0.0009									0.0023		0.0020					
BLEND 1-3479	0.4925				0.0010									0.0022		0.0017					
BLEND 1-3498	0.4806				0.0010									0.0023		0.0019					
BLEND 1-3510	0.4772				0.0010									0.0022		0.0019					
BLEND 1-3526	0.4745				0.0009									0.0020		0.0017					
BLEND 2-3611	0.5019				0.0010									0.0026		0.0017					
BLEND 2-3622	0.5078				0.0010									0.0023		0.0015					
BLEND 2-3635	0.5045				0.0010									0.0023		0.0015					
BLEND 2-3654	0.4977				0.0010									0.0023		0.0015					
BLEND 2-3666	0.5021				0.0010									0.0025		0.0015					
BLEND 2-3676	0.5066				0.0010									0.0022		0.0015					
BLEND 3-3768	0.5000	0.0005			0.0012									0.0028		0.0019					
BLEND 3-3789	0.4918	0.0004			0.0013									0.0025		0.0019					
BLEND 3-3793	0.4804	0.0003			0.0014									0.0025		0.0021					
BLEND 3-3802B	0.4775	0.0004			0.0013									0.0025		0.0020					
HM 1-3824	0.5160	0.0002			0.0010									0.0022		0.0015					
HM 1-3829	0.5213	0.0004			0.0010									0.0023		0.0013					
HM 1-3851	0.5200	0.0003			0.0010									0.0023		0.0013					
HM 1-3855	0.5290	0.0002			0.0010									0.0022		0.0013					
HM-2-1 (3979C)	0.5396	0.0008			0.0009									0.0051		0.0013					
HM-2-2 (4099A)	0.5328	0.0006			0.0009									0.0047		0.0015					
HM-2-3 (4120B)	0.5311	0.0007			0.0009									0.0039		0.0013					
HM-3-1 (4176)	0.5111	0.0005			0.0008									0.0038		0.0013					
HM-3-2 (4225)	0.4973	0.0005			0.0008									0.0038		0.0015					
HM-3-3 (4357)	0.4960	0.0007			0.0009									0.0041		0.0015					
HM-4-1 (5260)	0.5462	0.0120			0.0006									0.0045		0.0011					
HM-4-2 (5641)	0.5595	0.0071			0.0005									0.0069		0.0020					
HM-4-3 (5748)	0.5836	0.0046			0.0005									0.0039		0.0016					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
BATCH 1-7				0.0172		0.0011		0.0015													
BATCH 1-7 (2)																					
BATCH 1-1.6																					
BATCH 2-7				0.0141		0.0017		0.0026													
BATCH 2-7 (2)																					
BATCH 2-1.6																					
BATCH 3-7				0.0153		0.0012		0.0017													
BATCH 3-7 (2)																					
BATCH 3-7 (3)																					
BATCH 4-7				0.0254		0.0020		0.0039													
BATCH 4-7 (2)																					
BATCH 4-7 (3)																					
HM-1-7				0.0175		0.0022		0.0055													
HM-1-7 (2)																					
HM-1.6-7																					
PUREX 1-7				0.0169		0.0008		0.0006													
PUREX 1-7 (2)																					
PUREX 1.6-7																					
PUREX SRSS 1.6																					
PUREX SRST-4.0																					
PUREX CUA																					
BLEND 1-3457				0.0207																	
BLEND 1-3479				0.0211																	
BLEND 1-3498				0.0219																	
BLEND 1-3510				0.0219																	
BLEND 1-3526				0.0211																	
BLEND 2-3611				0.0209																	
BLEND 2-3622				0.0210																	
BLEND 2-3635				0.0206																	
BLEND 2-3654				0.0206																	
BLEND 2-3666				0.0210																	
BLEND 2-3676				0.0206																	
BLEND 3-3768				0.0221																	
BLEND 3-3789				0.0244																	
BLEND 3-3793				0.0251																	
BLEND 3-3802B				0.0248																	
HM 1-3824				0.0240																	
HM 1-3829				0.0254																	
HM 1-3851				0.0254																	
HM 1-3855				0.0263																	
HM-2-1 (3979C)				0.0279					0.0005												
HM-2-2 (4099A)				0.0280					0.0006												
HM-2-3 (4120B)				0.0268					0.0005												
HM-3-1 (4176)				0.0248					0.0004												
HM-3-2 (4225)				0.0273					0.0005												
HM-3-3 (4357)				0.0290					0.0004												
HM-4-1 (5260)				0.0151		0.0007			0.0010												
HM-4-2 (5641)		0.0002		0.0172		0.0004			0.0007												
HM-4-3 (5748)				0.0172		0.0002			0.0003												

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
BATCH 1-7										0.0068										0.9931
BATCH 1-7 (2)																				
BATCH 1-1.6																				
BATCH 2-7										0.0069										0.9963
BATCH 2-7 (2)																				
BATCH 2-1.6																				
BATCH 3-7										0.0068										0.9920
BATCH 3-7 (2)																				
BATCH 3-7 (3)																				
BATCH 4-7										0.0103										0.9931
BATCH 4-7 (2)																				
BATCH 4-7 (3)																				
HM-1-7										0.0056										0.9997
HM-1-7 (2)																				
HM-1.6-7																				
PUREX 1-7										0.0068										0.9938
PUREX 1-7 (2)																				
PUREX 1.6-7																				
PUREX SRSS 1.6																				
PUREX SRST-4.0																				
PUREX CUA																				
BLEND 1-3457										0.0024										0.9620
BLEND 1-3479										0.0022										0.9581
BLEND 1-3498										0.0019										0.9588
BLEND 1-3510										0.0019										0.9573
BLEND 1-3526										0.0017										0.9446
BLEND 2-3611										0.0017										0.9599
BLEND 2-3622										0.0015										0.9644
BLEND 2-3635										0.0017										0.9564
BLEND 2-3654										0.0014										0.9445
BLEND 2-3666										0.0014										0.9552
BLEND 2-3676										0.0014										0.9567
BLEND 3-3768										0.0013										0.9616
BLEND 3-3789										0.0013										0.9754
BLEND 3-3793										0.0012										0.9714
BLEND 3-3802B										0.0012										0.9606
HM 1-3824										0.0009										0.9688
HM 1-3829										0.0010										0.9747
HM 1-3851										0.0009										0.9733
HM 1-3855										0.0009										0.9803
HM-2-1 (3979C)						0.0015				0.0009								0.0010		1.0201
HM-2-2 (4099A)						0.0016				0.0012								0.0010		1.0175
HM-2-3 (4120B)						0.0015				0.0011								0.0009		1.0076
HM-3-1 (4176)						0.0014				0.0010								0.0008		0.9680
HM-3-2 (4225)						0.0015				0.0010								0.0009		0.9763
HM-3-3 (4357)						0.0015				0.0010								0.0008		0.9867
HM-4-1 (5260)						0.0008				0.0026								0.0012		1.0094
HM-4-2 (5641)						0.0009				0.0027								0.0011		1.0367
HM-4-3 (5748)						0.0009				0.0027								0.0011		1.0360

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
BATCH 1-7								
BATCH 1-7 (2)								
BATCH 1-1.6								
BATCH 2-7								
BATCH 2-7 (2)								
BATCH 2-1.6								
BATCH 3-7								
BATCH 3-7 (2)								
BATCH 3-7 (3)								
BATCH 4-7								
BATCH 4-7 (2)								
BATCH 4-7 (3)								
HM-1-7								
HM-1-7 (2)								
HM-1.6-7								
PUREX 1-7								
PUREX 1-7 (2)								
PUREX 1.6-7								
PUREX SRSS 1.6								
PUREX SRST-4.0								
PUREX CUA								
BLEND 1-3457								
BLEND 1-3479								
BLEND 1-3498								
BLEND 1-3510								
BLEND 1-3526								
BLEND 2-3611								
BLEND 2-3622								
BLEND 2-3635								
BLEND 2-3654								
BLEND 2-3666								
BLEND 2-3676								
BLEND 3-3768								
BLEND 3-3789								
BLEND 3-3793								
BLEND 3-3802B								
HM 1-3824								
HM 1-3829								
HM 1-3851								
HM 1-3855								
HM-2-1 (3979C)								
HM-2-2 (4099A)								
HM-2-3 (4120B)								
HM-3-1 (4176)								
HM-3-2 (4225)								
HM-3-3 (4357)								
HM-4-1 (5260)								
HM-4-2 (5641)								
HM-4-3 (5748)								

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
BATCH 1-7					
BATCH 1-7 (2)					
BATCH 1-1.6					
BATCH 2-7					
BATCH 2-7 (2)					
BATCH 2-1.6					
BATCH 3-7					
BATCH 3-7 (2)					
BATCH 3-7 (3)					
BATCH 4-7					
BATCH 4-7 (2)					
BATCH 4-7 (3)					
HM-1-7					
HM-1-7 (2)					
HM-1.6-7					
PUREX 1-7					
PUREX 1-7 (2)					
PUREX 1.6-7					
PUREX SRSS 1.6					
PUREX SRST-4.0					
PUREX CUA					
BLEND 1-3457					
BLEND 1-3479					
BLEND 1-3498					
BLEND 1-3510					
BLEND 1-3526					
BLEND 2-3611					
BLEND 2-3622					
BLEND 2-3635					
BLEND 2-3654					
BLEND 2-3666					
BLEND 2-3676					
BLEND 3-3768					
BLEND 3-3789					
BLEND 3-3793					
BLEND 3-3802B					
HM 1-3824					
HM 1-3829					
HM 1-3851					
HM 1-3855					
HM-2-1 (3979C)					
HM-2-2 (4099A)					
HM-2-3 (4120B)					
HM-3-1 (4176)					
HM-3-2 (4225)					
HM-3-3 (4357)					
HM-4-1 (5260)					
HM-4-2 (5641)					
HM-4-3 (5748)					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
BATCH 1-7															
BATCH 1-7 (2)															
BATCH 1-1.6															
BATCH 2-7															
BATCH 2-7 (2)															
BATCH 2-1.6															
BATCH 3-7															
BATCH 3-7 (2)															
BATCH 3-7 (3)															
BATCH 4-7															
BATCH 4-7 (2)															
BATCH 4-7 (3)															
HM-1-7															
HM-1-7 (2)															
HM-1.6-7															
PUREX 1-7															
PUREX 1-7 (2)															
PUREX 1.6-7															
PUREX SRSS 1.6															
PUREX SRST-4.0															
PUREX CUA															
BLEND 1-3457															
BLEND 1-3479															
BLEND 1-3498															
BLEND 1-3510															
BLEND 1-3526															
BLEND 2-3611															
BLEND 2-3622															
BLEND 2-3635															
BLEND 2-3654															
BLEND 2-3666															
BLEND 2-3676															
BLEND 3-3768															
BLEND 3-3789															
BLEND 3-3793															
BLEND 3-3802B															
HM 1-3824															
HM 1-3829															
HM 1-3851															
HM 1-3855															
HM-2-1 (3979C)															
HM-2-2 (4099A)															
HM-2-3 (4120B)															
HM-3-1 (4176)															
HM-3-2 (4225)															
HM-3-3 (4357)															
HM-4-1 (5260)															
HM-4-2 (5641)															
HM-4-3 (5748)															

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
BATCH 1-7																					
BATCH 1-7 (2)																					
BATCH 1-1.6																					
BATCH 2-7																					
BATCH 2-7 (2)																					
BATCH 2-1.6																					
BATCH 3-7																					
BATCH 3-7 (2)																					
BATCH 3-7 (3)																					
BATCH 4-7																					
BATCH 4-7 (2)																					
BATCH 4-7 (3)																					
HM-1-7																					
HM-1-7 (2)																					
HM-1.6-7																					
PUREX 1-7																					
PUREX 1-7 (2)																					
PUREX 1.6-7																					
PUREX SRSS 1.6																					
PUREX SRST-4.0																					
PUREX CUA																					
BLEND 1-3457																					
BLEND 1-3479																					
BLEND 1-3498																					
BLEND 1-3510																					
BLEND 1-3526																					
BLEND 2-3611																					
BLEND 2-3622																					
BLEND 2-3635																					
BLEND 2-3654																					
BLEND 2-3666																					
BLEND 2-3676																					
BLEND 3-3768																					
BLEND 3-3789																					
BLEND 3-3793																					
BLEND 3-3802B																					
HM 1-3824																					
HM 1-3829																					
HM 1-3851																					
HM 1-3855																					
HM-2-1 (3979C)																					
HM-2-2 (4099A)																					
HM-2-3 (4120B)																					
HM-3-1 (4176)																					
HM-3-2 (4225)																					
HM-3-3 (4357)																					
HM-4-1 (5260)																					
HM-4-2 (5641)																					
HM-4-3 (5748)																					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
BATCH 1-7					0.365	0.405	0.4	0.210	10.31							
BATCH 1-7 (2)					0.365	0.38	0.375	0.205	10.47							
BATCH 1-1.6					0.355	0.38	0.37	0.215	10.19							
BATCH 2-7					0.33	0.385	0.365	0.200	10.18							
BATCH 2-7 (2)					0.335	0.36	0.345	0.200	10.42							
BATCH 2-1.6					0.32	0.355	0.335	0.200	10.09							
BATCH 3-7					0.43	0.45	0.445	0.230	10.31							
BATCH 3-7 (2)					0.445	0.425	0.425	0.235	10.37							
BATCH 3-7 (3)					0.425	0.425	0.415	0.240	10.11							
BATCH 4-7					0.485	0.5	0.5	0.250	10.2							
BATCH 4-7 (2)					0.45	0.445	0.435	0.230	10.43							
BATCH 4-7 (3)					0.47	0.47	0.47	0.250	10.24							
HM-1-7					0.23	0.31	0.245	0.150	10.09							
HM-1-7 (2)					0.23	0.285	0.23	0.150	10.28							
HM-1.6-7					0.215	0.28	0.22	0.155	9.87							
PUREX 1-7					1.095	0.93	1.045	0.405	10.6							
PUREX 1-7 (2)					0.985	0.825	0.88	0.360	10.64							
PUREX 1.6-7					2.23	1.625	2.13	0.585	10.88							
PUREX SRSS 1.6					1.19	1.02	1.04	0.430	10.63							
PUREX SRST-4.0					1.13	0.98	0.995	0.425	10.62							
PUREX CUA					1.425	1.185	1.21	0.480	10.75							
BLEND 1-3457					0.3	0.335	0.325	0.190	10.22							
BLEND 1-3479					0.29	0.32	0.315	0.185	10.26							
BLEND 1-3498					0.315	0.35	0.335	0.195	10.31							
BLEND 1-3510					0.34	0.37	0.365	0.205	10.37							
BLEND 1-3526					0.335	0.37	0.36	0.210	10.28							
BLEND 2-3611					0.305	0.335	0.335	0.195	10.21							
BLEND 2-3622					0.305	0.33	0.33	0.195	10.24							
BLEND 2-3635					0.305	0.325	0.33	0.195	10.14							
BLEND 2-3654					0.3	0.325	0.32	0.195	10.23							
BLEND 2-3666					0.3	0.325	0.32	0.195	10.1							
BLEND 2-3676					0.295	0.32	0.315	0.195	10.07							
BLEND 3-3768					0.3	0.32	0.33	0.185	9.99							
BLEND 3-3789					0.315	0.33	0.35	0.185	10.14							
BLEND 3-3793					0.315	0.33	0.355	0.190	10.13							
BLEND 3-3802B					0.35	0.355	0.385	0.195	10.18							
HM 1-3824					0.295	0.315	0.31	0.180	9.98							
HM 1-3829					0.285	0.315	0.305	0.175	9.96							
HM 1-3851					0.26	0.3	0.275	0.180	9.98							
HM 1-3855					0.265	0.3	0.275	0.170	9.99							
HM-2-1 (3979C)					0.265	0.305	0.27	0.185	9.56							
HM-2-2 (4099A)					0.275	0.315	0.28	0.180	9.6							
HM-2-3 (4120B)					0.265	0.31	0.27	0.180	9.22							
HM-3-1 (4176)					0.28	0.325	0.265	0.180	9.22							
HM-3-2 (4225)					0.275	0.32	0.26	0.180	9.22							
HM-3-3 (4357)					0.255	0.295	0.265	0.175	9.2							
HM-4-1 (5260)					0.375	0.38	0.32	0.175	9.29							
HM-4-2 (5641)					0.265	0.285	0.26	0.150	9.32							
HM-4-3 (5748)					0.35	0.355	0.325	0.170	9.7							

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
BATCH 1-7												
BATCH 1-7 (2)												
BATCH 1-1.6												
BATCH 2-7												
BATCH 2-7 (2)												
BATCH 2-1.6												
BATCH 3-7												
BATCH 3-7 (2)												
BATCH 3-7 (3)												
BATCH 4-7												
BATCH 4-7 (2)												
BATCH 4-7 (3)												
HM-1-7												
HM-1-7 (2)												
HM-1.6-7												
PUREX 1-7												
PUREX 1-7 (2)												
PUREX 1.6-7												
PUREX SRSS 1.6												
PUREX SRST-4.0												
PUREX CUA												
BLEND 1-3457												
BLEND 1-3479												
BLEND 1-3498												
BLEND 1-3510												
BLEND 1-3526												
BLEND 2-3611												
BLEND 2-3622												
BLEND 2-3635												
BLEND 2-3654												
BLEND 2-3666												
BLEND 2-3676												
BLEND 3-3768												
BLEND 3-3789												
BLEND 3-3793												
BLEND 3-3802B												
HM 1-3824												
HM 1-3829												
HM 1-3851												
HM 1-3855												
HM-2-1 (3979C)												
HM-2-2 (4099A)												
HM-2-3 (4120B)												
HM-3-1 (4176)												
HM-3-2 (4225)												
HM-3-3 (4357)												
HM-4-1 (5260)												
HM-4-2 (5641)												
HM-4-3 (5748)												

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
PX 1-1 (4643)	0.0533	0.0742	0.0148	0.1071	0.0000	0.0293	0.0436	0.0148	0.0991	0.0162	0.0000	0.5003	0.0008			0.0019				0.0000	
PX 1-2 (4726)	0.0490	0.0726	0.0148	0.1103	0.0000	0.0299	0.0428	0.0142	0.0989	0.0169	0.0002	0.4995	0.0008			0.0019				0.0000	
PX 1-3 (4776)	0.0435	0.0727	0.0133	0.0999	0.0000	0.0277	0.0450	0.0147	0.0958	0.0157	0.0000	0.5256	0.0008			0.0017				0.0000	
PX 2-1 (4455)	0.0846	0.0682	0.0079	0.0946	0.0000	0.0214	0.0431	0.0158	0.1038	0.0063	0.0000	0.5153	0.0006			0.0009				0.0000	
PX 2-2 (4509)	0.0696	0.0719	0.0114	0.1100	0.0000	0.0248	0.0432	0.0155	0.0955	0.0118	0.0000	0.5020	0.0006			0.0014				0.0000	
PX 2-3 (4566)	0.0601	0.0744	0.0146	0.1095	0.0000	0.0303	0.0431	0.0151	0.0989	0.0152	0.0000	0.4907	0.0008			0.0019				0.0000	
PX 3-1 (5780)	0.0409	0.0793	0.0066	0.0875	0.0000	0.0234	0.0463	0.0138	0.0851	0.0071	0.0002	0.5762	0.0070			0.0005				0.0000	
PX 3-2 (5818)	0.0374	0.0770	0.0070	0.0953	0.0000	0.0221	0.0464	0.0142	0.0817	0.0076	0.0002	0.5765	0.0070			0.0007				0.0000	
PX 3-3 (5880)	0.0310	0.0729	0.0072	0.0989	0.0000	0.0229	0.0474	0.0149	0.0886	0.0085	0.0000	0.5723	0.0089			0.0007				0.0000	
PX 4-1 (6390)	0.0291	0.0819	0.0085	0.1063	0.0000	0.0268	0.0501	0.0169	0.0898	0.0096	0.0007	0.5423	0.0085			0.0007				0.0000	
PX 4-2 (6434)	0.0264	0.0819	0.0092	0.1079	0.0000	0.0279	0.0489	0.0170	0.0886	0.0100	0.0004	0.5433	0.0083			0.0007				0.0000	
PX 4-3 (6458)	0.0262	0.0824	0.0091	0.1082	0.0003	0.0272	0.0494	0.0173	0.0850	0.0101	0.0007	0.5454	0.0077			0.0010				0.0000	
PX 5-1 (6787)	0.0338	0.0823	0.0083	0.0970	0.0000	0.0230	0.0498	0.0172	0.0854	0.0114	0.0000	0.5548	0.0066			0.0010				0.0000	
PX 5-2 (6795)	0.0358	0.0798	0.0092	0.1124	0.0000	0.0286	0.0447	0.0155	0.1164	0.0135	0.0000	0.4998	0.0095			0.0009				0.0000	
PX 5-3 (6812)	0.0342	0.0801	0.0096	0.1197	0.0000	0.0333	0.0432	0.0149	0.1323	0.0131	0.0000	0.4761	0.0075			0.0009				0.0000	
PX 5-4 (6820)	0.0322	0.0795	0.0094	0.1138	0.0000	0.0329	0.0446	0.0151	0.1330	0.0129	0.0000	0.4838	0.0072			0.0009				0.0000	
PX 5-5 (6839)	0.0304	0.0775	0.0093	0.1092	0.0000	0.0330	0.0437	0.0152	0.1373	0.0123	0.0000	0.4881	0.0093			0.0009				0.0000	
PX 5-6 (6862)	0.0283	0.0806	0.0083	0.0955	0.0000	0.0287	0.0463	0.0157	0.1291	0.0116	0.0000	0.5166	0.0081			0.0007				0.0000	
PX 5-7 (6871)	0.0265	0.0839	0.0080	0.0914	0.0000	0.0278	0.0470	0.0159	0.1316	0.0104	0.0000	0.5201	0.0078			0.0007				0.0000	
PX 5-8 (6884)	0.0279	0.0948	0.0082	0.0948	0.0000	0.0303	0.0443	0.0152	0.1365	0.0120	0.0000	0.4971	0.0079			0.0007				0.0000	
PX 5-9 (6960)	0.0268	0.1087	0.0076	0.0916	0.0000	0.0294	0.0438	0.0145	0.1364	0.0112	0.0000	0.4928	0.0075			0.0007				0.0000	
PX 5-10 (6972)	0.0266	0.1095	0.0075	0.0872	0.0000	0.0279	0.0439	0.0145	0.1354	0.0111	0.0000	0.5000	0.0072			0.0007				0.0000	
PX 6-1 (7340)	0.0207	0.0863	0.0084	0.0991	0.0000	0.0281	0.0487	0.0159	0.1090	0.0114	0.0000	0.5336	0.0101			0.0007				0.0000	
BATCH 1 STUDY-6-	0.0256	0.1144	0.0053	0.0260	0.0163	0.0771	0.0467	0.0137	0.0912	0.0028	0.0002	0.5432	0.0016			0.0020				0.0000	
BATCH 1 STUDY-1(	0.0270	0.0990	0.0016	0.0278	0.0156	0.0421	0.0526	0.0160	0.0823	0.0026	0.0000	0.6038	0.0020			0.0015				0.0000	
BATCH 1 STUDY-1:	0.0256	0.0810	0.0056	0.0320	0.0112	0.0225	0.0563	0.0170	0.0723	0.0027	0.0000	0.6528	0.0019			0.0010				0.0000	
H-GLAS-0112	0.0407	0.0826	0.0133	0.0984	0.0000	0.0159	0.0462	0.0136	0.0938	0.0145	0.0007	0.5295	0.0062			0.0017				0.0000	
H-GLAS-0130	0.0386	0.0945	0.0126	0.0945	0.0006	0.0162	0.0471	0.0116	0.0887	0.0131	0.0009	0.5374	0.0062			0.0014				0.0000	
H-GLAS-0162	0.0324	0.1161	0.0078	0.0859	0.0002	0.0082	0.0479	0.0069	0.0799	0.0100	0.0009	0.5458	0.0261			0.0010				0.0000	
H-GLAS-0244	0.0435	0.0940	0.0100	0.1102	0.0004	0.0144	0.0453	0.0100	0.0928	0.0091	0.0007	0.5236	0.0133			0.0009				0.0000	
H-GLAS-0254	0.0319	0.1216	0.0068	0.0827	0.0000	0.0066	0.0486	0.0059	0.0769	0.0092	0.0011	0.5529	0.0283			0.0010				0.0000	
H-GLAS-0278	0.0322	0.1187	0.0057	0.0889	0.0000	0.0060	0.0472	0.0054	0.0763	0.0085	0.0009	0.5543	0.0293			0.0007				0.0000	
H-GLAS-0293	0.0292	0.1229	0.0056	0.0938	0.0006	0.0063	0.0480	0.0050	0.0813	0.0085	0.0011	0.5559	0.0158			0.0007				0.0000	
H-GLAS-0308	0.0310	0.1264	0.0058	0.0841	0.0002	0.0051	0.0503	0.0046	0.0791	0.0101	0.0011	0.5417	0.0323			0.0007				0.0000	
H-GLAS-0334	0.0306	0.1296	0.0052	0.0968	0.0000	0.0047	0.0492	0.0043	0.0805	0.0093	0.0009	0.5457	0.0175			0.0007				0.0000	
H-GLAS-0352	0.0290	0.1318	0.0047	0.0931	0.0000	0.0041	0.0494	0.0034	0.0791	0.0095	0.0009	0.5356	0.0353			0.0007				0.0000	
H-GLAS-0387	0.0283	0.1360	0.0040	0.0805	0.0000	0.0032	0.0499	0.0029	0.0764	0.0080	0.0009	0.5496	0.0371			0.0007				0.0000	
H-GLAS-0421	0.0303	0.1376	0.0043	0.0891	0.0000	0.0030	0.0508	0.0028	0.0797	0.0085	0.0009	0.5510	0.0191			0.0007				0.0000	
H-GLAS-0466	0.0285	0.1373	0.0039	0.0921	0.0000	0.0032	0.0502	0.0024	0.0789	0.0075	0.0009	0.5345	0.0379			0.0007				0.0000	
FRIT-202-CLEAR	0.0039	0.0776	0.0010	0.0000	0.0000	0.0012	0.0656	0.0189	0.0576	0.0000	0.0000	0.7654	0.0000			0.0000				0.0000	
FRIT-202-INT	0.0039	0.0776	0.0010	0.0000	0.0000	0.0012	0.0656	0.0189	0.0576	0.0000	0.0000	0.7654	0.0000			0.0000				0.0000	
FRIT-202-WHITE	0.0039	0.0776	0.0010	0.0000	0.0000	0.0012	0.0656	0.0189	0.0576	0.0000	0.0000	0.7654	0.0000			0.0000				0.0000	
FRIT-165-7	0.0000	0.0939	0.0000	0.0000	0.0000	0.0000	0.0701	0.0100	0.1224	0.0000	0.0000	0.6937	0.0099			0.0000				0.0000	
FRIT-131-7	0.0036	0.1511	0.0009	0.0005	0.0000	0.0019	0.0539	0.0178	0.1977	0.0010	0.0000	0.5473	0.0048			0.0000				0.0000	
MG 9-7	0.0020	0.0563	0.0925	0.0000	0.0000	0.0000	0.0000	0.0000	0.2597	0.0000	0.0000	0.5894	0.0000			0.0000				0.0000	
MG 18-7	0.0094	0.1610	0.0933	0.0000	0.0000	0.0000	0.0000	0.0000	0.2585	0.0000	0.0000	0.4779	0.0000			0.0000				0.0000	
MG 25-7	0.1296	0.1371	0.0301	0.0823	0.0116	0.0000	0.0000	0.0000	0.1547	0.0000	0.0000	0.4545	0.0000			0.0000				0.0000	
MG 28-7	0.1463	0.0923	0.0000	0.1119	0.0215	0.0000	0.0000	0.0000	0.1685	0.0000	0.0000	0.4594	0.0000			0.0000				0.0000	

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
PX 1-1 (4643)				0.0047	0.0000	0.0031							0.0000		0.0315		0.0000		0.0000	0.0017	
PX 1-2 (4726)				0.0054	0.0000	0.0032							0.0000		0.0322		0.0000		0.0000	0.0017	
PX 1-3 (4776)				0.0052	0.0000	0.0028							0.0000		0.0284		0.0000		0.0000	0.0017	
PX 2-1 (4455)				0.0040	0.0000	0.0016							0.0000		0.0281		0.0000		0.0000	0.0003	
PX 2-2 (4509)				0.0047	0.0000	0.0023							0.0000		0.0304		0.0000		0.0000	0.0010	
PX 2-3 (4566)				0.0047	0.0000	0.0028							0.0000		0.0326		0.0000		0.0000	0.0014	
PX 3-1 (5780)				0.0034	0.0000	0.0019							0.0000		0.0167		0.0000		0.0000	0.0004	
PX 3-2 (5818)				0.0034	0.0000	0.0019							0.0000		0.0168		0.0002		0.0000	0.0007	
PX 3-3 (5880)				0.0031	0.0000	0.0019							0.0000		0.0164		0.0000		0.0000	0.0007	
PX 4-1 (6390)				0.0036	0.0000	0.0029							0.0000		0.0173		0.0000		0.0000	0.0011	
PX 4-2 (6434)				0.0036	0.0000	0.0034							0.0000		0.0172		0.0000		0.0000	0.0010	
PX 4-3 (6458)				0.0038	0.0000	0.0035							0.0000		0.0172		0.0002		0.0000	0.0011	
PX 5-1 (6787)				0.0041	0.0004	0.0030							0.0000		0.0159		0.0000		0.0005	0.0014	
PX 5-2 (6795)				0.0037	0.0004	0.0039							0.0000		0.0180		0.0000		0.0016	0.0017	
PX 5-3 (6812)				0.0035	0.0009	0.0044							0.0000		0.0194		0.0000		0.0010	0.0014	
PX 5-4 (6820)				0.0042	0.0009	0.0043							0.0000		0.0185		0.0000		0.0010	0.0014	
PX 5-5 (6839)				0.0038	0.0004	0.0042							0.0000		0.0185		0.0000		0.0010	0.0014	
PX 5-6 (6862)				0.0043	0.0004	0.0036							0.0000		0.0163		0.0000		0.0011	0.0011	
PX 5-7 (6871)				0.0034	0.0004	0.0036							0.0000		0.0158		0.0000		0.0011	0.0011	
PX 5-8 (6884)				0.0050	0.0004	0.0037							0.0000		0.0161		0.0000		0.0005	0.0010	
PX 5-9 (6960)				0.0040	0.0004	0.0036							0.0000		0.0154		0.0000		0.0011	0.0010	
PX 5-10 (6972)				0.0045	0.0004	0.0035							0.0000		0.0149		0.0000		0.0011	0.0011	
PX 6-1 (7340)				0.0038	0.0000	0.0028							0.0000		0.0172		0.0002		0.0000	0.0014	
BATCH 1 STUDY-6-7				0.0005	0.0018	0.0078							0.0000		0.0076		0.0000		0.0000	0.0004	
BATCH 1 STUDY-10B-7				0.0005	0.0014	0.0035							0.0000		0.0074		0.0000		0.0022	0.0000	
BATCH 1 STUDY-15-7				0.0003	0.0005	0.0021							0.0000		0.0072		0.0000		0.0022	0.0000	
H-GLAS-0112				0.0045	0.0000	0.0026							0.0005		0.0255		0.0002		0.0000	0.0021	
H-GLAS-0130				0.0043	0.0000	0.0022							0.0000		0.0214		0.0007		0.0000	0.0021	
H-GLAS-0162				0.0043	0.0000	0.0014							0.0025		0.0129		0.0011		0.0000	0.0017	
H-GLAS-0244				0.0037	0.0000	0.0017							0.0010		0.0179		0.0007		0.0000	0.0017	
H-GLAS-0254				0.0038	0.0000	0.0011							0.0025		0.0113		0.0011		0.0000	0.0017	
H-GLAS-0278				0.0038	0.0000	0.0012							0.0025		0.0099		0.0013		0.0000	0.0017	
H-GLAS-0293				0.0038	0.0000	0.0010							0.0025		0.0100		0.0013		0.0000	0.0017	
H-GLAS-0308				0.0052	0.0000	0.0010							0.0025		0.0097		0.0016		0.0000	0.0017	
H-GLAS-0334				0.0045	0.0000	0.0007							0.0025		0.0091		0.0016		0.0000	0.0017	
H-GLAS-0352				0.0040	0.0000	0.0007							0.0025		0.0079		0.0016		0.0000	0.0017	
H-GLAS-0387				0.0040	0.0000	0.0006							0.0020		0.0070		0.0016		0.0000	0.0017	
H-GLAS-0421				0.0045	0.0000	0.0006							0.0020		0.0070		0.0016		0.0000	0.0017	
H-GLAS-0466				0.0038	0.0000	0.0007							0.0025		0.0066		0.0018		0.0000	0.0021	
FRIT-202-CLEAR				0.0000	0.0089	0.0000							0.0000		0.0000		0.0000		0.0000	0.0000	
FRIT-202-INT				0.0000	0.0089	0.0000							0.0000		0.0000		0.0000		0.0000	0.0000	
FRIT-202-WHITE				0.0000	0.0089	0.0000							0.0000		0.0000		0.0000		0.0000	0.0000	
FRIT-165-7				0.0000	0.0000	0.0000							0.0000		0.0000		0.0000		0.0000	0.0000	
FRIT-131-7				0.0000	0.0000	0.0000							0.0000		0.0015		0.0000		0.0052	0.0000	
MG 9-7				0.0000	0.0000	0.0000							0.0000		0.0000		0.0000		0.0000	0.0000	
MG 18-7				0.0000	0.0000	0.0000							0.0000		0.0000		0.0000		0.0000	0.0000	
MG 25-7				0.0000	0.0000	0.0000							0.0000		0.0000		0.0000		0.0000	0.0000	
MG 28-7				0.0000	0.0000	0.0000							0.0000		0.0000		0.0000		0.0000	0.0000	

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
PX 1-1 (4643)																	0.0003				0.0017
PX 1-2 (4726)																	0.0003				0.0037
PX 1-3 (4776)																	0.0002				0.0036
PX 2-1 (4455)																	0.0014				0.0010
PX 2-2 (4509)																	0.0008				0.0017
PX 2-3 (4566)																	0.0005				0.0022
PX 3-1 (5780)																	0.0005				0.0023
PX 3-2 (5818)																	0.0005				0.0023
PX 3-3 (5880)																	0.0003				0.0020
PX 4-1 (6390)																	0.0002				0.0026
PX 4-2 (6434)																	0.0002				0.0028
PX 4-3 (6458)																	0.0002				0.0029
PX 5-1 (6787)																	0.0002				0.0029
PX 5-2 (6795)																	0.0003				0.0030
PX 5-3 (6812)																	0.0003				0.0031
PX 5-4 (6820)																	0.0003				0.0028
PX 5-5 (6839)																	0.0003				0.0028
PX 5-6 (6862)																	0.0002				0.0025
PX 5-7 (6871)																	0.0002				0.0024
PX 5-8 (6884)																	0.0002				0.0024
PX 5-9 (6960)																	0.0002				0.0022
PX 5-10 (6972)																	0.0000				0.0021
PX 6-1 (7340)																	0.0000				0.0015
BATCH 1 STUDY-6-7																	0.0002				0.0153
BATCH 1 STUDY-10B-7																	0.0000				0.0104
BATCH 1 STUDY-15-7																	0.0000				0.0052
H-GLAS-0112																	0.0003				0.0039
H-GLAS-0130																	0.0003				0.0028
H-GLAS-0162																	0.0003				0.0021
H-GLAS-0244																	0.0003				0.0020
H-GLAS-0254																	0.0003				0.0019
H-GLAS-0278																	0.0003				0.0017
H-GLAS-0293																	0.0003				0.0017
H-GLAS-0308																	0.0003				0.0017
H-GLAS-0334																	0.0003				0.0016
H-GLAS-0352																	0.0003				0.0016
H-GLAS-0387																	0.0003				0.0015
H-GLAS-0421																	0.0003				0.0015
H-GLAS-0466																	0.0003				0.0016
FRIT-202-CLEAR																	0.0000				0.0000
FRIT-202-INT																	0.0000				0.0000
FRIT-202-WHITE																	0.0000				0.0000
FRIT-165-7																	0.0000				0.0000
FRIT-131-7																	0.0000				0.0099
MG 9-7																	0.0000				0.0000
MG 18-7																	0.0000				0.0000
MG 25-7																	0.0000				0.0000
MG 28-7																	0.0000				0.0000

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
PX 1-1 (4643)							0.0000	0.0016		1.0000	0.0523	0.0729	0.0146	0.1051		0.0288	0.0428	0.0146	0.0973	0.0159	
PX 1-2 (4726)							0.0000	0.0017		1.0000	0.0496	0.0736	0.0150	0.1117		0.0303	0.0434	0.0144	0.1002	0.0171	
PX 1-3 (4776)							0.0000	0.0016		1.0000	0.0434	0.0725	0.0133	0.0996		0.0277	0.0449	0.0147	0.0955	0.0157	
PX 2-1 (4455)							0.0000	0.0010		1.0000	0.0852	0.0687	0.0079	0.0952		0.0215	0.0433	0.0159	0.1045	0.0064	
PX 2-2 (4509)							0.0000	0.0014		1.0000	0.0697	0.0719	0.0114	0.1099		0.0248	0.0432	0.0156	0.0955	0.0118	
PX 2-3 (4566)							0.0000	0.0015		1.0000	0.0599	0.0740	0.0145	0.1090		0.0302	0.0429	0.0151	0.0984	0.0151	
PX 3-1 (5780)							0.0000	0.0010		1.0000	0.0423	0.0821	0.0068	0.0908		0.0241	0.0480	0.0143	0.0881	0.0074	
PX 3-2 (5818)							0.0000	0.0012		1.0000	0.0392	0.0806	0.0074	0.0999		0.0232	0.0486	0.0149	0.0856	0.0081	0.0003
PX 3-3 (5880)							0.0000	0.0013		1.0000	0.0294	0.0690	0.0069	0.0938		0.0216	0.0449	0.0141	0.0840	0.0080	
PX 4-1 (6390)							0.0000	0.0013		1.0000	0.0281	0.0789	0.0081	0.1026		0.0259	0.0483	0.0163	0.0866	0.0092	0.0007
PX 4-2 (6434)							0.0000	0.0013		1.0000	0.0257	0.0801	0.0090	0.1055		0.0274	0.0478	0.0166	0.0867	0.0097	0.0005
PX 4-3 (6458)							0.0000	0.0013		1.0000	0.0256	0.0807	0.0088	0.1057	0.0003	0.0266	0.0483	0.0169	0.0831	0.0099	0.0007
PX 5-1 (6787)							0.0000	0.0009		1.0000	0.0331	0.0807	0.0082	0.0951		0.0226	0.0488	0.0169	0.0838	0.0112	
PX 5-2 (6795)							0.0000	0.0011		1.0000	0.0347	0.0774	0.0090	0.1090		0.0278	0.0434	0.0150	0.1129	0.0131	
PX 5-3 (6812)							0.0000	0.0011		1.0000	0.0326	0.0764	0.0092	0.1263		0.0318	0.0412	0.0143	0.1143	0.0125	
PX 5-4 (6820)							0.0000	0.0011		1.0000	0.0305	0.0755	0.0089	0.1078		0.0313	0.0423	0.0143	0.1262	0.0121	
PX 5-5 (6839)							0.0000	0.0011		1.0000	0.0299	0.0762	0.0091	0.1073		0.0325	0.0430	0.0150	0.1351	0.0121	
PX 5-6 (6862)							0.0000	0.0010		1.0000	0.0277	0.0789	0.0081	0.0935		0.0280	0.0453	0.0154	0.1263	0.0114	
PX 5-7 (6871)							0.0000	0.0009		1.0000	0.0258	0.0815	0.0078	0.0887		0.0270	0.0457	0.0155	0.1278	0.0101	
PX 5-8 (6884)							0.0000	0.0009		1.0000	0.0274	0.0935	0.0081	0.0934		0.0299	0.0437	0.0149	0.1346	0.0119	
PX 5-9 (6960)							0.0000	0.0009		1.0000	0.0262	0.1064	0.0075	0.0896		0.0288	0.0429	0.0142	0.1335	0.0110	
PX 5-10 (6972)							0.0000	0.0009		1.0000	0.0262	0.1080	0.0074	0.0859		0.0275	0.0433	0.0143	0.1335	0.0110	
PX 6-1 (7340)							0.0000	0.0010		1.0000	0.0207	0.0861	0.0084	0.0988		0.0279	0.0486	0.0158	0.1086	0.0114	
BATCH 1 STUDY-6-7							0.0000	0.0003		1.0000	0.0613	0.0796	0.0152	0.1012	0.0372	0.0481	0.0366	0.0122	0.0952	0.0084	0.0003
BATCH 1 STUDY-10B-7							0.0000	0.0005		1.0000	0.0265	0.0970	0.0055	0.0120	0.0247	0.0413	0.0515	0.0157	0.0805	0.0025	0.0001
BATCH 1 STUDY-15-7							0.0000	0.0005		1.0000	0.0254	0.0803	0.0056	0.0269	0.0257	0.0223	0.0558	0.0168	0.0717	0.0027	0.0002
H-GLAS-0112							0.0000	0.0033		1.0000	0.0392	0.0793	0.0128	0.0946		0.0153	0.0444	0.0131	0.0902	0.0139	0.0006
H-GLAS-0130							0.0000	0.0028		1.0000	0.0372	0.0909	0.0120	0.0908	0.0006	0.0156	0.0453	0.0111	0.0852	0.0126	0.0008
H-GLAS-0162							0.0000	0.0044		1.0000	0.0308	0.1104	0.0074	0.0818	0.0003	0.0078	0.0456	0.0065	0.0761	0.0095	0.0009
H-GLAS-0244							0.0000	0.0029		1.0000	0.0417	0.0907	0.0096	0.1057	0.0004	0.0138	0.0436	0.0096	0.0890	0.0088	0.0007
H-GLAS-0254							0.0000	0.0027		1.0000	0.0311	0.1182	0.0067	0.0803		0.0064	0.0473	0.0058	0.0746	0.0090	0.0011
H-GLAS-0278							0.0000	0.0033		1.0000	0.0306	0.1132	0.0054	0.0845		0.0057	0.0450	0.0052	0.0726	0.0081	0.0008
H-GLAS-0293							0.0000	0.0028		1.0000	0.0271	0.1143	0.0052	0.0874	0.0005	0.0059	0.0446	0.0047	0.0756	0.0079	0.0011
H-GLAS-0308							0.0000	0.0034		1.0000	0.0299	0.1218	0.0055	0.0811	0.0002	0.0050	0.0485	0.0045	0.0762	0.0097	0.0010
H-GLAS-0334							0.0000	0.0030		1.0000	0.0293	0.1241	0.0049	0.0925		0.0045	0.0471	0.0041	0.0771	0.0089	0.0009
H-GLAS-0352							0.0000	0.0030		1.0000	0.0281	0.1265	0.0048	0.0854		0.0039	0.0473	0.0036	0.0761	0.0087	0.0010
H-GLAS-0387							0.0000	0.0034		1.0000	0.0270	0.1304	0.0036	0.0762		0.0029	0.0477	0.0028	0.0724	0.0075	0.0007
H-GLAS-0421							0.0000	0.0028		1.0000	0.0282	0.1314	0.0041	0.0794		0.0027	0.0483	0.0027	0.0777	0.0081	0.0006
H-GLAS-0466							0.0000	0.0026		1.0000	0.0275	0.1328	0.0037	0.0891		0.0031	0.0486	0.0023	0.0763	0.0073	0.0008
FRIT-202-CLEAR							0.0000	0.0000		1.0000	0.0040	0.0781	0.0010			0.0030	0.0660	0.0190	0.0580		
FRIT-202-INT							0.0000	0.0000		1.0000											
FRIT-202-WHITE							0.0000	0.0000		1.0000											
FRIT-165-7							0.0000	0.0000		1.0000		0.0932					0.0696	0.0099	0.1216		
FRIT-131-7							0.0029	0.0000		1.0000	0.0035	0.1437	0.0008	0.0006		0.0018	0.0512	0.0169	0.1880	0.0010	
MG 9-7							0.0000	0.0000		1.0000											
MG 18-7							0.0000	0.0000		1.0000											
MG 25-7							0.0000	0.0000		1.0000											
MG 28-7							0.0000	0.0000		1.0000											

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
PX 1-1 (4643)	0.4914	0.0008			0.0019									0.0046		0.0016					
PX 1-2 (4726)	0.5058	0.0007			0.0020									0.0055		0.0032					
PX 1-3 (4776)	0.5242	0.0008			0.0018									0.0052		0.0028					
PX 2-1 (4455)	0.5186	0.0006			0.0009									0.0039		0.0015					
PX 2-2 (4509)	0.5020	0.0006			0.0014									0.0045		0.0022					
PX 2-3 (4566)	0.4886	0.0007			0.0018									0.0046		0.0027					
PX 3-1 (5780)	0.5969	0.0073			0.0006									0.0035		0.0016					
PX 3-2 (5818)	0.6040	0.0072			0.0007									0.0036		0.0020					
PX 3-3 (5880)	0.5425	0.0085			0.0006									0.0029		0.0018					
PX 4-1 (6390)	0.5229	0.0082			0.0008									0.0035		0.0028					
PX 4-2 (6434)	0.5314	0.0081			0.0008									0.0035		0.0032					
PX 4-3 (6458)	0.5336	0.0077			0.0008									0.0038		0.0034					
PX 5-1 (6787)	0.5439	0.0066			0.0009									0.0040	0.0005	0.0028					
PX 5-2 (6795)	0.4847	0.0092			0.0009									0.0036	0.0005	0.0036					
PX 5-3 (6812)	0.4542	0.0071			0.0009									0.0033	0.0007	0.0039					
PX 5-4 (6820)	0.4585	0.0069			0.0009									0.0039	0.0006	0.0039					
PX 5-5 (6839)	0.4797	0.0092			0.0008									0.0038	0.0006	0.0039					
PX 5-6 (6862)	0.5051	0.0079			0.0007									0.0042	0.0006	0.0034					
PX 5-7 (6871)	0.5051	0.0076			0.0007									0.0033	0.0006	0.0034					
PX 5-8 (6884)	0.4900	0.0079			0.0007									0.0050	0.0006	0.0036					
PX 5-9 (6960)	0.4820	0.0073			0.0007									0.0041	0.0006	0.0034					
PX 5-10 (6972)	0.4927	0.0071			0.0006									0.0044	0.0006	0.0032					
PX 6-1 (7340)	0.5319	0.0101			0.0008									0.0040		0.0026					
BATCH 1 STUDY-6-	0.4353	0.0048			0.0020									0.0004	0.0012	0.0049					
BATCH 1 STUDY-1(	0.5910	0.0020			0.0015									0.0004	0.0012	0.0032					
BATCH 1 STUDY-1:	0.6468	0.0018			0.0009									0.0004	0.0005	0.0021					
H-GLAS-0112	0.5091	0.0060			0.0016									0.0043		0.0026					
H-GLAS-0130	0.5165	0.0060			0.0014									0.0041		0.0022					
H-GLAS-0162	0.5195	0.0248			0.0009									0.0041		0.0013					
H-GLAS-0244	0.5038	0.0129			0.0010									0.0036		0.0008					
H-GLAS-0254	0.5377	0.0275			0.0008									0.0038		0.0007					
H-GLAS-0278	0.5273	0.0279			0.0008									0.0035		0.0010					
H-GLAS-0293	0.5168	0.0148			0.0007									0.0036		0.0009					
H-GLAS-0308	0.5217	0.0312			0.0007									0.0049		0.0009					
H-GLAS-0334	0.5223	0.0167			0.0007									0.0043		0.0008					
H-GLAS-0352	0.5173	0.0338			0.0006									0.0038		0.0007					
H-GLAS-0387	0.5220	0.0352			0.0006									0.0039		0.0007					
H-GLAS-0421	0.5239	0.0366			0.0006									0.0045		0.0007					
H-GLAS-0466	0.5171	0.0367			0.0006									0.0036		0.0007					
FRIT-202-CLEAR	0.7704																				
FRIT-202-INT																					
FRIT-202-WHITE																					
FRIT-165-7	0.6889	0.0099																			
FRIT-131-7	0.5206	0.0046																			
MG 9-7																					
MG 18-7																					
MG 25-7																					
MG 28-7																					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
PX 1-1 (4643)				0.0310					0.0017												
PX 1-2 (4726)				0.0326					0.0019												
PX 1-3 (4776)				0.0284					0.0016												
PX 2-1 (4455)				0.0284					0.0003												
PX 2-2 (4509)				0.0304					0.0011												
PX 2-3 (4566)				0.0324					0.0015												
PX 3-1 (5780)				0.0173		0.0001			0.0005												
PX 3-2 (5818)		0.0001		0.0175		0.0001			0.0007												
PX 3-3 (5880)				0.0156		0.0001			0.0007												
PX 4-1 (6390)				0.0166		0.0001			0.0010												
PX 4-2 (6434)				0.0168		0.0001			0.0011												
PX 4-3 (6458)				0.0169		0.0001			0.0011												
PX 5-1 (6787)				0.0156				0.0010	0.0013												
PX 5-2 (6795)				0.0175				0.0013	0.0015												
PX 5-3 (6812)				0.0185				0.0010	0.0014												
PX 5-4 (6820)				0.0175				0.0009	0.0014												
PX 5-5 (6839)				0.0182				0.0006	0.0014												
PX 5-6 (6862)				0.0158				0.0007	0.0012												
PX 5-7 (6871)				0.0153				0.0009	0.0012												
PX 5-8 (6884)				0.0159				0.0007	0.0012												
PX 5-9 (6960)				0.0151				0.0005	0.0011												
PX 5-10 (6972)				0.0147				0.0005	0.0011												
PX 6-1 (7340)		0.0001		0.0171		0.0002			0.0014												
BATCH 1 STUDY-6-7				0.0236				0.0067	0.0013												
BATCH 1 STUDY-10B-7				0.0072				0.0022	0.0004												
BATCH 1 STUDY-15-7				0.0072				0.0022	0.0004												
H-GLAS-0112		0.0004		0.0244		0.0003			0.0020												
H-GLAS-0130				0.0206		0.0006			0.0021												
H-GLAS-0162		0.0022		0.0124		0.0011			0.0018												
H-GLAS-0244		0.0011		0.0171		0.0006			0.0016												
H-GLAS-0254		0.0025		0.0110		0.0012			0.0017												
H-GLAS-0278		0.0024		0.0095		0.0012			0.0017												
H-GLAS-0293		0.0025		0.0093		0.0012			0.0016												
H-GLAS-0308		0.0025		0.0094		0.0014			0.0017												
H-GLAS-0334		0.0024		0.0087		0.0015			0.0016												
H-GLAS-0352		0.0023		0.0078		0.0015			0.0017												
H-GLAS-0387		0.0021		0.0066		0.0015			0.0015												
H-GLAS-0421		0.0021		0.0066		0.0016			0.0017												
H-GLAS-0466		0.0022		0.0063		0.0016			0.0020												
FRIT-202-CLEAR																					
FRIT-202-INT																					
FRIT-202-WHITE																					
FRIT-165-7																					
FRIT-131-7				0.0013		0.0027		0.0050													
MG 9-7																					
MG 18-7																					
MG 25-7																					
MG 28-7																					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
PX 1-1 (4643)						0.0003				0.0017								0.0016		0.9809
PX 1-2 (4726)						0.0003				0.0037								0.0017		1.0127
PX 1-3 (4776)						0.0002				0.0035								0.0017		0.9975
PX 2-1 (4455)						0.0014				0.0010								0.0010		1.0062
PX 2-2 (4509)						0.0008				0.0017								0.0013		0.9998
PX 2-3 (4566)						0.0005				0.0022								0.0015		0.9956
PX 3-1 (5780)						0.0005				0.0024								0.0011		1.0357
PX 3-2 (5818)						0.0004				0.0024								0.0012		1.0477
PX 3-3 (5880)						0.0002				0.0019								0.0013		0.9478
PX 4-1 (6390)						0.0002				0.0025								0.0012		0.9645
PX 4-2 (6434)						0.0002				0.0027								0.0012		0.9781
PX 4-3 (6458)						0.0002				0.0028								0.0012		0.9782
PX 5-1 (6787)						0.0002				0.0028								0.0009		0.9809
PX 5-2 (6795)						0.0002				0.0029								0.0011		0.9693
PX 5-3 (6812)						0.0002				0.0029								0.0011		0.9538
PX 5-4 (6820)						0.0002				0.0027								0.0011		0.9474
PX 5-5 (6839)						0.0002				0.0027								0.0011		0.9824
PX 5-6 (6862)						0.0001				0.0025								0.0010		0.9778
PX 5-7 (6871)						0.0001				0.0023								0.0009		0.9713
PX 5-8 (6884)						0.0001				0.0024								0.0009		0.9864
PX 5-9 (6960)						0.0001				0.0022								0.0009		0.9781
PX 5-10 (6972)						0.0001				0.0021								0.0009		0.9851
PX 6-1 (7340)										0.0016								0.0010		0.9971
BATCH 1 STUDY-6-7						0.0003				0.0099							0.0001	0.0003		0.9861
BATCH 1 STUDY-10B-7						0.0001				0.0101								0.0003		0.9769
BATCH 1 STUDY-15-7						0.0001				0.0051								0.0005		1.0014
H-GLAS-0112						0.0003				0.0037								0.0032		0.9613
H-GLAS-0130						0.0004				0.0026								0.0027		0.9613
H-GLAS-0162						0.0003				0.0020								0.0042		0.9517
H-GLAS-0244						0.0004				0.0019								0.0028		0.9612
H-GLAS-0254						0.0003				0.0018								0.0026		0.9721
H-GLAS-0278						0.0003				0.0017								0.0032		0.9516
H-GLAS-0293						0.0003				0.0016								0.0026		0.9302
H-GLAS-0308						0.0003				0.0016								0.0033		0.9630
H-GLAS-0334						0.0003				0.0016								0.0027		0.9570
H-GLAS-0352						0.0003				0.0016								0.0029		0.9597
H-GLAS-0387						0.0003				0.0014								0.0033		0.9503
H-GLAS-0421						0.0003				0.0014								0.0029		0.9661
H-GLAS-0466						0.0004				0.0015								0.0026		0.9668
FRIT-202-CLEAR										0.0010										1.0005
FRIT-202-INT																				
FRIT-202-WHITE																				
FRIT-165-7																				0.9931
FRIT-131-7										0.0095										0.9512
MG 9-7																				
MG 18-7																				
MG 25-7																				
MG 28-7																				

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
PX 1-1 (4643)								
PX 1-2 (4726)								
PX 1-3 (4776)								
PX 2-1 (4455)								
PX 2-2 (4509)								
PX 2-3 (4566)								
PX 3-1 (5780)								
PX 3-2 (5818)								
PX 3-3 (5880)								
PX 4-1 (6390)								
PX 4-2 (6434)								
PX 4-3 (6458)								
PX 5-1 (6787)								
PX 5-2 (6795)								
PX 5-3 (6812)								
PX 5-4 (6820)								
PX 5-5 (6839)								
PX 5-6 (6862)								
PX 5-7 (6871)								
PX 5-8 (6884)								
PX 5-9 (6960)								
PX 5-10 (6972)								
PX 6-1 (7340)								
BATCH 1 STUDY-6-7								
BATCH 1 STUDY-10B-7								
BATCH 1 STUDY-15-7								
H-GLAS-0112								
H-GLAS-0130								
H-GLAS-0162								
H-GLAS-0244								
H-GLAS-0254								
H-GLAS-0278								
H-GLAS-0293								
H-GLAS-0308								
H-GLAS-0334								
H-GLAS-0352								
H-GLAS-0387								
H-GLAS-0421								
H-GLAS-0466								
FRIT-202-CLEAR								
FRIT-202-INT								
FRIT-202-WHITE								
FRIT-165-7								
FRIT-131-7								
MG 9-7								
MG 18-7								
MG 25-7								
MG 28-7								

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
PX 1-1 (4643)					
PX 1-2 (4726)					
PX 1-3 (4776)					
PX 2-1 (4455)					
PX 2-2 (4509)					
PX 2-3 (4566)					
PX 3-1 (5780)					
PX 3-2 (5818)					
PX 3-3 (5880)					
PX 4-1 (6390)					
PX 4-2 (6434)					
PX 4-3 (6458)					
PX 5-1 (6787)					
PX 5-2 (6795)					
PX 5-3 (6812)					
PX 5-4 (6820)					
PX 5-5 (6839)					
PX 5-6 (6862)					
PX 5-7 (6871)					
PX 5-8 (6884)					
PX 5-9 (6960)					
PX 5-10 (6972)					
PX 6-1 (7340)					
BATCH 1 STUDY-6-7					
BATCH 1 STUDY-10B-7					
BATCH 1 STUDY-15-7					
H-GLAS-0112					
H-GLAS-0130					
H-GLAS-0162					
H-GLAS-0244					
H-GLAS-0254					
H-GLAS-0278					
H-GLAS-0293					
H-GLAS-0308					
H-GLAS-0334					
H-GLAS-0352					
H-GLAS-0387					
H-GLAS-0421					
H-GLAS-0466					
FRIT-202-CLEAR					
FRIT-202-INT					
FRIT-202-WHITE					
FRIT-165-7					
FRIT-131-7					
MG 9-7					
MG 18-7					
MG 25-7					
MG 28-7					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
PX 1-1 (4643)															
PX 1-2 (4726)															
PX 1-3 (4776)															
PX 2-1 (4455)															
PX 2-2 (4509)															
PX 2-3 (4566)															
PX 3-1 (5780)															
PX 3-2 (5818)															
PX 3-3 (5880)															
PX 4-1 (6390)															
PX 4-2 (6434)															
PX 4-3 (6458)															
PX 5-1 (6787)															
PX 5-2 (6795)															
PX 5-3 (6812)															
PX 5-4 (6820)															
PX 5-5 (6839)															
PX 5-6 (6862)															
PX 5-7 (6871)															
PX 5-8 (6884)															
PX 5-9 (6960)															
PX 5-10 (6972)															
PX 6-1 (7340)															
BATCH 1 STUDY-6-7															
BATCH 1 STUDY-10B-7															
BATCH 1 STUDY-15-7															
H-GLAS-0112															
H-GLAS-0130															
H-GLAS-0162															
H-GLAS-0244															
H-GLAS-0254															
H-GLAS-0278															
H-GLAS-0293															
H-GLAS-0308															
H-GLAS-0334															
H-GLAS-0352															
H-GLAS-0387															
H-GLAS-0421															
H-GLAS-0466															
FRIT-202-CLEAR															
FRIT-202-INT															
FRIT-202-WHITE															
FRIT-165-7															
FRIT-131-7															
MG 9-7															
MG 18-7															
MG 25-7															
MG 28-7															

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
PX 1-1 (4643)																					
PX 1-2 (4726)																					
PX 1-3 (4776)																					
PX 2-1 (4455)																					
PX 2-2 (4509)																					
PX 2-3 (4566)																					
PX 3-1 (5780)																					
PX 3-2 (5818)																					
PX 3-3 (5880)																					
PX 4-1 (6390)																					
PX 4-2 (6434)																					
PX 4-3 (6458)																					
PX 5-1 (6787)																					
PX 5-2 (6795)																					
PX 5-3 (6812)																					
PX 5-4 (6820)																					
PX 5-5 (6839)																					
PX 5-6 (6862)																					
PX 5-7 (6871)																					
PX 5-8 (6884)																					
PX 5-9 (6960)																					
PX 5-10 (6972)																					
PX 6-1 (7340)																					
BATCH 1 STUDY-6-7																					
BATCH 1 STUDY-10B-7																					
BATCH 1 STUDY-15-7																					
H-GLAS-0112																					
H-GLAS-0130																					
H-GLAS-0162																					
H-GLAS-0244																					
H-GLAS-0254																					
H-GLAS-0278																					
H-GLAS-0293																					
H-GLAS-0308																					
H-GLAS-0334																					
H-GLAS-0352																					
H-GLAS-0387																					
H-GLAS-0421																					
H-GLAS-0466																					
FRIT-202-CLEAR																					
FRIT-202-INT																					
FRIT-202-WHITE																					
FRIT-165-7																					
FRIT-131-7																					
MG 9-7																					
MG 18-7																					
MG 25-7																					
MG 28-7																					

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
PX 1-1 (4643)					0.36	0.39	0.365	0.210	9.46							
PX 1-2 (4726)					0.355	0.38	0.36	0.215	9.36							
PX 1-3 (4776)					0.395	0.415	0.385	0.230	9.38							
PX 2-1 (4455)					0.24	0.285	0.24	0.165	9.32							
PX 2-2 (4509)					0.29	0.325	0.305	0.185	9.35							
PX 2-3 (4566)					0.365	0.39	0.365	0.205	9.49							
PX 3-1 (5780)					0.42	0.41	0.335	0.210	9.68							
PX 3-2 (5818)					0.54	0.505	0.425	0.245	9.7							
PX 3-3 (5880)					0.675	0.605	0.52	0.315	9.62							
PX 4-1 (6390)					1.135	0.985	0.92	0.465	10.05							
PX 4-2 (6434)					2.27	1.815	1.8	0.780	10.52							
PX 4-3 (6458)					2.185	1.745	1.825	0.765	10.42							
PX 5-1 (6787)					0.535	0.525	0.53	0.250	10.36							
PX 5-2 (6795)					4.58	3.095	4.085	0.995	11.61							
PX 5-3 (6812)					9.6	5.305	8.235	1.965	12.04							
PX 5-4 (6820)					10.5	5.645	8.94	2.225	12.01							
PX 5-5 (6839)					10.515	5.7	8.485	2.330	11.99							
PX 5-6 (6862)					9.485	5.405	7.56	2.285	11.84							
PX 5-7 (6871)					9.29	5.21	7.215	2.315	11.84							
PX 5-8 (6884)					10.79	5.9	8.575	2.350	11.87							
PX 5-9 (6960)					8.57	4.79	6.85	2.195	11.78							
PX 5-10 (6972)					10.95	4.745	8.685	1.615	11.73							
PX 6-1 (7340)					7.56	4.805	8.415	1.950	11.65							
BATCH 1 STUDY-6-7					8.595	6.81	7.725	2.270	11.34							
BATCH 1 STUDY-10B-7					5.265	4.495	4.765	1.565	10.9							
BATCH 1 STUDY-15-7					0.83	0.76	0.71	0.360	10.35							
H-GLAS-0112					0.44	0.415	0.375	0.220	9.83							
H-GLAS-0130					0.58	0.515	0.46	0.245	9.63							
H-GLAS-0162					1.005	0.835	0.69	0.320	9.69							
H-GLAS-0244					1.475	1.085	0.69	0.365	9.89							
H-GLAS-0254					1.05	0.91	0.715	0.320	9.79							
H-GLAS-0278					1.25	1.06	0.77	0.350	9.82							
H-GLAS-0293					1.54	1.29	0.925	0.380	9.84							
H-GLAS-0308					1.01	0.865	0.66	0.300	9.73							
H-GLAS-0334					1.205	1.075	0.775	0.325	9.76							
H-GLAS-0352					1.33	1.18	0.835	0.340	9.62							
H-GLAS-0387					1.29	1.155	0.785	0.330	9.67							
H-GLAS-0421					1.14	1.04	0.685	0.305	9.62							
H-GLAS-0466					1.395	1.205	0.83	0.330	9.69							
FRIT-202-CLEAR					15.98	14.445	15.19	5.755								
FRIT-202-INT					21.95	18.635	19.54	10.485								
FRIT-202-WHITE					31.535	29.13	28.72	1.055								
FRIT-165-7					40.16	42.155	37.08	30.515								
FRIT-131-7					25.15	24.3	21.565	14.830								
MG 9-7					35.12		28.21	17.005	12.63							
MG 18-7					28.91		23.885	8.340	12.01							
MG 25-7					0.415		0.395	0.120	10.05							
MG 28-7					0.315		0.36	0.160	10.65							

DWPF PCT Model (Jantzen et al. 1995)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
PX 1-1 (4643)												
PX 1-2 (4726)												
PX 1-3 (4776)												
PX 2-1 (4455)												
PX 2-2 (4509)												
PX 2-3 (4566)												
PX 3-1 (5780)												
PX 3-2 (5818)												
PX 3-3 (5880)												
PX 4-1 (6390)												
PX 4-2 (6434)												
PX 4-3 (6458)												
PX 5-1 (6787)												
PX 5-2 (6795)												
PX 5-3 (6812)												
PX 5-4 (6820)												
PX 5-5 (6839)												
PX 5-6 (6862)												
PX 5-7 (6871)												
PX 5-8 (6884)												
PX 5-9 (6960)												
PX 5-10 (6972)												
PX 6-1 (7340)												
BATCH 1 STUDY-6-7												
BATCH 1 STUDY-10B-7												
BATCH 1 STUDY-15-7												
H-GLAS-0112												
H-GLAS-0130												
H-GLAS-0162												
H-GLAS-0244												
H-GLAS-0254												
H-GLAS-0278												
H-GLAS-0293												
H-GLAS-0308												
H-GLAS-0334												
H-GLAS-0352												
H-GLAS-0387												
H-GLAS-0421												
H-GLAS-0466												
FRIT-202-CLEAR												
FRIT-202-INT												
FRIT-202-WHITE												
FRIT-165-7												
FRIT-131-7												
MG 9-7												
MG 18-7												
MG 25-7												
MG 28-7												

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
PBG3/Ce	0.0500	0.0600	0.0490	0.0160		0.0300	0.0400	0.0200	0.1000	0.0050	0.0030	0.4500	0.0300			0.0022					0.0450
PBG3/0x	0.0500	0.0600	0.0490	0.0160		0.0300	0.0400	0.0200	0.1000	0.0050	0.0030	0.4500	0.0300			0.0022					0.0450
PBG3-.5C	0.0500	0.0600	0.0490	0.0160		0.0300	0.0400	0.0200	0.1000	0.0050	0.0030	0.4500	0.0300			0.0022					0.0450
SRC-Al-1	0.0000	0.0632	0.0516	0.0168		0.0316	0.0421	0.0211	0.1053	0.0053	0.0032	0.4737	0.0316			0.0023					0.0474
SRC-Al-2	0.1000	0.0568	0.0464	0.0152		0.0284	0.0379	0.0189	0.0947	0.0047	0.0028	0.4263	0.0284			0.0021					0.0426
SRC-B-1	0.0532	0.0000	0.0521	0.0170		0.0319	0.0426	0.0213	0.1064	0.0053	0.0032	0.4787	0.0319			0.0023					0.0479
SRC-B-2	0.0511	0.0400	0.0500	0.0163		0.0306	0.0409	0.0204	0.1021	0.0051	0.0031	0.4596	0.0306			0.0022					0.0460
SRC-B-3	0.0468	0.1200	0.0459	0.0150		0.0281	0.0374	0.0187	0.0936	0.0047	0.0028	0.4213	0.0281			0.0021					0.0421
SRC-Ca-1	0.0526	0.0631	0.0000	0.0168		0.0315	0.0421	0.0210	0.1052	0.0053	0.0032	0.4732	0.0315			0.0023					0.0473
SRC-Ca-2	0.0515	0.0618	0.0200	0.0165		0.0309	0.0412	0.0206	0.1030	0.0052	0.0031	0.4637	0.0309			0.0023					0.0464
SRC-Ca-3	0.0484	0.0580	0.0800	0.0155		0.0290	0.0387	0.0193	0.0967	0.0048	0.0029	0.4353	0.0290			0.0021					0.0435
SRC-Ce-1	0.0524	0.0628	0.0513	0.0168		0.0314	0.0419	0.0209	0.1047	0.0052	0.0031	0.4712	0.0314			0.0023					0.0000
SRC-Ce-2	0.0510	0.0613	0.0500	0.0163		0.0306	0.0408	0.0204	0.1021	0.0051	0.0031	0.4594	0.0306			0.0022					0.0250
SRC-Ce-3	0.0490	0.0587	0.0480	0.0157		0.0294	0.0392	0.0196	0.0979	0.0049	0.0029	0.4406	0.0294			0.0022					0.0650
SRC-Ce-4	0.0482	0.0578	0.0472	0.0154		0.0289	0.0385	0.0193	0.0963	0.0048	0.0029	0.4335	0.0289			0.0021					0.0800
SRC-Eu-1	0.0501	0.0602	0.0491	0.0160		0.0301	0.0401	0.0201	0.1003	0.0050	0.0030	0.4512	0.0301			0.0022					0.0424
SRC-Gd-1	0.0524	0.0628	0.0513	0.0168		0.0314	0.0419	0.0209	0.1047	0.0052	0.0031	0.4712	0.0314			0.0023					0.0471
SRC-Gd-2	0.0510	0.0613	0.0500	0.0163		0.0306	0.0408	0.0204	0.1021	0.0051	0.0031	0.4594	0.0306			0.0022					0.0459
SRC-Gd-3	0.0490	0.0587	0.0480	0.0157		0.0294	0.0392	0.0196	0.0979	0.0049	0.0029	0.4406	0.0294			0.0022					0.0441
SRC-Gd-4	0.0482	0.0578	0.0472	0.0154		0.0289	0.0385	0.0193	0.0963	0.0048	0.0029	0.4335	0.0289			0.0021					0.0434
SRC-K-1	0.0515	0.0619	0.0505	0.0165		0.0000	0.0412	0.0206	0.1031	0.0052	0.0031	0.4639	0.0309			0.0023					0.0464
SRC-K-2	0.0485	0.0581	0.0475	0.0155		0.0600	0.0388	0.0194	0.0969	0.0048	0.0029	0.4361	0.0291			0.0021					0.0436
SRC-K-3	0.0469	0.0563	0.0460	0.0150		0.0900	0.0375	0.0188	0.0938	0.0047	0.0028	0.4222	0.0281			0.0021					0.0422
SRC-K-3i	0.0469	0.0563	0.0460	0.0150		0.0900	0.0375	0.0188	0.0938	0.0047	0.0028	0.4222	0.0281			0.0021					0.0422
SRC-Li-1	0.0521	0.0625	0.0510	0.0167		0.0313	0.0000	0.0208	0.1042	0.0052	0.0031	0.4688	0.0313			0.0023					0.0469
SRC-Li-2	0.0513	0.0616	0.0503	0.0164		0.0308	0.0150	0.0205	0.1026	0.0051	0.0031	0.4617	0.0308			0.0023					0.0462
SRC-Li-3	0.0497	0.0597	0.0487	0.0159		0.0298	0.0450	0.0199	0.0995	0.0050	0.0030	0.4477	0.0298			0.0022					0.0448
SRC-Mg-1	0.0485	0.0582	0.0475	0.0155		0.0291	0.0388	0.0500	0.0969	0.0048	0.0029	0.4362	0.0291			0.0021					0.0436
SRC-Mg-2	0.0469	0.0563	0.0460	0.0150		0.0282	0.0376	0.0800	0.0939	0.0047	0.0028	0.4224	0.0282			0.0021					0.0422
SRC-Mg-3	0.0449	0.0539	0.0440	0.0144		0.0269	0.0359	0.1200	0.0898	0.0045	0.0027	0.4041	0.0269			0.0020					0.0404
SRC-Na-1	0.0551	0.0661	0.0540	0.0176		0.0331	0.0441	0.0220	0.0081	0.0055	0.0033	0.4960	0.0331			0.0024					0.0496
SRC-Na-2	0.0511	0.0613	0.0501	0.0164		0.0307	0.0409	0.0204	0.0800	0.0051	0.0031	0.4600	0.0307			0.0022					0.0460
SRC-Pb-1	0.0505	0.0606	0.0495	0.0162		0.0303	0.0404	0.0202	0.1010	0.0051	0.0030	0.4545	0.0303			0.0022					0.0455
SRC-Pb-2	0.0480	0.0576	0.0470	0.0154		0.0288	0.0384	0.0192	0.0960	0.0048	0.0029	0.4318	0.0288			0.0021					0.0432
SRC-Pb-3	0.0454	0.0545	0.0445	0.0145		0.0273	0.0363	0.0182	0.0909	0.0045	0.0027	0.4091	0.0273			0.0020					0.0409
SRC-Si-1	0.0545	0.0655	0.0535	0.0175		0.0327	0.0436	0.0218	0.1091	0.0055	0.0033	0.4000	0.0327			0.0024					0.0491
SRC-Si-2	0.0409	0.0491	0.0401	0.0131		0.0245	0.0327	0.0164	0.0818	0.0041	0.0025	0.5500	0.0245			0.0018					0.0368
SRC-Sm-1	0.0501	0.0602	0.0491	0.0160		0.0301	0.0401	0.0201	0.1003	0.0050	0.0030	0.4512	0.0301			0.0022					0.0424
SRC-Sn-1	0.0490	0.0588	0.0480	0.0157		0.0294	0.0392	0.0196	0.0980	0.0049	0.0029	0.4410	0.0294			0.0022					0.0441
SRC-Sn-2	0.0480	0.0576	0.0470	0.0154		0.0288	0.0384	0.0192	0.0960	0.0048	0.0029	0.4320	0.0288			0.0021					0.0432
SRC-Sn-3	0.0470	0.0564	0.0461	0.0150		0.0282	0.0376	0.0188	0.0940	0.0047	0.0028	0.4230	0.0282			0.0021					0.0423
SRC-Ti-1	0.0505	0.0606	0.0495	0.0162		0.0303	0.0404	0.0202	0.1010	0.0051	0.0030	0.4545	0.0303			0.0022					0.0455
SRC-Ti-2	0.0480	0.0576	0.0470	0.0154		0.0288	0.0384	0.0192	0.0960	0.0048	0.0029	0.4318	0.0288			0.0021					0.0432
SRC-Zr-1	0.0515	0.0619	0.0505	0.0165		0.0309	0.0412	0.0206	0.1031	0.0052	0.0031	0.4639	0.0000			0.0023					0.0464
SRC-Zr-2	0.0490	0.0588	0.0480	0.0157		0.0294	0.0392	0.0196	0.0979	0.0049	0.0029	0.4407	0.0500			0.0022					0.0441

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
PBG3/Ce	0.0050			0.0040	0.0100	0.0004		0.0010		0.0450							0.0064		0.0080	0.0100	
PBG3/0x	0.0050			0.0040	0.0100	0.0004		0.0010		0.0450							0.0064		0.0080	0.0100	
PBG3-.5C	0.0050			0.0040	0.0100	0.0004		0.0010		0.0450							0.0064		0.0080	0.0100	
SRC-Al-1	0.0053			0.0042	0.0105	0.0004		0.0011		0.0474							0.0067		0.0084	0.0105	
SRC-Al-2	0.0047			0.0038	0.0095	0.0004		0.0009		0.0426							0.0061		0.0076	0.0095	
SRC-B-1	0.0053			0.0043	0.0106	0.0004		0.0011		0.0479							0.0068		0.0085	0.0106	
SRC-B-2	0.0051			0.0041	0.0102	0.0004		0.0010		0.0460							0.0065		0.0082	0.0102	
SRC-B-3	0.0047			0.0037	0.0094	0.0004		0.0009		0.0421							0.0060		0.0075	0.0094	
SRC-Ca-1	0.0053			0.0042	0.0105	0.0004		0.0011		0.0473							0.0067		0.0084	0.0105	
SRC-Ca-2	0.0052			0.0041	0.0103	0.0004		0.0010		0.0464							0.0066		0.0082	0.0103	
SRC-Ca-3	0.0048			0.0039	0.0097	0.0004		0.0010		0.0435							0.0062		0.0077	0.0097	
SRC-Ce-1	0.0052			0.0042	0.0105	0.0004		0.0010		0.0471							0.0067		0.0084	0.0105	
SRC-Ce-2	0.0051			0.0041	0.0102	0.0004		0.0010		0.0459							0.0065		0.0082	0.0102	
SRC-Ce-3	0.0049			0.0039	0.0098	0.0004		0.0010		0.0441							0.0063		0.0078	0.0098	
SRC-Ce-4	0.0048			0.0039	0.0096	0.0004		0.0010		0.0434							0.0062		0.0077	0.0096	
SRC-Eu-1	0.0050			0.0040	0.0100	0.0004	0.0451	0.0010		0.0000							0.0064		0.0080	0.0100	
SRC-Gd-1	0.0052			0.0042	0.0105	0.0004		0.0010		0.0000							0.0067		0.0084	0.0105	
SRC-Gd-2	0.0051			0.0041	0.0102	0.0004		0.0010		0.0250							0.0065		0.0082	0.0102	
SRC-Gd-3	0.0049			0.0039	0.0098	0.0004		0.0010		0.0650							0.0063		0.0078	0.0098	
SRC-Gd-4	0.0048			0.0039	0.0096	0.0004		0.0010		0.0800							0.0062		0.0077	0.0096	
SRC-K-1	0.0052			0.0041	0.0103	0.0004		0.0010		0.0464							0.0066		0.0082	0.0103	
SRC-K-2	0.0048			0.0039	0.0097	0.0004		0.0010		0.0436							0.0062		0.0078	0.0097	
SRC-K-3	0.0047			0.0038	0.0094	0.0004		0.0009		0.0422							0.0060		0.0075	0.0094	
SRC-K-3i	0.0047			0.0038	0.0094	0.0004		0.0009		0.0422							0.0060		0.0075	0.0094	
SRC-Li-1	0.0052			0.0042	0.0104	0.0004		0.0010		0.0469							0.0067		0.0083	0.0104	
SRC-Li-2	0.0051			0.0041	0.0103	0.0004		0.0010		0.0462							0.0066		0.0082	0.0103	
SRC-Li-3	0.0050			0.0040	0.0099	0.0004		0.0010		0.0448							0.0064		0.0080	0.0099	
SRC-Mg-1	0.0048			0.0039	0.0097	0.0004		0.0010		0.0436							0.0062		0.0078	0.0097	
SRC-Mg-2	0.0047			0.0038	0.0094	0.0004		0.0009		0.0422							0.0060		0.0075	0.0094	
SRC-Mg-3	0.0045			0.0036	0.0090	0.0004		0.0009		0.0404							0.0057		0.0072	0.0090	
SRC-Na-1	0.0055			0.0044	0.0110	0.0004		0.0011		0.0496							0.0071		0.0088	0.0110	
SRC-Na-2	0.0051			0.0041	0.0102	0.0004		0.0010		0.0460							0.0065		0.0082	0.0102	
SRC-Pb-1	0.0051			0.0040	0.0101	0.0004		0.0010		0.0455							0.0065		0.0081	0.0000	
SRC-Pb-2	0.0048			0.0038	0.0096	0.0004		0.0010		0.0432							0.0061		0.0077	0.0500	
SRC-Pb-3	0.0045			0.0036	0.0091	0.0004		0.0009		0.0409							0.0058		0.0073	0.1000	
SRC-Si-1	0.0055			0.0044	0.0109	0.0004		0.0011		0.0491							0.0070		0.0087	0.0109	
SRC-Si-2	0.0041			0.0033	0.0082	0.0003		0.0008		0.0368							0.0052		0.0065	0.0082	
SRC-Sm-1	0.0050			0.0040	0.0100	0.0004		0.0010		0.0000							0.0064		0.0080	0.0100	
SRC-Sn-1	0.0049			0.0039	0.0098	0.0004		0.0010		0.0441							0.0063		0.0078	0.0098	
SRC-Sn-2	0.0048			0.0038	0.0096	0.0004		0.0010		0.0432							0.0061		0.0077	0.0096	
SRC-Sn-3	0.0047			0.0038	0.0094	0.0004		0.0009		0.0423							0.0060		0.0075	0.0094	
SRC-Ti-1	0.0051			0.0040	0.0101	0.0004		0.0010		0.0455							0.0065		0.0081	0.0101	
SRC-Ti-2	0.0048			0.0038	0.0096	0.0004		0.0010		0.0432							0.0061		0.0077	0.0096	
SRC-Zr-1	0.0052			0.0041	0.0103	0.0004		0.0010		0.0464							0.0066		0.0082	0.0103	
SRC-Zr-2	0.0049			0.0039	0.0098	0.0004		0.0010		0.0441							0.0063		0.0078	0.0098	

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
PBG3/Ce																					0.0100
PBG3/0x																					0.0100
PBG3-.5C																					0.0100
SRC-Al-1																					0.0105
SRC-Al-2																					0.0095
SRC-B-1																					0.0106
SRC-B-2																					0.0102
SRC-B-3																					0.0094
SRC-Ca-1																					0.0105
SRC-Ca-2																					0.0103
SRC-Ca-3																					0.0097
SRC-Ce-1																					0.0105
SRC-Ce-2																					0.0102
SRC-Ce-3																					0.0098
SRC-Ce-4																					0.0096
SRC-Eu-1																					0.0100
SRC-Gd-1																					0.0105
SRC-Gd-2																					0.0102
SRC-Gd-3																					0.0098
SRC-Gd-4																					0.0096
SRC-K-1																					0.0103
SRC-K-2																					0.0097
SRC-K-3																					0.0094
SRC-K-3i																					0.0094
SRC-Li-1																					0.0104
SRC-Li-2																					0.0103
SRC-Li-3																					0.0099
SRC-Mg-1																					0.0097
SRC-Mg-2																					0.0094
SRC-Mg-3																					0.0090
SRC-Na-1																					0.0110
SRC-Na-2																					0.0102
SRC-Pb-1																					0.0101
SRC-Pb-2																					0.0096
SRC-Pb-3																					0.0091
SRC-Si-1																					0.0109
SRC-Si-2																					0.0082
SRC-Sm-1													0.0451								0.0100
SRC-Sn-1															0.0200						0.0098
SRC-Sn-2															0.0400						0.0096
SRC-Sn-3															0.0600						0.0094
SRC-Ti-1																					0.0000
SRC-Ti-2																					0.0500
SRC-Zr-1																					0.0103
SRC-Zr-2																					0.0098

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
PBG3/Ce										1.0000											
PBG3/0x										1.0000											
PBG3-.5C										1.0000											
SRC-Al-1										1.0002											
SRC-Al-2										0.9998											
SRC-B-1										0.9999											
SRC-B-2										0.9999											
SRC-B-3										1.0001											
SRC-Ca-1										1.0000											
SRC-Ca-2										0.9999											
SRC-Ca-3										0.9998											
SRC-Ce-1										0.9999											
SRC-Ce-2										0.9997											
SRC-Ce-3										1.0003											
SRC-Ce-4										1.0000											
SRC-Eu-1										0.9998											
SRC-Gd-1										0.9999											
SRC-Gd-2										0.9997											
SRC-Gd-3										1.0003											
SRC-Gd-4										1.0000											
SRC-K-1										0.9999											
SRC-K-2										1.0001											
SRC-K-3										1.0001											
SRC-K-3i										1.0001											
SRC-Li-1										1.0001											
SRC-Li-2										1.0002											
SRC-Li-3										1.0000											
SRC-Mg-1										1.0000											
SRC-Mg-2										1.0000											
SRC-Mg-3										1.0001											
SRC-Na-1										0.9999											
SRC-Na-2										0.9999											
SRC-Pb-1										1.0001											
SRC-Pb-2										1.0002											
SRC-Pb-3										0.9997											
SRC-Si-1										1.0001											
SRC-Si-2										0.9999											
SRC-Sm-1										0.9998											
SRC-Sn-1										1.0000											
SRC-Sn-2										1.0000											
SRC-Sn-3										1.0000											
SRC-Ti-1										1.0001											
SRC-Ti-2										1.0002											
SRC-Zr-1										0.9999											
SRC-Zr-2										1.0002											

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
PBG3/Ce																					
PBG3/0x																					
PBG3-.5C																					
SRC-Al-1																					
SRC-Al-2																					
SRC-B-1																					
SRC-B-2																					
SRC-B-3																					
SRC-Ca-1																					
SRC-Ca-2																					
SRC-Ca-3																					
SRC-Ce-1																					
SRC-Ce-2																					
SRC-Ce-3																					
SRC-Ce-4																					
SRC-Eu-1																					
SRC-Gd-1																					
SRC-Gd-2																					
SRC-Gd-3																					
SRC-Gd-4																					
SRC-K-1																					
SRC-K-2																					
SRC-K-3																					
SRC-K-3i																					
SRC-Li-1																					
SRC-Li-2																					
SRC-Li-3																					
SRC-Mg-1																					
SRC-Mg-2																					
SRC-Mg-3																					
SRC-Na-1																					
SRC-Na-2																					
SRC-Pb-1																					
SRC-Pb-2																					
SRC-Pb-3																					
SRC-Si-1																					
SRC-Si-2																					
SRC-Sm-1																					
SRC-Sn-1																					
SRC-Sn-2																					
SRC-Sn-3																					
SRC-Ti-1																					
SRC-Ti-2																					
SRC-Zr-1																					
SRC-Zr-2																					

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
PBG3/Ce																					
PBG3/0x																					
PBG3-.5C																					
SRC-Al-1																					
SRC-Al-2																					
SRC-B-1																					
SRC-B-2																					
SRC-B-3																					
SRC-Ca-1																					
SRC-Ca-2																					
SRC-Ca-3																					
SRC-Ce-1																					
SRC-Ce-2																					
SRC-Ce-3																					
SRC-Ce-4																					
SRC-Eu-1																					
SRC-Gd-1																					
SRC-Gd-2																					
SRC-Gd-3																					
SRC-Gd-4																					
SRC-K-1																					
SRC-K-2																					
SRC-K-3																					
SRC-K-3i																					
SRC-Li-1																					
SRC-Li-2																					
SRC-Li-3																					
SRC-Mg-1																					
SRC-Mg-2																					
SRC-Mg-3																					
SRC-Na-1																					
SRC-Na-2																					
SRC-Pb-1																					
SRC-Pb-2																					
SRC-Pb-3																					
SRC-Si-1																					
SRC-Si-2																					
SRC-Sm-1																					
SRC-Sn-1																					
SRC-Sn-2																					
SRC-Sn-3																					
SRC-Ti-1																					
SRC-Ti-2																					
SRC-Zr-1																					
SRC-Zr-2																					

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
PBG3/Ce																				
PBG3/0x																				
PBG3-.5C																				
SRC-Al-1																				
SRC-Al-2																				
SRC-B-1																				
SRC-B-2																				
SRC-B-3																				
SRC-Ca-1																				
SRC-Ca-2																				
SRC-Ca-3																				
SRC-Ce-1																				
SRC-Ce-2																				
SRC-Ce-3																				
SRC-Ce-4																				
SRC-Eu-1																				
SRC-Gd-1																				
SRC-Gd-2																				
SRC-Gd-3																				
SRC-Gd-4																				
SRC-K-1																				
SRC-K-2																				
SRC-K-3																				
SRC-K-3i																				
SRC-Li-1																				
SRC-Li-2																				
SRC-Li-3																				
SRC-Mg-1																				
SRC-Mg-2																				
SRC-Mg-3																				
SRC-Na-1																				
SRC-Na-2																				
SRC-Pb-1																				
SRC-Pb-2																				
SRC-Pb-3																				
SRC-Si-1																				
SRC-Si-2																				
SRC-Sm-1																				
SRC-Sn-1																				
SRC-Sn-2																				
SRC-Sn-3																				
SRC-Ti-1																				
SRC-Ti-2																				
SRC-Zr-1																				
SRC-Zr-2																				

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
PBG3/Ce	1240							
PBG3/0x	1240							
PBG3-.5C	1240							
SRC-Al-1	1180							
SRC-Al-2	1242							
SRC-B-1	1268							
SRC-B-2	1242							
SRC-B-3	1095							
SRC-Ca-1	1258							
SRC-Ca-2	1250							
SRC-Ca-3	1143							
SRC-Ce-1								
SRC-Ce-2	1200							
SRC-Ce-3	1243							
SRC-Ce-4								
SRC-Eu-1	1248							
SRC-Gd-1								
SRC-Gd-2	1192							
SRC-Gd-3	1243							
SRC-Gd-4								
SRC-K-1	1264							
SRC-K-2	1169							
SRC-K-3	1136							
SRC-K-3i	1146							
SRC-Li-1	1390							
SRC-Li-2	1293							
SRC-Li-3	1152							
SRC-Mg-1	1189							
SRC-Mg-2	1158							
SRC-Mg-3	1138							
SRC-Na-1	1368							
SRC-Na-2	1215							
SRC-Pb-1	1246							
SRC-Pb-2	1126							
SRC-Pb-3	1083							
SRC-Si-1	1250							
SRC-Si-2	1365							
SRC-Sm-1	1250							
SRC-Sn-1	1180							
SRC-Sn-2	1203							
SRC-Sn-3	1306							
SRC-Ti-1	1184							
SRC-Ti-2	1208							
SRC-Zr-1	1169							
SRC-Zr-2	1170							

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
PBG3/Ce					
PBG3/0x					
PBG3-.5C					
SRC-Al-1					
SRC-Al-2					
SRC-B-1					
SRC-B-2					
SRC-B-3					
SRC-Ca-1					
SRC-Ca-2					
SRC-Ca-3					
SRC-Ce-1					
SRC-Ce-2					
SRC-Ce-3					
SRC-Ce-4					
SRC-Eu-1					
SRC-Gd-1					
SRC-Gd-2					
SRC-Gd-3					
SRC-Gd-4					
SRC-K-1					
SRC-K-2					
SRC-K-3					
SRC-K-3i					
SRC-Li-1					
SRC-Li-2					
SRC-Li-3					
SRC-Mg-1					
SRC-Mg-2					
SRC-Mg-3					
SRC-Na-1					
SRC-Na-2					
SRC-Pb-1					
SRC-Pb-2					
SRC-Pb-3					
SRC-Si-1					
SRC-Si-2					
SRC-Sm-1					
SRC-Sn-1					
SRC-Sn-2					
SRC-Sn-3					
SRC-Ti-1					
SRC-Ti-2					
SRC-Zr-1					
SRC-Zr-2					

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
PBG3/Ce							-13.500	20914.0	3.31		1114	1053	1096	6.094	1046
PBG3/0x															
PBG3-.5C							-12.700	19967.0	3.79		1120	1056	1195	2.355	996
SRC-Al-1							-13.200	19930.0	2.24		1075	1014	1190	1.587	1141
SRC-Al-2							-12.500	20656.0	7.51		1195	1126	1148	9.887	1247
SRC-B-1							-12.700	21231.0	9.21		1209	1141	1288	2.371	1239
SRC-B-2							-11.600	18852.0	5.20		1154	1083	1239	2.358	1190
SRC-B-3							-12.700	19085.0	2.04		1065	1003	1189	1.536	1140
SRC-Ca-1							-11.000	18423.0	7.00		1188	1112	1290	2.131	1241
SRC-Ca-2							-11.000	18084.0	5.52		1158	1084	1239	2.51	1190
SRC-Ca-3							-13.400	20707.0	3.16		1103	1042	1097	5.624	1147
SRC-Ce-1							-12.700	19944.0	3.73		1124	1060	1096	6.692	1046
SRC-Ce-2							-11.900	18913.0	4.02		1129	1061	1191	2.881	1142
SRC-Ce-3							-12.800	20042.0	3.61		1120	1056	1239	1.592	1190
SRC-Ce-4							-14.000	21866.0	3.92		1130	1070	1240	1.638	1191
SRC-Eu-1							-12.100	19223.0	4.09		1134	1066	1241	1.881	1191
SRC-Gd-1							-11.900	18941.0	4.10		1124	1056	1239	1.74	1191
SRC-Gd-2							-11.500	18418.0	4.23		1132	1061	1239	1.964	1190
SRC-Gd-3							-12.100	19150.0	3.89		1124	1057	1239	1.763	1190
SRC-Gd-4							-13.700	21362.0	3.71		1127	1066	1097	7.035	1047
SRC-K-1							-11.200	18126.0	4.65		1138	1066	1289	1.46	1239
SRC-K-2							-12.600	19605.0	3.25		1107	1043	1098	5.601	1148
SRC-K-3															
SRC-K-3i															
SRC-Li-1							-12.100	22194.0	33.00		1343	1266	1389	3.399	1339
SRC-Li-2							-11.600	20126.0	12.72		1248	1173	1338	2.378	1288
SRC-Li-3							-12.700	19675.0	3.08		1106	1043	1097	5.871	1147
SRC-Mg-1							-14.000	21647.0	3.36		1111	1052	1190	2.1	1141
SRC-Mg-2							-12.900	19912.0	2.98		1103	1040	1239	1.408	1189
SRC-Mg-3															
SRC-Na-1							-12.000	21104.0	16.96		1282	1206	1388	2.059	1339
SRC-Na-2							-12.300	19914.0	5.44		1159	1091	1238	2.393	1188
SRC-Pb-1							-11.800	18771.0	4.02		1128	1059	1239	1.901	1190
SRC-Pb-2							-12.700	19628.0	2.98		1103	1039	1196	2.033	1146
SRC-Pb-3							-11.300	17621.0	2.95		1096	1026	1239	1.566	1190
SRC-Si-1							-11.000	16823.0	2.28		1059	990	1239	1.184	1190
SRC-Si-2							-11.100	20166.0	21.57		1314	1232	1386	2.737	1337
SRC-Sm-1							-11.800	18947.0	4.55		1136	1067	1240	1.947	1190
SRC-Sn-1							-12.900	20472.0	4.42		1135	1071	1239	1.839	1189
SRC-Sn-2							-14.200	22304.0	4.37		1139	1080	1239	1.769	1189
SRC-Sn-3															
SRC-Ti-1							-11.700	18672.0	4.14		1130	1060	1239	1.898	1190
SRC-Ti-2							-12.800	19802.0	3.05		1098	1035	1239	1.329	1189
SRC-Zr-1							-10.700	17113.0	3.77		1116	1042	1239	1.822	1190
SRC-Zr-2							-13.300	20889.0	3.97		1131	1068	1239	1.765	1189

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
PBG3/Ce	10.507	996	19.44	1045	10.634	1096	6.134	1146	3.609	1196	2.253	1096	6.23	945	39.523	895	91.36				
PBG3/0x																					
PBG3-.5C	20.376	1195	2.415	1145	3.864	1096	6.429	1046	11.032	996	20.255	1046	11.286	1195	2.435	1146	3.92	1096	6.493		
SRC-Al-1	2.466	1092	4.135	1042	7.042	993	12.971	1190	1.558	1141	2.457	1092	4.182	1042	7.194	993	13.178				
SRC-Al-2	2.929	1297	1.922	1198	4.533	1148	7.201	1098	12.622	1047	23.304	1147	8.218	1197	5.146	1248	3.145				
SRC-B-1	3.848	1189	6.079	1141	10.062	1090	17.025	1288	2.371	1239	3.824	1189	6.134	1140	10.158	1090	17.388				
SRC-B-2	3.584	1141	5.756	1092	8.796	1042	15.272	1240	2.345	1190	3.624	1141	5.772	1092	8.946	1042	15.67				
SRC-B-3	2.317	1091	3.736	1041	6.325	993	11.445	1189	1.52	1140	2.326	1091	3.784	1041	6.453	993	11.604				
SRC-Ca-1	3.213	1191	4.874	1142	7.64	1093	11.524	1290	2.181	1241	3.266	1192	4.93	1141	7.801	1093	11.973				
SRC-Ca-2	3.816	1141	5.949	1092	9.021	1042	15.158	1240	2.5	1190	3.8	1141	5.997	1092	9.156	1042	15.3				
SRC-Ca-3	3.242	1196	1.871	1147	3.083	1097	5.266	1047	9.331	997	17.146	1096	5.369	1146	3.131	1196	1.899				
SRC-Ce-1	11.27	996	19.984	1045	11.207	1096	6.652	1146	4.063	1196	2.642	1096	6.803	945	40.152	895	89.305				
SRC-Ce-2	4.498	1092	7.295	1043	11.778	994	21.187	1191	2.75	1141	4.409	1093	7.231	1043	11.733	995	21.13				
SRC-Ce-3	2.447	1142	3.896	1092	6.59	1042	11.149	1240	1.628	1190	2.529	1141	4.073	1092	7.007	1042	12.168				
SRC-Ce-4	2.819	1142	5.323	1093	9.246	1043	16.978	1239	1.523	1190	2.391	1141	4.033	1092	6.494	1042	11.074				
SRC-Eu-1	3.016	1142	4.698	1092	7.889	1043	12.842	1240	1.832	1191	2.983	1142	4.746	1093	7.253	1043	12.468				
SRC-Gd-1	2.69	1142	4.273	1092	6.951	1042	11.209	1239	1.737	1190	2.736	1141	4.346	1092	7.159	1042	11.329				
SRC-Gd-2	2.94	1141	4.562	1092	7.456	1042	11.778	1240	1.95	1190	2.957	1141	4.602	1092	7.544	1042	12.258				
SRC-Gd-3	2.684	1140	4.249	1091	7.095	1042	11.614	1239	1.763	1190	2.704	1141	4.281	1092	7.119	1041	11.748				
SRC-Gd-4	13.543	997	27.138	1047	13.893	1097	7.266	1147	3.975	1197	2.212	1097	6.238	947	41.354	897	95.606				
SRC-K-1	2.049	1190	3.108	1141	4.906	1092	7.568	1289	1.464	1240	2.079	1190	3.151	1141	4.995	1092	7.717				
SRC-K-2	3.37	1198	2.049	1148	3.258	1098	5.489	1048	9.379	998	16.663	1097	5.601	1147	3.354	1197	2.081				
SRC-K-3																					
SRC-K-3i																					
SRC-Li-1	5.243	1290	7.657	1240	12.573	1189	21.13	1388	3.471	1339	5.371	1289	7.942	1240	12.977	1189	21.813				
SRC-Li-2	3.568	1239	5.484	1190	8.092	1140	13.696	1338	2.348	1289	3.608	1239	5.588	1190	8.302	1140	14.086				
SRC-Li-3	3.418	1196	2.036	1147	3.211	1097	5.441	1047	9.426	997	16.693	1096	5.648	1146	3.338	1197	2.084				
SRC-Mg-1	3.728	1092	6.294	1042	11.429	994	21.433	1190	2.094	1141	3.665	1092	6.182	1042	11.111	994	20.769				
SRC-Mg-2	2.071	1140	3.314	1091	5.608	1042	9.903	1239	1.386	1190	2.068	1140	3.33	1091	5.672	1042	9.935				
SRC-Mg-3																					
SRC-Na-1	3.042	1289	4.73	1240	7.408	1190	11.269	1388	2.059	1339	3.125	1289	4.77	1240	7.504	1190	11.464				
SRC-Na-2	3.776	1139	6.015	1090	10.046	1040	17.267	1238	2.419	1188	3.864	1139	6.166	1090	10.285	1040	17.871				
SRC-Pb-1	2.848	1141	4.441	1091	7.263	1041	11.898	1240	1.822	1190	2.802	1141	4.441	1091	7.311	1042	12.048				
SRC-Pb-2	3.179	1096	5.274	1046	9.029	996	16.422	1196	2.014	1146	3.29	1096	5.433	1046	9.379	996	16.844				
SRC-Pb-3	2.089	1141	3.271	1091	5.307	1041	8.452	1239	1.477	1190	2.144	1140	3.327	1091	5.411	1041	8.646				
SRC-Si-1	1.473	1141	2.325	1092	3.96	1240	1.164	1190	1.539	1142	2.25	1092	3.752								
SRC-Si-2	4.151	1288	6.158	1239	9.315	1189	14.248	1388	2.842	1338	4.254	1289	6.294	1240	9.633	1190	14.58				
SRC-Sm-1	2.977	1141	4.746	1092	7.841	1042	12.767	1240	2.019	1190	3.085	1141	4.85	1091	7.977	1042	13.067				
SRC-Sn-1	2.878	1141	4.626	1050	13.217	1240	1.845	1190	2.901	1142	4.682	1092	7.969	1042	13.502						
SRC-Sn-2	2.842	1140	4.884	1091	8.536	1042	15.667	1239	1.797	1190	2.9	1140	4.971	1091	8.886	1042	16.663				
SRC-Sn-3																					
SRC-Ti-1	2.888	1141	4.361	1091	7.336	1042	11.943	1240	1.894	1190	2.898	1141	4.465	1091	7.464	1042	12.108				
SRC-Ti-2	2.02	1140	3.179	1092	5.282	1042	9.188	1189	2.008	1140	3.226	1092	5.354	1042	9.379						
SRC-Zr-1	2.661	1141	3.976	1092	6.309	1042	9.695	1240	1.806	1190	2.677	1140	4.033	1092	6.382	1042	9.905				
SRC-Zr-2	2.734	1141	4.445	1091	7.64	1042	13.718	1239	1.708	1189	2.702	1141	4.525	1091	7.68	1041	13.798				

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
PBG3/Ce																
PBG3/0x																
PBG3-.5C					0.483	0.554	0.554	0.197								
SRC-Al-1					6.096	4.909	4.961	1.536	11.88							
SRC-Al-2					0.226	0.306	0.291	0.104	10.95							
SRC-B-1						0.627	0.603	0.197	11.53							
SRC-B-2					0.347	0.306	0.292	0.101	10.97							
SRC-B-3					1.787	1.697	1.541	0.349	10.93							
SRC-Ca-1					0.334	0.411	0.394	0.173	10.90							
SRC-Ca-2					0.411	0.503	0.480	0.191	11.09							
SRC-Ca-3					0.630	0.696	0.670	0.216	11.33							
SRC-Ce-1					0.626	0.669	0.635	0.231	11.18							
SRC-Ce-2					0.605	0.663	0.618	0.228	11.23							
SRC-Ce-3					0.593	0.645	0.604	0.219	11.29							
SRC-Ce-4					0.626	0.669	0.631	0.227	11.19							
SRC-Eu-1					0.718	0.773	0.731	0.269	11.26							
SRC-Gd-1					0.342	0.431	0.416	0.160	11.03							
SRC-Gd-2					0.471	0.554	0.541	0.201	11.18							
SRC-Gd-3					0.558	0.592	0.579	0.216	11.19							
SRC-Gd-4					0.580	0.620	0.588	0.202	11.18							
SRC-K-1					0.472	0.504	0.481	0.182	11.10							
SRC-K-2					0.602	0.675	0.639	0.222	11.31							
SRC-K-3																
SRC-K-3i																
SRC-Li-1					0.253		0.314	0.108	10.26							
SRC-Li-2					0.315	0.361	0.363	0.130	10.61							
SRC-Li-3					0.617	0.668	0.639	0.243	11.30							
SRC-Mg-1					1.270	1.187	1.116	0.320	11.55							
SRC-Mg-2					4.042	3.419	3.306	0.651	11.98							
SRC-Mg-3																
SRC-Na-1					0.140	0.239	0.165	0.088	10.16							
SRC-Na-2					0.422	0.484	0.454	0.170	10.92							
SRC-Pb-1					0.542	0.618	0.571	0.200	11.24							
SRC-Pb-2					0.498	0.573	0.534	0.193	11.21							
SRC-Pb-3					0.465	0.568	0.537	0.191	11.20							
SRC-Si-1					0.935	0.990	0.940	0.285	11.55							
SRC-Si-2					0.275	0.359	0.332	0.151	10.45							
SRC-Sm-1					0.792	0.826	0.795	0.290	11.38							
SRC-Sn-1					0.541	0.615	0.568	0.202	11.17							
SRC-Sn-2					0.440	0.513	0.474	0.180	11.09							
SRC-Sn-3																
SRC-Ti-1					0.550	0.616	0.576	0.199	11.27							
SRC-Ti-2					0.483	0.538	0.493	0.188	11.11							
SRC-Zr-1					0.582	0.670	0.631	0.235	11.24							
SRC-Zr-2					0.462	0.538	0.498	0.168	11.23							

Plutonium Vitrification (Bulkley and Vienna 1997)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
PBG3/Ce												
PBG3/0x												
PBG3-.5C												
SRC-Al-1												
SRC-Al-2												
SRC-B-1												
SRC-B-2												
SRC-B-3												
SRC-Ca-1												
SRC-Ca-2												
SRC-Ca-3												
SRC-Ce-1												
SRC-Ce-2												
SRC-Ce-3												
SRC-Ce-4												
SRC-Eu-1												
SRC-Gd-1												
SRC-Gd-2												
SRC-Gd-3												
SRC-Gd-4												
SRC-K-1												
SRC-K-2												
SRC-K-3												
SRC-K-3i												
SRC-Li-1												
SRC-Li-2												
SRC-Li-3												
SRC-Mg-1												
SRC-Mg-2												
SRC-Mg-3												
SRC-Na-1												
SRC-Na-2												
SRC-Pb-1												
SRC-Pb-2												
SRC-Pb-3												
SRC-Si-1												
SRC-Si-2												
SRC-Sm-1												
SRC-Sn-1												
SRC-Sn-2												
SRC-Sn-3												
SRC-Ti-1												
SRC-Ti-2												
SRC-Zr-1												
SRC-Zr-2												

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
1											0.0177	0.1257	0.0267	0.0692				0.0000	0.0931	0.0302	
2											0.0000	0.1554	0.0000	0.0000				0.0483	0.1303	0.0218	
3											0.0000	0.0620	0.1144	0.0748				0.0244	0.1414	0.0000	
4											0.0000	0.0956	0.0858	0.0000				0.0491	0.1393	0.0000	
5											0.0000	0.0912	0.0830	0.0000				0.0491	0.1385	0.0000	
6											0.0000	0.0894	0.0825	0.0000				0.0480	0.1439	0.0000	
7											0.2094	0.0610	0.0314	0.0000				0.0440	0.0944	0.0290	
8											0.2072	0.1171	0.0000	0.0448				0.0000	0.1155	0.0283	
9											0.1930	0.1255	0.0000	0.0000				0.0067	0.1424	0.0000	
10											0.0000	0.0734	0.1227	0.0000				0.0131	0.1035	0.0327	
11											0.0000	0.1161	0.1154	0.0743				0.0478	0.1015	0.0000	
12											0.2130	0.0920	0.1020	0.0703				0.0000	0.1383	0.0276	
13											0.0774	0.1409	0.0000	0.0741				0.0181	0.1429	0.0000	
14											0.2184	0.0690	0.0000	0.0000				0.0000	0.0984	0.0000	
15											0.0213	0.0697	0.0000	0.0716				0.0458	0.1296	0.0000	
16											0.0710	0.1277	0.1076	0.0704				0.0000	0.1128	0.0000	
17											0.2143	0.0579	0.0254	0.0000				0.0000	0.1330	0.0000	
18											0.1071	0.0968	0.0547	0.0354				0.0221	0.1146	0.0155	
19											0.1085	0.0978	0.0531	0.0354				0.0226	0.1155	0.0144	
20											0.1088	0.0898	0.0532	0.0331				0.0227	0.1185	0.0144	
21											0.2062	0.1219	0.0000	0.0682				0.0419	0.0944	0.0000	
22											0.0000	0.0664	0.1121	0.0726				0.0000	0.1005	0.0000	
23											0.2042	0.1170	0.0754	0.0000				0.0000	0.0955	0.0000	
24											0.0000	0.1425	0.0924	0.0000				0.0503	0.1630	0.0348	
25											0.2017	0.0596	0.0000	0.0650				0.0407	0.0991	0.0252	
26											0.1988	0.0602	0.0000	0.0636				0.0000	0.1404	0.0256	
27											0.0000	0.0679	0.1198	0.0000				0.0000	0.1478	0.0000	
28											0.0000	0.1246	0.0000	0.0000				0.0000	0.1414	0.0000	
29											0.0187	0.0650	0.0000	0.0685				0.0488	0.1025	0.0000	
30											0.0000	0.1406	0.0881	0.0230				0.0510	0.1570	0.0335	
31											0.0000	0.0657	0.1157	0.0729				0.0000	0.1452	0.0319	
32											0.2190	0.0619	0.1154	0.0000				0.0078	0.1395	0.0000	
33											0.2152	0.1265	0.1134	0.0000				0.0000	0.0954	0.0000	
34											0.0000	0.1291	0.0858	0.0642				0.0498	0.0967	0.0000	
35											0.2124	0.1117	0.0095	0.0562				0.0437	0.1308	0.0000	
36											0.2065	0.1177	0.0078	0.0647				0.0439	0.1394	0.0000	
37											0.2240	0.0628	0.0000	0.0000				0.0461	0.1035	0.0303	
38											0.2063	0.0552	0.0974	0.0546				0.0000	0.0924	0.0000	
39											0.0000	0.1331	0.1186	0.0626				0.0000	0.1068	0.0328	
40											0.0000	0.1335	0.1172	0.0697				0.0000	0.1082	0.0326	
41											0.0000	0.0727	0.1189	0.0000				0.0510	0.1029	0.0331	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
1	0.5018													0.0637							
2	0.5550													0.0000							
3	0.4738													0.0712							
4	0.4097													0.0546							
5	0.3982													0.0750							
6	0.4045													0.0682							
7	0.3952													0.0655							
8	0.4076													0.0000							
9	0.5325													0.0000							
10	0.5728													0.0000							
11	0.3952													0.0753							
12	0.3569													0.0000							
13	0.3995													0.0705							
14	0.5245													0.0000							
15	0.5161													0.0613							
16	0.3707													0.0670							
17	0.4726													0.0000							
18	0.4426													0.0337							
19	0.4415													0.0337							
20	0.4443													0.0315							
21	0.3978													0.0000							
22	0.4897													0.0000							
23	0.3593													0.0681							
24	0.5170													0.0000							
25	0.4468													0.0618							
26	0.3696													0.0000							
27	0.5061													0.0706							
28	0.5063													0.0703							
29	0.5347													0.0000							
30	0.4170													0.0000							
31	0.4303													0.0627							
32	0.3817													0.0000							
33	0.3778													0.0000							
34	0.4113													0.0000							
35	0.3780													0.0578							
36	0.3584													0.0616							
37	0.4972													0.0000							
38	0.3565													0.0623							
39	0.5461													0.0000							
40	0.5387													0.0000							
41	0.4733													0.0721							

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
1										0.0000								0.0717		1.0000
2										0.0892								0.0000		1.0000
3										0.0000								0.0381		1.0000
4										0.0885								0.0775		1.0000
5										0.0874								0.0778		1.0000
6										0.0866								0.0768		1.0000
7										0.0000								0.0701		1.0000
8										0.0795								0.0000		1.0000
9										0.0000								0.0000		1.0000
10										0.0000								0.0818		1.0000
11										0.0744								0.0000		1.0000
12										0.0000								0.0000		1.0000
13										0.0000								0.0766		1.0000
14										0.0897								0.0000		1.0000
15										0.0847								0.0000		1.0000
16										0.0000								0.0729		1.0000
17										0.0245								0.0724		1.0000
18										0.0414								0.0361		1.0000
19										0.0413								0.0361		1.0000
20										0.0403								0.0434		1.0000
21										0.0000								0.0695		1.0000
22										0.0835								0.0752		1.0000
23										0.0806								0.0000		1.0000
24										0.0000								0.0000		1.0000
25										0.0000								0.0000		1.0000
26										0.0757								0.0659		1.0000
27										0.0878								0.0000		1.0000
28										0.0834								0.0740		1.0000
29										0.0857								0.0760		1.0000
30										0.0897								0.0000		1.0000
31										0.0000								0.0755		1.0000
32										0.0000								0.0747		1.0000
33										0.0000								0.0716		1.0000
34										0.0864								0.0767		1.0000
35										0.0000								0.0000		1.0000
36										0.0000								0.0000		1.0000
37										0.0361								0.0000		1.0000
38										0.0754								0.0000		1.0000
39										0.0000								0.0000		1.0000
40										0.0000								0.0000		1.0000
41										0.0000								0.0760		1.0000

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
1	1250							
2	1250							
3	1250							
4	1250							
5	1250							
6	1250							
7	1350							
8	1350							
9	1350							
10	1250							
11	1350							
12	1250							
13	1160							
14	1450							
15	1250							
16	1250							
17	1350							
18	1160							
19	1160							
20	1160							
21	1450							
22	1150							
23	1350							
24	1150							
25	1350							
26	1350						24.5 wt% $NiFe_2O_4/Zn_2Ti_3O_8$	
27	1250						3.5 wt% $Cr_2O_3/CaTiSiO_5$	
28	1250						15 wt% $ZnCr_2O_4$	
29	1250						amorphous	
30	1150						amorphous	
31	1150						10.5 wt% (Ni, Zn)$(Fe,Cr)_2O_4$	
32	1400						amorphous	
33	1380						amorphous	
34	1150						amorphous	
35	1320						15.5 wt% $Mg(Cr,Fe,Al)_2O_4$	
36	1320						15.5 wt% $Mg(Cr,Fe,Al)_2O_4$	
37	1400						4 wt% $AlNi_2Ti$	
38	1450						6.5 wt% $(Fe,Ti)Cr_2O_4$	
39	1150						amorphous	
40	1150						amorphous	
41	1250						13.5 wt% $(Zn,Ni)Cr_2O_4/Cr_2O_3$	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
1					
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25					
26			65 wt% $NaAlSiO_4/NiFe_2O_4$		
27			18 wt% $CaTiSiO_5/Cr_2O_3$		
28			21 wt% $ZnCr_2O_4/TiO_2$		
29			12.5 wt% $MgTi_2O_5$		
30			27 wt% $CaTiSiO_5/NiFe_2O_4$		
31			18 wt% $(Ni,Zn)(Fe,Cr)CrO_4$		
32			93.5 wt% $NaAlSiO_4/ZnAl_2O_4$		
33			11.5 wt% $ZnAl_2O_4$		
34			11.5 wt% $MgTi_2O_5$		
35			19 wt% $Mg(Cr,Fe,Al)_2O_4$		
36			22 wt% $Mg(Cr,Fe,Al)_2O_4$		
37			16.5 wt% $MgAl_2O_4/MgTi_2O_5$		
38			49.5 wt% $NaAlSiO_4/(Fe,Cr)Cr_2O_3$		
39			3 wt% $NiFe_2O_4/(Ca,Na)FeSi_2O_6$		
40			4.5 wt% $NiFe_2O_4/(Ca,Na)FeSi_2O_6$		
41			42 wt% $(Ca,Na)FeSi_2O_6/(Zn,Ni)Cr_2O_4$		

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
1													1250	>580	
2													1250	2.2	
3													1250	2.4	
4													1250	1.3	
5													1250	1.8	
6													1250	1.2	
7													1250	>580	
8													1250	74	
9													1250	97	
10													1250	1.8	
11													1250	6	
12													1250	10.5	
13													1250	35	
14													1250	>580	
15													1250	47	
16													1250	2.5	
17													1250	82	
18													1250	33	
19													1250	30	
20													1250	28	
21													1250	96	
22													1250	1.2	
23													1250	64	
24													1250	0.55	
25													1250	>580	
26													1250	>580	
27													1250	4.4	
28													1250	8.3	
29													1250	7.7	
30													1250	0.13	
31													1250	6.6	
32													1250	8.2	
33													1250	8.4	
34													1250	0.62	
35													1250	>580	
36													1250	>580	
37													1250	140	
38													1250	49.5	
39													1250	3.4	
40													1250	3.3	
41													1250	6.8	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
42																					
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
42																					
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
42											0.2042	0.1135	0.0000	0.0000				0.0173	0.0873	0.0279	
43											0.1086	0.0947	0.0556	0.0354				0.0226	0.1146	0.0155	
44											0.1088	0.0939	0.0549	0.0355				0.0233	0.1185	0.0155	
45											0.1088	0.0939	0.0557	0.0355				0.0233	0.1167	0.0155	
46											0.0000	0.1337	0.0086	0.0000				0.0223	0.1553	0.0000	
47											0.1122	0.0714	0.0989	0.0650				0.0511	0.1009	0.0270	
48											0.2142	0.0604	0.0357	0.0476				0.0000	0.1336	0.0192	
49											0.0000	0.1493	0.0000	0.0267				0.0000	0.1471	0.0000	
50											0.0361	0.1359	0.0000	0.0000				0.0533	0.0896	0.0000	
51											0.0375	0.1344	0.0000	0.0000				0.0488	0.0883	0.0000	
52											0.0361	0.1371	0.0000	0.0000				0.0508	0.0867	0.0000	
53											0.0000	0.0739	0.0000	0.0773				0.0554	0.1413	0.0315	
54											0.2153	0.0615	0.0557	0.0573				0.0000	0.0966	0.0000	
55											0.2230	0.1272	0.0081	0.0000				0.0464	0.1445	0.0226	
56											0.0485	0.1422	0.1119	0.0000				0.0000	0.1370	0.0000	
57											0.1981	0.0638	0.0000	0.0000				0.0000	0.1229	0.0225	
58											0.2093	0.1346	0.0000	0.0000				0.0498	0.1429	0.0000	
59											0.0000	0.0701	0.0976	0.0000				0.0000	0.1022	0.0308	
60											0.0491	0.0725	0.1116	0.0621				0.0000	0.1590	0.0000	
61											0.2236	0.0720	0.1091	0.0000				0.0517	0.1130	0.0000	
62											0.1984	0.1278	0.0292	0.0656				0.0000	0.0790	0.0000	
63											0.0190	0.1446	0.1122	0.0743				0.0519	0.0923	0.0290	
64											0.1919	0.0701	0.1088	0.0000				0.0000	0.1405	0.0288	
65											0.2072	0.0687	0.1082	0.0000				0.0000	0.1332	0.0286	
66											0.2087	0.0687	0.1090	0.0000				0.0000	0.1360	0.0231	
67											0.2219	0.1274	0.0089	0.0000				0.0465	0.1474	0.0248	
68											0.2089	0.1317	0.1013	0.0000				0.0000	0.0979	0.0255	
69											0.0000	0.0713	0.0093	0.0000				0.0000	0.1270	0.0281	
70											0.1220	0.0975	0.0646	0.0419				0.0265	0.1338	0.0174	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
42	0.3610													0.0651							
43	0.4407													0.0337							
44	0.4427													0.0315							
45	0.4426													0.0315							
46	0.5217													0.0724							
47	0.3878													0.0000							
48	0.3526													0.0577							
49	0.5028													0.0000							
50	0.5330													0.0771							
51	0.5395													0.0792							
52	0.5406													0.0748							
53	0.5432													0.0000							
54	0.4486													0.0650							
55	0.3605													0.0678							
56	0.3958													0.0000							
57	0.3732													0.0686							
58	0.3754													0.0000							
59	0.5265													0.0789							
60	0.5456													0.0000							
61	0.4306													0.0000							
62	0.3565													0.0000							
63	0.4024													0.0000							
64	0.3863													0.0000							
65	0.3822													0.0000							
66	0.3814													0.0000							
67	0.3576													0.0657							
68	0.3676													0.0670							
69	0.5394													0.0549							
70	0.3690													0.0333							

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
42										0.0563								0.0674		1.0000
43										0.0414								0.0373		1.0000
44										0.0403								0.0350		1.0000
45										0.0403								0.0362		1.0000
46										0.0860								0.0000		1.0000
47										0.0855								0.0000		1.0000
48										0.0790								0.0000		1.0000
49										0.0960								0.0780		1.0000
50										0.0000								0.0751		1.0000
51										0.0000								0.0723		1.0000
52										0.0000								0.0738		1.0000
53										0.0000								0.0775		1.0000
54										0.0000								0.0000		1.0000
55										0.0000								0.0000		1.0000
56										0.0908								0.0737		1.0000
57										0.0842								0.0668		1.0000
58										0.0880								0.0000		1.0000
59										0.0939								0.0000		1.0000
60										0.0000								0.0000		1.0000
61										0.0000								0.0000		1.0000
62										0.0788								0.0647		1.0000
63										0.0000								0.0744		1.0000
64										0.0000								0.0735		1.0000
65										0.0000								0.0719		1.0000
66										0.0000								0.0731		1.0000
67										0.0000								0.0000		1.0000
68										0.0000								0.0000		1.0000
69										0.0927								0.0772		1.0000
70										0.0536								0.0404		1.0000

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
42	1550						30 wt% (Mg,Ni,Zn)(Al,Cr)2O4/ TiO2	
43	1250						9 wt% (Mg,Ni,Zn)(Cr,Fe)2O4	
44	1250						9 wt% (Mg,Ni,Zn)(Cr,Fe)2O4	
45	1250						9 wt% (Mg,Ni,Zn)(Cr,Fe)2O4	
46	1250						7 wt% MgCr2O4/Cr2O3	
47	1250						4.5 wt% Ni(Fe,Ti)2O4	
48	1300						13.5 wt% Cr2O3/Ni(Cr,Ti,Fe)2O 4	
49	1200						amorphous	
50	1200						18.5 wt% (Mg,Zn)Cr2O4	
51	1200						20.5 wt% (Mg,Zn)Cr2O4	
52	1200						20 wt% (Mg,Zn)Cr2O4	
53	1200						amorphous	
54	1250						9.5 wt% (Cr,Fe)CrO3	
55	1250						16.5 wt% (Ni,Mg)(Cr,Al)CrO4	
56	1050						amorphous	
57	1150						27.5 wt% (Ni,Zn)(Cr,Ti,Al)CrO4	
58	1150						amorphous	
59	1300						11.5 wt% Cr2O3/TiO2	
60	1050						amorphous	
61	1250						amorphous	
62	1300						16.5 wt% unidentifiable	
63	1150						amorphous	
64	1200						amorphous	
65	1200						amorphous	
66	1200						amorphous	
67	1150						18.5 wt% (Mg,Ni)(Al,Cr)CrO4	
68	1400						12.5 wt% Cr2O3/NiCr2O4	
69	1400						14 wt% (Ni,Zn)Cr2O4	
70	1280						14 wt% spinel	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
42			35.5 wt% (Ca,Na)FeSi2O6/(Zn,Ni)Cr2O4		
43			18.5 wt% (Mg,Ni,Zn)(Cr,Fe)2O4/(Mg,Fe)Al2O4		
44			22.5 wt% (Mg,Ni,Zn)(Cr,Fe)2O4/(Mg,Fe)Al2O4		
45			20.5 wt% (Mg,Ni,Zn)(Cr,Fe)2O4/(Mg,Fe)Al2O4		
46			14 wt% Cr2O3/TiO2		
47			32 wt% (Ca,Fe,Mg)SiO3/CaTiSiO5		
48			55 wt% NaAlSiO4/TiO2		
49			4 wt% TiO2		
50			18.5 wt% (Mg,Zn)Cr2O4		
51			19 wt% (Mg,Zn)Cr2O4		
52			18.5 wt% (Mg,Zn)Cr2O4		
53			6.5 wt% NiSiO4		
54			2.4 wt% (Cr,Fe)CrO3/(Na,Ca)Al3Si5O16		
55			17 wt% (Ni,Mg)(Cr,Al)CrO4/NiAl2O4		
56			4 wt% Ca4Ti3O10		
57			40.5 wt% (Ni,Zn)(Cr,Ti,Al)CrO4/NaAlSiO4		
58			15.5 wt% NaAlSiO4/MgTi2O5		
59			19.5 wt% Cr2O3/CaTiSiO5		
60			amorphous		
61			21 wt% NaAlSiO4/CaAl2SiO6		
62			16 wt% Fe2TiO5/ZnAl2O4		
63			30 wt% (Ca,Fe,Mg)SiO3/NiFe2O4		
64			76.5 wt% NaAlSiO4/Ca2Al2SiO7		
65			76 wt% NaAlSiO4/Ca2Al2SiO7		
66			78 wt% NaAlSiO4/Ca2Al2SiO7		
67			18 wt% (Mg,Ni)(Al,Cr)CrO4		
68			16.5 wt% NaAlSiO4/Cr2O3		
69			26 wt% (Ni,Zn)Cr2O4/TiO2		
70					

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
42													1250	>580	
43													1250	22	
44													1250	17.5	
45													1250	24.3	
46													1250	15	
47													1250	1.8	
48													1250	80	
49													1250	2.3	
50													1250	52.3	
51													1250	60	
52													1250	35	
53													1250	1.3	
54													1250	>580	
55													1250	58.5	
56													1250	0.39	
57													1250	>580	
58													1250	7.4	
59													1250	29.3	
60													1250	3.7	
61													1250	13	
62													1250	9	
63													1250	0.9	
64													1250	5.1	
65													1250	6.8	
66													1250	5.7	
67													1250	68	
68													1250	52	
69													1250	15	
70													1250	11.5	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
42																					
43																					
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45																					
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
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Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
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99																					
100																					
101																					
102																					
31-01	0.0800	0.0000	0.1500	0.0000					0.1700			0.6000									
73-01	0.0800	0.0000	0.1500	0.0000					0.1700			0.6000									
27-02	0.0800	0.0200	0.0000	0.0000					0.3000			0.6000									
72-02	0.0800	0.0200	0.0000	0.0000					0.3000			0.6000									
09-03	0.0800	0.0000	0.0000	0.2000					0.1200			0.6000									
47-04	0.0000	0.0600	0.0000	0.0000		0.0009			0.1200	0.0077	0.0598	0.6000	0.0044								0.0026
50-05	0.0000	0.0000	0.0000	0.0000		0.0009			0.1800	0.0077	0.0598	0.6000	0.0044								0.0026
33-06	0.0800	0.2000	0.0000	0.0000					0.1200			0.6000									
59-06	0.0800	0.2000	0.0000	0.0000					0.1200			0.6000									
57-07	0.0000	0.0000	0.0400	0.2400					0.1200			0.6000									
83-08	0.0000	0.2000	0.0000	0.0000					0.2000			0.6000									
01-09	0.0000	0.0000	0.0000	0.2400					0.1600			0.6000									
26-10	0.0000	0.2000	0.0000	0.0800					0.1200			0.6000									
43-11	0.0600	0.0000	0.0000	0.0000		0.0009			0.1200	0.0077	0.0598	0.6000	0.0044								0.0026
74-12	0.0000	0.0000	0.1500	0.0000					0.3000			0.5500									
49-13	0.0000	0.2000	0.1500	0.0000					0.1200			0.5300									
30-14	0.0800	0.0000	0.1500	0.0000		0.0009			0.1200	0.0077	0.0598	0.4300	0.0044								0.0026

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
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102																					
31-01																					
73-01																					
27-02																					
72-02																					
09-03																					
47-04				0.0163	0.0033									0.0101			0.0042		0.0040		
50-05				0.0163	0.0033									0.0101			0.0042		0.0040		
33-06																					
59-06																					
57-07																					
83-08																					
01-09																					
26-10																					
43-11				0.0163	0.0033									0.0101			0.0042		0.0040		
74-12																					
49-13																					
30-14				0.0163	0.0033									0.0101			0.0042		0.0040		

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
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31-01																					
73-01																					
27-02																					
72-02																					
09-03																					
47-04																	0.0033			0.0781	
50-05																	0.0033			0.0781	
33-06																					
59-06																					
57-07																					
83-08																					
01-09																					
26-10																					
43-11																	0.0033			0.0781	
74-12																					
49-13																					
30-14																	0.0033			0.0781	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
71											0.0777	0.0764	0.0393	0.0268				0.0178	0.1124	0.0125	
72											0.1099	0.0555	0.0580	0.0401				0.0244	0.1290	0.0176	
73											0.0882	0.1484	0.0468	0.0309				0.0204	0.1238	0.0145	
74											0.0000	0.1017	0.0664	0.0442				0.0298	0.1392	0.0195	
75											0.2204	0.0768	0.0401	0.0252				0.0167	0.1091	0.0107	
76											0.1168	0.0919	0.0000	0.0417				0.0269	0.1303	0.0173	
77											0.0836	0.0867	0.1141	0.0291				0.0196	0.1233	0.0147	
78											0.1095	0.0889	0.0578	0.0394				0.0000	0.1287	0.0174	
79											0.0917	0.0891	0.0504	0.0341				0.0541	0.1256	0.0148	
80											0.1096	0.0902	0.0586	0.0376				0.0243	0.0849	0.0165	
81											0.0930	0.0875	0.0503	0.0334				0.0205	0.1557	0.0145	
82											0.1077	0.0942	0.0567	0.0380				0.0246	0.1291	0.0200	
83											0.0948	0.0873	0.0397	0.0330				0.0220	0.1235	0.0154	
84											0.1093	0.0933	0.0584	0.0404				0.0264	0.1319	0.0189	
85											0.0918	0.0843	0.0488	0.0330				0.0214	0.1207	0.0143	
86											0.1077	0.0946	0.0576	0.0386				0.0255	0.1310	0.0169	
87											0.0962	0.0778	0.0505	0.0324				0.0211	0.1151	0.0152	
88											0.1080	0.0927	0.0569	0.0000				0.0244	0.1285	0.0170	
89											0.0960	0.0867	0.0487	0.0786				0.0228	0.1274	0.0151	
90											0.1045	0.0931	0.0550	0.0356				0.0233	0.1280	0.0000	
91											0.0968	0.0867	0.0507	0.0355				0.0227	0.1241	0.0377	
92											0.2040	0.0504	0.0318	0.0793				0.0000	0.0871	0.0360	
93											0.2143	0.0532	0.0330	0.0000				0.0000	0.0929	0.0000	
94											0.2073	0.0287	0.0327	0.0000				0.0000	0.0873	0.0000	
95											0.2411	0.0552	0.0000	0.0000				0.0000	0.1466	0.0329	
96											0.0000	0.1204	0.0899	0.0764				0.0000	0.0889	0.0347	
97											0.0000	0.1538	0.0189	0.0955				0.0593	0.1654	0.0000	
98											0.0000	0.1384	0.1176	0.0000				0.0557	0.0972	0.0394	
99											0.0000	0.1194	0.1115	0.0805				0.0000	0.1527	0.0161	
100											0.1519	0.1183	0.0363	0.0000				0.0000	0.1231	0.0000	
101											0.0000	0.1320	0.0391	0.0824				0.0000	0.1326	0.0000	
102											0.0411	0.0982	0.1087	0.0520				0.0388	0.1336	0.0000	
31-01										1.0000	0.0815	0.0000	0.1496	0.0000					0.1665		
73-01										1.0000	0.0830	0.0000	0.1530	0.0000					0.1740		
27-02										1.0000	0.0838	0.0000	0.0021	0.0000					0.2996		
72-02										1.0000	0.0836	0.0000	0.0033	0.0000					0.3084		
09-03										1.0000	0.0814	0.0000	0.0000	0.1719					0.1200		
47-04			0.0253							1.0000	0.0041	0.0601	0.0015	0.0000		0.0008			0.1328	0.0069	0.0533
50-05			0.0253							1.0000	0.0104	0.0000	0.0013	0.0000		0.0008			0.1816	0.0070	0.0547
33-06										1.0000	0.0832	0.1922	0.0014	0.0000					0.1189		
59-06										1.0000	0.0832	0.1945	0.0016	0.0000					0.1193		
57-07										1.0000	0.0111	0.0000	0.0423	0.2002					0.1227		
83-08										1.0000	0.0044	0.1947	0.0025	0.0000					0.2103		
01-09										1.0000	0.0102	0.0000	0.0039	0.2043					0.1636		
26-10										1.0000	0.0064	0.1931	0.0020	0.0680					0.1186		
43-11			0.0253							1.0000	0.0642	0.0000	0.0031	0.0000		0.0008			0.1204	0.0074	0.0571
74-12										1.0000	0.0038	0.0000	0.1492	0.0000					0.3034		
49-13										1.0000	0.0029	0.2005	0.1511	0.0000					0.1280		
30-14			0.0253							1.0000	0.0880	0.0000	0.1548	0.0000		0.0009			0.1272	0.0075	0.0580

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
71	0.5514													0.0255							
72	0.4427													0.0359							
73	0.4290													0.0295							
74	0.4676													0.0351							
75	0.4181													0.0218							
76	0.4409													0.0397							
77	0.4315													0.0277							
78	0.4388													0.0353							
79	0.4377													0.0301							
80	0.4512													0.0358							
81	0.4421													0.0295							
82	0.4460													0.0362							
83	0.4371													0.0314							
84	0.4464													0.0362							
85	0.4274													0.0314							
86	0.4443													0.0000							
87	0.4385													0.0750							
88	0.4538													0.0345							
89	0.4193													0.0308							
90	0.4453													0.0339							
91	0.4366													0.0316							
92	0.5115													0.0000							
93	0.5210													0.0000							
94	0.5263													0.0756							
95	0.5242													0.0000							
96	0.3507													0.0770							
97	0.4184													0.0000							
98	0.3798													0.0850							
99	0.3645													0.0789							
100	0.5080													0.0000							
101	0.5460													0.0000							
102	0.4193													0.0024							
31-01	0.6025																				
73-01	0.5900																				
27-02	0.6145																				
72-02	0.6047																				
09-03	0.6267																				
47-04	0.6055	0.0039								0.0024				0.0145	0.0029						
50-05	0.6053	0.0040								0.0024				0.0149	0.0030						
33-06	0.6043																				
59-06	0.6014																				
57-07	0.6237																				
83-08	0.5881																				
01-09	0.6179																				
26-10	0.6120																				
43-11	0.6022	0.0042								0.0025				0.0156	0.0032						
74-12	0.5436																				
49-13	0.5174																				
30-14	0.4167	0.0043								0.0026				0.0158	0.0032						

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
71																					
72																					
73																					
74																					
75																					
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96																					
97																					
98																					
99																					
100																					
101																					
102																					
31-01																					
73-01																					
27-02																					
72-02																					
09-03																					
47-04			0.0090			0.0037		0.0035													
50-05			0.0092			0.0038		0.0036													
33-06																					
59-06																					
57-07																					
83-08																					
01-09																					
26-10																					
43-11			0.0096			0.0040		0.0038													
74-12																					
49-13																					
30-14			0.0098			0.0041		0.0038													

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
71										0.0341								0.0261		1.0000
72										0.0484								0.0385		1.0000
73										0.0381								0.0303		1.0000
74										0.0541								0.0426		1.0000
75										0.0355								0.0256		1.0000
76										0.0533								0.0413		1.0000
77										0.0412								0.0284		1.0000
78										0.0476								0.0366		1.0000
79										0.0402								0.0322		1.0000
80										0.0529								0.0383		1.0000
81										0.0418								0.0316		1.0000
82										0.0475								0.0000		1.0000
83										0.0413								0.0745		1.0000
84										0.0000								0.0388		1.0000
85										0.0943								0.0324		1.0000
86										0.0470								0.0368		1.0000
87										0.0452								0.0331		1.0000
88										0.0472								0.0370		1.0000
89										0.0416								0.0330		1.0000
90										0.0463								0.0351		1.0000
91										0.0438								0.0338		1.0000
92										0.0000								0.0000		1.0000
93										0.0857								0.0000		1.0000
94										0.0420								0.0000		1.0000
95										0.0000								0.0000		1.0000
96										0.0888								0.0733		1.0000
97										0.0000								0.0886		1.0000
98										0.0869								0.0000		1.0000
99										0.0000								0.0762		1.0000
100										0.0000								0.0624		1.0000
101										0.0000								0.0679		1.0000
102										0.0719								0.0341		1.0000
31-01																				1.0001
73-01																				1.0000
27-02																				1.0000
72-02																				1.0000
09-03																				1.0000
47-04						0.0029			0.0696				0.0225							1.0000
50-05						0.0030			0.0715				0.0232							1.0000
33-06																				1.0000
59-06																				1.0000
57-07																				1.0000
83-08																				1.0000
01-09																				0.9999
26-10																				1.0001
43-11						0.0032			0.0746				0.0242							0.9999
74-12																				1.0000
49-13																				0.9999
30-14						0.0032			0.0757				0.0245							0.9999

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
71	1570						5.9 wt% spinel	
72	1350						13 wt% spinel	
73	1250						9.4 wt% spinel	
74	1150						9.9 wt% spinel	
75	1600						13.9 wt% spinel	
76	1450						19.5 wt% spinel	
77	1150						7.2 wt% spinel	
78	1350						12.6 wt% spinel	
79	1250						11.3 wt% spinel	
80	1450						13.3 wt% spinel	
81	1210						7 wt% spinel	
82	1250						9.4 wt% spinel	
83	1250						12.9 wt% spinel	
84	1250						12.7 wt% spinel	
85	1350						10.2 wt% spinel	
86	1250						amorphous	
87	1550						18.8 wt% spinel	
88	1350						10.7 wt% spinel	
89	1300						12.8wt% spinel	
90	1410						10.1 wt% spinel	
91	1250						15.5 wt% spinel	
92	1610						4.3 wt% unknown	
93	1600						amorphous	
94	1720						10.7 wt% FeNiBO4	
95	1600						2 wt% unknown	
96	1450						18.4 wt% spinel	
97	1050						amorphous	
98	1350						10.9 wt% Cr2O3	
99	1450						13.4 wt% spinel	
100	1400						amorphous	
101	1250						amorphous	
102	1200						amorphous	
31-01					amorphous			
73-01					amorphous			
27-02					amorphous			
72-02					amorphous			
09-03					amorphous			
47-04					0.05 crystallinity			
50-05					amorphous			
33-06					amorphous			
59-06					amorphous			
57-07					amorphous			
83-08					amorphous			
01-09					amorphous			
26-10					amorphous			
43-11					0.16 crystallinity			
74-12					amorphous			
49-13					amorphous			
30-14					amorphous			

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
71					
72					
73					
74					
75					
76					
77					
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79					
80					
81					
82					
83					
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92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
31-01	0.17 crystallinity			0.05 crystallinity	
73-01	0.19 crystallinity			0.06 crystallinity	
27-02	amorphous			amorphous	
72-02	amorphous			amorphous	
09-03	0.06 crystallinity			amorphous	
47-04	amorphous			0.04 crystallinity	
50-05	0.11 crystallinity			amorphous	
33-06	amorphous			amorphous	
59-06	amorphous			amorphous	
57-07	amorphous			amorphous	
83-08	amorphous			amorphous	
01-09	amorphous			amorphous	
26-10	amorphous			amorphous	
43-11	0.31 crystallinity			0.05 crystallinity	
74-12	0.84 crystallinity			0.76 crystallinity	
49-13	amorphous			amorphous	
30-14	0.64 crystallinity			0.41 crystallinity	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
71													1250	23	
72													1250	25	
73													1250	6.1	
74													1250	4.6	
75													1250	59	
76													1250	72	
77													1250	2.8	
78													1250	18	
79													1250	13	
80													1250	35	
81													1250	7	
82													1250	10	
83													1250	14	
84													1250	15	
85													1250	8.2	
86													1250	2.7	
87													1250	43	
88													1250	8.6	
89													1250	21	
90													1250		
91													1250	6.1	
92													1250	64	
93													1250	180	
94													1250		
95													1250	230	
96													1250	19	
97													1250	0.13	
98													1250	4	
99													1250	11	
100													1250	16	
101													1250	1.6	
102													1250	0.45	
31-01												1294	1454	3	
73-01												1307	1460	3	
27-02												1240	1431	3	
72-02												1168	1332	3	
09-03												1586	1747	3	
47-04												1425	1600	3	
50-05												1364	1522	3	
33-06												1327	1503	3	
59-06												1402	1589	3	
57-07												1270	1445	3	
83-08												1050	1176	3	
01-09												1345	1503	3	
26-10												1198	1364	3	
43-11												1625	1806	3	
74-12													1176	3	
49-13												1032	1152	3	
30-14												1220	1383	3	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
71																					
72																					
73																					
74																					
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101																					
102																					
31-01																					
73-01																					
27-02																					
72-02																					
09-03																					
47-04																					
50-05																					
33-06																					
59-06																					
57-07																					
83-08																					
01-09																					
26-10																					
43-11																					
74-12																					
49-13																					
30-14																					

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
71																
72																
73																
74																
75																
76																
77																
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101																
102																
31-01																
73-01																
27-02																
72-02																
09-03																
47-04																
50-05																
33-06																
59-06																
57-07																
83-08																
01-09																
26-10																
43-11																
74-12																
49-13																
30-14																

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
71												
72												
73												
74												
75												
76												
77												
78												
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96												
97												
98												
99												
100												
101												
102												
31-01												
73-01												
27-02												
72-02												
09-03												
47-04												
50-05												
33-06												
59-06												
57-07												
83-08												
01-09												
26-10												
43-11												
74-12												
49-13												
30-14												

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
03-15	0.0000	0.0000	0.0000	0.2400		0.0009			0.1200	0.0077	0.0598	0.4200	0.0044								0.0026
69-16	0.0800	0.0000	0.1500	0.2400					0.1200			0.4100									
85-16	0.0800	0.0000	0.1500	0.2400					0.1200			0.4100									
45-17	0.0800	0.0000	0.0000	0.0000		0.0009			0.3000	0.0077	0.0598	0.4000	0.0044								0.0026
34-18	0.0800	0.2000	0.0000	0.0000		0.0009			0.1200	0.0077	0.0598	0.3800	0.0044								0.0026
36-19	0.0800	0.0000	0.0000	0.2400					0.3000			0.3800									
60-20	0.0800	0.2000	0.0000	0.2400					0.1200			0.3600									
17-21	0.0000	0.1100	0.0000	0.2400					0.3000			0.3500									
20-22	0.0000	0.0000	0.0000	0.2400		0.0004			0.3000	0.0039	0.0299	0.3500	0.0022								0.0013
44-23	0.0000	0.0000	0.0000	0.1300		0.0009			0.3000	0.0077	0.0598	0.3500	0.0044								0.0026
82-24	0.0000	0.2000	0.0000	0.0000		0.0006			0.3000	0.0053	0.0408	0.3500	0.0030								0.0018
77-25	0.0800	0.2000	0.1500	0.1000					0.1200			0.3500									
75-26	0.0800	0.0800	0.1500	0.0000		0.0009			0.1200	0.0077	0.0598	0.3500	0.0044								0.0026
22-27	0.0800	0.2000	0.0700	0.0000					0.3000			0.3500									
55-27	0.0800	0.2000	0.0700	0.0000					0.3000			0.3500									
64-28	0.0000	0.2000	0.0900	0.2400					0.1200			0.3500									
76-29	0.0000	0.2000	0.1100	0.0000		0.0009			0.1200	0.0077	0.0598	0.3500	0.0044								0.0026
10-30	0.0000	0.0000	0.1500	0.2000					0.3000			0.3500									
37-31	0.0000	0.0000	0.1500	0.0000		0.0009			0.2800	0.0077	0.0598	0.3500	0.0044								0.0026
48-32	0.0800	0.0000	0.0000	0.2300		0.0009			0.1200	0.0077	0.0598	0.3500	0.0044								0.0026
66-33	0.0000	0.2000	0.1500	0.0000					0.3000			0.3500									
71-33	0.0000	0.2000	0.1500	0.0000					0.3000			0.3500									
07-34	0.0374	0.0809	0.0630	0.0926		0.0003			0.1939	0.0031	0.0237	0.4450	0.0017								0.0010
42-34	0.0374	0.0809	0.0630	0.0926		0.0003			0.1939	0.0031	0.0237	0.4450	0.0017								0.0010
63-34	0.0374	0.0809	0.0630	0.0926		0.0003			0.1939	0.0031	0.0237	0.4450	0.0017								0.0010
81-34	0.0374	0.0809	0.0630	0.0926		0.0003			0.1939	0.0031	0.0237	0.4450	0.0017								0.0010
35-35	0.0456	0.0986	0.0768	0.1128		0.0004			0.2100	0.0037	0.0289	0.3500	0.0021								0.0013
21-36	0.0241	0.0521	0.0406	0.0596		0.0002			0.1676	0.0020	0.0152	0.5999	0.0011								0.0007
29-37	0.0441	0.0000	0.0743	0.1093		0.0004			0.2072	0.0036	0.0280	0.4621	0.0021								0.0012
02-38	0.0275	0.2000	0.0463	0.0680		0.0003			0.1743	0.0022	0.0174	0.4198	0.0013								0.0008
58-39	0.0435	0.0940	0.0732	0.1076		0.0004			0.1200	0.0035	0.0275	0.4604	0.0020								0.0012
05-40	0.0287	0.0621	0.0483	0.0711		0.0003			0.3000	0.0023	0.0182	0.4229	0.0013								0.0008
24-41	0.0424	0.0918	0.0000	0.1051		0.0004			0.2039	0.0035	0.0269	0.4578	0.0020								0.0012
52-42	0.0304	0.0658	0.1500	0.0753		0.0003			0.1801	0.0025	0.0193	0.4273	0.0014								0.0009
79-43	0.0000	0.0870	0.0678	0.0996		0.0004			0.1995	0.0033	0.0255	0.4522	0.0019								0.0011
04-44	0.0800	0.0739	0.0576	0.0846		0.0003			0.1875	0.0028	0.0217	0.4368	0.0016								0.0010
28-45	0.0453	0.0980	0.0763	0.0000		0.0004			0.2095	0.0037	0.0287	0.4651	0.0021								0.0013
80-46	0.0248	0.0536	0.0418	0.2400		0.0002			0.1690	0.0020	0.0157	0.4130	0.0012								0.0007
40-47	0.0448	0.0968	0.0754	0.1108					0.2085			0.4637									
78-48	0.0262	0.0566	0.0441	0.0648		0.0009			0.1717	0.0077	0.0598	0.4165	0.0044								0.0026
65-49	0.0000	0.0000	0.1500	0.2000		0.0009			0.1200	0.0063	0.0489	0.3500	0.0036								0.0022
68-50	0.0800	0.0000	0.1500	0.0600		0.0009			0.3000	0.0021	0.0163	0.3500	0.0012								0.0007
84-51	0.0000	0.2000	0.0000	0.1750		0.0009			0.1200	0.0054	0.0421	0.3500	0.0031								0.0019
53-52	0.0000	0.0000	0.1500	0.0650		0.0009			0.1200	0.0023	0.0177	0.6000	0.0013								0.0008
38-53	0.0000	0.0000	0.0000	0.0500		0.0009			0.3000	0.0018	0.0136	0.6000	0.0010								0.0006
62-54	0.0400	0.2000	0.1500	0.0000		0.0009			0.1200	0.0049	0.0381	0.3500	0.0028								0.0017
70-55	0.0400	0.2000	0.0000	0.1100					0.3000			0.3500									
46-56	0.0800	0.0000	0.0750	0.2400		0.0009			0.1200	0.0047	0.0367	0.3500	0.0027								0.0016
11-57	0.0400	0.0900	0.0000	0.0000		0.0009			0.3000	0.0077	0.0598	0.3500	0.0044								0.0026

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
03-15				0.0163	0.0033									0.0101			0.0042		0.0040		
69-16																					
85-16																					
45-17				0.0163	0.0033									0.0101			0.0042		0.0040		
34-18				0.0163	0.0033									0.0101			0.0042		0.0040		
36-19																					
60-20																					
17-21																					
20-22				0.0081	0.0017									0.0051			0.0021		0.0020		
44-23				0.0163	0.0033									0.0101			0.0042		0.0040		
82-24				0.0111	0.0023									0.0069			0.0029		0.0027		
77-25																					
75-26				0.0163	0.0033									0.0101			0.0042		0.0040		
22-27																					
55-27																					
64-28																					
76-29				0.0163	0.0033									0.0101			0.0042		0.0040		
10-30																					
37-31				0.0163	0.0033									0.0101			0.0042		0.0040		
48-32				0.0163	0.0033									0.0101			0.0042		0.0040		
66-33																					
71-33																					
07-34				0.0065	0.0013									0.0040			0.0017		0.0016		
42-34				0.0065	0.0013									0.0040			0.0017		0.0016		
63-34				0.0065	0.0013									0.0040			0.0017		0.0016		
81-34				0.0065	0.0013									0.0040			0.0017		0.0016		
35-35				0.0079	0.0016									0.0049			0.0020		0.0019		
21-36				0.0042	0.0008									0.0026			0.0011		0.0010		
29-37				0.0076	0.0015									0.0047			0.0020		0.0019		
02-38				0.0047	0.0010									0.0029			0.0012		0.0012		
58-39				0.0075	0.0015									0.0047			0.0019		0.0018		
05-40				0.0050	0.0010									0.0031			0.0013		0.0012		
24-41				0.0073	0.0015									0.0045			0.0019		0.0018		
52-42				0.0053	0.0011									0.0033			0.0013		0.0013		
79-43				0.0069	0.0014									0.0043			0.0018		0.0017		
04-44				0.0059	0.0012									0.0037			0.0015		0.0014		
28-45				0.0078	0.0016									0.0049			0.0020		0.0019		
80-46				0.0043	0.0009									0.0027			0.0011		0.0010		
40-47																					
78-48				0.0163	0.0033									0.0101			0.0042		0.0040		
65-49				0.0133	0.0027									0.0083			0.0034		0.0032		
68-50				0.0044	0.0009									0.0028			0.0011		0.0011		
84-51				0.0115	0.0023									0.0071			0.0029		0.0028		
53-52				0.0048	0.0010									0.0030			0.0012		0.0012		
38-53				0.0037	0.0008									0.0023			0.0010		0.0009		
62-54				0.0104	0.0021									0.0064			0.0027		0.0025		
70-55																					
46-56				0.0100	0.0020									0.0062			0.0026		0.0024		
11-57				0.0163	0.0033									0.0101			0.0042		0.0040		

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
03-15																	0.0033			0.0781	
69-16																					
85-16																					
45-17																	0.0033			0.0781	
34-18																	0.0033			0.0781	
36-19																					
60-20																					
17-21																					
20-22																	0.0017			0.0391	
44-23																	0.0033			0.0781	
82-24																	0.0023			0.0533	
77-25																					
75-26																	0.0033			0.0781	
22-27																					
55-27																					
64-28																					
76-29																	0.0033			0.0781	
10-30																					
37-31																	0.0033			0.0781	
48-32																	0.0033			0.0781	
66-33																					
71-33																					
07-34																	0.0013			0.0310	
42-34																	0.0013			0.0310	
63-34																	0.0013			0.0310	
81-34																	0.0013			0.0310	
35-35																	0.0016			0.0377	
21-36																	0.0008			0.0199	
29-37																	0.0015			0.0365	
02-38																	0.0010			0.0228	
58-39																	0.0015			0.0360	
05-40																	0.0010			0.0237	
24-41																	0.0015			0.0351	
52-42																	0.0011			0.0252	
79-43																	0.0014			0.0333	
04-44																	0.0012			0.0283	
28-45																	0.0016			0.0375	
80-46																	0.0009			0.0205	
40-47																					
78-48																	0.0033			0.0781	
65-49																	0.0027			0.0639	
68-50																	0.0009			0.0213	
84-51																	0.0023			0.0550	
53-52																	0.0010			0.0231	
38-53																	0.0008			0.0178	
62-54																	0.0021			0.0497	
70-55																					
46-56																	0.0020			0.0479	
11-57																	0.0033			0.0781	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
03-15			0.0253							1.0000	0.0134	0.0000	0.0031	0.2086		0.0008			0.1239	0.0074	0.0574
69-16										1.0000	0.0896	0.0000	0.1568	0.2037					0.1273		
85-16										1.0000	0.0883	0.0000	0.1584	0.2000					0.1259		
45-17			0.0253							1.0000	0.0825	0.0000	0.0007	0.0000		0.0008			0.2984	0.0074	0.0576
34-18			0.0253							1.0000	0.0847	0.1992	0.0020	0.0000		0.0008			0.1215	0.0071	0.0553
36-19										1.0000	0.0898	0.0000	0.0026	0.2031					0.2984		
60-20										1.0000	0.0848	0.2356	0.0024	0.1943					0.1172		
17-21										1.0000	0.0081	0.1126	0.0022	0.2050					0.2979		
20-22			0.0127							1.0000	0.0104	0.0000	0.0039	0.2085		0.0004			0.2956	0.0038	0.0292
44-23			0.0253							1.0000	0.0090	0.0000	0.0016	0.1151		0.0008			0.3013	0.0073	0.0570
82-24			0.0173							1.0003	0.0034	0.1909	0.0000	0.0000		0.0007			0.2933	0.0062	0.0474
77-25										1.0000	0.0845	0.1976	0.1548	0.0845					0.1253		
75-26			0.0253							1.0000	0.0854	0.0830	0.1502	0.0000		0.0008			0.1229	0.0072	0.0558
22-27										1.0000	0.0827	0.1982	0.0746	0.0000					0.2891		
55-27										1.0000	0.0817	0.1962	0.0707	0.0000					0.3038		
64-28										1.0000	0.0085	0.1997	0.0918	0.2017					0.1251		
76-29			0.0253							1.0000	0.0046	0.1925	0.1112	0.0000		0.0009			0.1221	0.0075	0.0581
10-30										1.0000	0.0069	0.0000	0.1527	0.1701					0.3003		
37-31			0.0253							1.0000	0.0040	0.0000	0.1531	0.0000		0.0009			0.2813	0.0075	0.0581
48-32			0.0253							1.0000	0.0818	0.0000	0.0040	0.1749		0.0008			0.1097	0.0069	0.0532
66-33										1.0000	0.0025	0.1918	0.1535	0.0000					0.3069		
71-33										1.0000	0.0428	0.0911	0.0666	0.0000					0.2745		
07-34			0.0100							1.0000	0.0451	0.0841	0.0625	0.0810		0.0003			0.1917	0.0029	0.0224
42-34			0.0100							1.0000	0.0446	0.0810	0.0633	0.0800		0.0003			0.1973	0.0027	0.0209
63-34			0.0100							1.0000	0.0442	0.0802	0.0627	0.0792		0.0003			0.1984	0.0029	0.0225
81-34			0.0100							1.0000	0.0442	0.0802	0.0637	0.0791		0.0003			0.1963	0.0030	0.0229
35-35			0.0122							1.0000	0.0551	0.1044	0.0805	0.0580		0.0004			0.2193	0.0033	0.0254
21-36			0.0065							1.0000	0.0292	0.0514	0.0423	0.0524		0.0002			0.1633	0.0021	0.0161
29-37			0.0118							0.9999	0.0524	0.0000	0.0768	0.0956		0.0004			0.2095	0.0032	0.0251
02-38			0.0074							1.0000	0.0329	0.2044	0.0462	0.0596		0.0002			0.1736	0.0022	0.0169
58-39			0.0116							1.0000	0.0524	0.0929	0.0709	0.0919		0.0004			0.1237	0.0031	0.0244
05-40			0.0077							1.0000	0.0346	0.0631	0.0508	0.0620		0.0003			0.2873	0.0028	0.0218
24-41			0.0114							1.0000	0.0498	0.0916	0.0060	0.0906		0.0004			0.2010	0.0034	0.0267
52-42			0.0082							0.9999	0.0365	0.0657	0.1511	0.0646		0.0002			0.1814	0.0021	0.0166
79-43			0.0108							0.9999	0.0077	0.0870	0.0686	0.0849		0.0004			0.2077	0.0031	0.0244
04-44			0.0092							1.0001	0.0875	0.0763	0.0590	0.0743		0.0003			0.1872	0.0026	0.0201
28-45			0.0122							0.9999	0.0504	0.0977	0.0793	0.0000		0.0004			0.2082	0.0032	0.0251
80-46			0.0066							1.0000	0.0359	0.0553	0.0430	0.1998		0.0002			0.1742	0.0021	0.0167
40-47										1.0000	0.0507	0.0954	0.0775	0.0974					0.2078		
78-48			0.0253							0.9999	0.0350	0.0577	0.0433	0.0566		0.0008			0.1792	0.0072	0.0557
65-49			0.0207							1.0001	0.0095	0.0000	0.1545	0.1713		0.0008			0.1251	0.0056	0.0438
68-50			0.0069							1.0006	0.0842	0.0000	0.1500	0.0503		0.0009			0.3010	0.0021	0.0166
84-51			0.0178							1.0002	0.0093	0.1974	0.0020	0.1490		0.0009			0.1234	0.0054	0.0416
53-52			0.0075							1.0006	0.0064	0.0000	0.1489	0.0557		0.0009			0.1205	0.0023	0.0176
38-53			0.0058							1.0007	0.0064	0.0000	0.0017	0.0427		0.0009			0.2944	0.0018	0.0139
62-54			0.0161							1.0003	0.0438	0.2004	0.1545	0.0000		0.0008			0.1232	0.0043	0.0335
70-55										1.0000	0.0452	0.1977	0.0025	0.0933					0.3101		
46-56			0.0155							1.0003	0.0913	0.0000	0.0810	0.2020		0.0009			0.1231	0.0047	0.0362
11-57			0.0253							1.0000	0.0440	0.0911	0.0021	0.0000		0.0008			0.2977	0.0072	0.0558

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
03-15	0.4398	0.0042								0.0025				0.0156	0.0032						
69-16	0.4226																				
85-16	0.4274																				
45-17	0.4063	0.0042								0.0025				0.0157	0.0032						
34-18	0.3892	0.0041								0.0024				0.0151	0.0031						
36-19	0.4062																				
60-20	0.3657																				
17-21	0.3742																				
20-22	0.3740	0.0022								0.0013				0.0080	0.0016						
44-23	0.3634	0.0042								0.0025				0.0155	0.0031						
82-24	0.3381	0.0035								0.0021				0.0129	0.0027						
77-25	0.3534																				
75-26	0.3533	0.0041								0.0025				0.0152	0.0031						
22-27	0.3555																				
55-27	0.3476																				
64-28	0.3732																				
76-29	0.3559	0.0043								0.0026				0.0158	0.0032						
10-30	0.3700																				
37-31	0.3478	0.0043								0.0026				0.0158	0.0032						
48-32	0.4336	0.0039								0.0024				0.0145	0.0029						
66-33	0.3453																				
71-33	0.3426																				
07-34	0.4532	0.0016								0.0009				0.0061	0.0012						
42-34	0.4569	0.0015								0.0009				0.0057	0.0011						
63-34	0.4524	0.0016								0.0010				0.0062	0.0012						
81-34	0.4523	0.0016								0.0010				0.0063	0.0013						
35-35	0.3894	0.0018								0.0011				0.0069	0.0014						
21-36	0.6020	0.0012								0.0007				0.0044	0.0009						
29-37	0.4735	0.0018								0.0011				0.0068	0.0014						
02-38	0.4212	0.0012								0.0007				0.0046	0.0009						
58-39	0.4785	0.0018								0.0011				0.0066	0.0013						
05-40	0.4220	0.0016								0.0010				0.0059	0.0012						
24-41	0.4628	0.0020								0.0012				0.0073	0.0015						
52-42	0.4399	0.0012								0.0007				0.0045	0.0009						
79-43	0.4544	0.0018								0.0011				0.0067	0.0013						
04-44	0.4416	0.0015								0.0009				0.0055	0.0011						
28-45	0.4721	0.0018								0.0011				0.0068	0.0014						
80-46	0.4303	0.0012								0.0007				0.0045	0.0009						
40-47	0.4712																				
78-48	0.4233	0.0041								0.0025				0.0152	0.0031						
65-49	0.3784	0.0032								0.0019				0.0119	0.0024						
68-50	0.3534	0.0012								0.0007				0.0045	0.0009						
84-51	0.3659	0.0031								0.0018				0.0113	0.0023						
53-52	0.6036	0.0013								0.0008				0.0048	0.0010						
38-53	0.6038	0.0010								0.0006				0.0038	0.0008						
62-54	0.3549	0.0025								0.0015				0.0091	0.0018						
70-55	0.3512																				
46-56	0.3692	0.0027								0.0016				0.0099	0.0020						
11-57	0.3598	0.0041								0.0025				0.0152	0.0031						

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
03-15			0.0097			0.0040		0.0038													
69-16																					
85-16																					
45-17			0.0097			0.0040		0.0038													
34-18			0.0093			0.0039		0.0037													
36-19																					
60-20																					
17-21																					
20-22			0.0050			0.0021		0.0019													
44-23			0.0096			0.0040		0.0038													
82-24			0.0080			0.0034		0.0031													
77-25																					
75-26			0.0094			0.0039		0.0037													
22-27																					
55-27																					
64-28																					
76-29			0.0098			0.0041		0.0038													
10-30																					
37-31			0.0098			0.0041		0.0039													
48-32			0.0090			0.0037		0.0035													
66-33																					
71-33																					
07-34			0.0038			0.0016		0.0015													
42-34			0.0035			0.0015		0.0014													
63-34			0.0038			0.0016		0.0015													
81-34			0.0039			0.0016		0.0015													
35-35			0.0043			0.0018		0.0017													
21-36			0.0027			0.0011		0.0011													
29-37			0.0042			0.0018		0.0017													
02-38			0.0028			0.0012		0.0011													
58-39			0.0041			0.0017		0.0016													
05-40			0.0037			0.0015		0.0014													
24-41			0.0045			0.0019		0.0018													
52-42			0.0028			0.0012		0.0011													
79-43			0.0041			0.0017		0.0016													
04-44			0.0034			0.0014		0.0013													
28-45			0.0042			0.0018		0.0017													
80-46			0.0028			0.0012		0.0011													
40-47																					
78-48			0.0094			0.0039		0.0037													
65-49			0.0074			0.0031		0.0029													
68-50			0.0028			0.0012		0.0011													
84-51			0.0070			0.0029		0.0028													
53-52			0.0030			0.0012		0.0012													
38-53			0.0023			0.0010		0.0009													
62-54			0.0057			0.0023		0.0022													
70-55																					
46-56			0.0061			0.0025		0.0024													
11-57			0.0094			0.0039		0.0037													

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
03-15						0.0032			0.0750				0.0243							1.0000
69-16																				1.0000
85-16																				1.0000
45-17						0.0032			0.0753				0.0244							0.9999
34-18						0.0031			0.0722				0.0234							1.0000
36-19																				1.0001
60-20																				1.0000
17-21																				1.0000
20-22						0.0016			0.0382				0.0124							0.9999
44-23						0.0031			0.0744				0.0241							1.0000
82-24						0.0027			0.0620				0.0201							1.0004
77-25																				1.0001
75-26						0.0031			0.0728				0.0236							1.0000
22-27																				1.0001
55-27																				1.0000
64-28																				1.0000
76-29						0.0032			0.0758				0.0246							0.9999
10-30																				1.0000
37-31						0.0032			0.0759				0.0246							1.0001
48-32						0.0029			0.0695				0.0225							0.9999
66-33																				1.0000
71-33																				0.8176
07-34						0.0012			0.0293				0.0094							0.9999
42-34						0.0011			0.0273				0.0088							1.0000
63-34						0.0012			0.0295				0.0095							1.0000
81-34						0.0013			0.0299				0.0097							1.0000
35-35						0.0014			0.0331				0.0107							1.0000
21-36						0.0009			0.0210				0.0068							0.9998
29-37						0.0014			0.0327				0.0106							1.0000
02-38						0.0009			0.0220				0.0071							0.9999
58-39						0.0013			0.0318				0.0103							1.0000
05-40						0.0012			0.0284				0.0092							0.9999
24-41						0.0015			0.0349				0.0113							1.0001
52-42						0.0009			0.0216				0.0070							1.0001
79-43						0.0013			0.0319				0.0103							1.0001
04-44						0.0011			0.0263				0.0085							1.0000
28-45						0.0014			0.0328				0.0106							1.0000
80-46						0.0009			0.0218				0.0071							0.9999
40-47																				1.0000
78-48						0.0031			0.0727				0.0236							1.0000
65-49						0.0024			0.0572				0.0185							1.0001
68-50						0.0009			0.0217				0.0070							1.0005
84-51						0.0023			0.0544				0.0176							1.0003
53-52						0.0010			0.0230				0.0075							1.0006
38-53						0.0008			0.0181				0.0059							1.0007
62-54						0.0018			0.0437				0.0142							1.0003
70-55																				1.0000
46-56						0.0020			0.0473				0.0153							1.0002
11-57						0.0031			0.0729				0.0236							1.0000

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
03-15					amorphous			
69-16					amorphous			
85-16					amorphous			
45-17					0.14 crystallinity			
34-18					amorphous			
36-19					amorphous			
60-20					0.12 crystallinity			
17-21					amorphous			
20-22					0.71 crystallinity			
44-23					0.42 crystallinity			
82-24					amorphous			
77-25					amorphous			
75-26					amorphous			
22-27					amorphous			
55-27					amorphous			
64-28					amorphous			
76-29					amorphous			
10-30					0.83 crystallinity			
37-31					1.88 crystallinity			
48-32					0.52 crystallinity			
66-33					amorphous			
71-33					amorphous			
07-34					amorphous			
42-34					amorphous			
63-34					amorphous			
81-34					amorphous			
35-35					0.09 crystallinity			
21-36					amorphous			
29-37					amorphous			
02-38					amorphous			
58-39					amorphous			
05-40					amorphous			
24-41					amorphous			
52-42					amorphous			
79-43					0.09 crystallinity			
04-44					amorphous			
28-45					amorphous			
80-46					amorphous			
40-47					amorphous			
78-48					amorphous			
65-49					amorphous			
68-50					1.61 crystallinity			
84-51					amorphous			
53-52					amorphous			
38-53					amorphous			
62-54					amorphous			
70-55					amorphous			
46-56					0.42 crystallinity			
11-57					amorphous			

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
03-15	0.45 crystallinity			0.53 crystallinity	
69-16	1.66 crystallinity			0.25 crystallinity	
85-16	1.60 crystallinity			0.43 crystallinity	
45-17	0.38 crystallinity			0.31 crystallinity	
34-18	0.88 crystallinity			0.38 crystallinity	
36-19	0.04 crystallinity			amorphous	
60-20	0.34 crystallinity			0.18 crystallinity	
17-21	amorphous			amorphous	
20-22	0.02 crystallinity			amorphous	
44-23	0.40 crystallinity			0.27 crystallinity	
82-24	amorphous			0.02 crystallinity	
77-25	amorphous			amorphous	
75-26	0.52 crystallinity			0.25 crystallinity	
22-27	0.14 crystallinity			0.14 crystallinity	
55-27	0.06 crystallinity			0.14 crystallinity	
64-28	amorphous			amorphous	
76-29	0.06 crystallinity			0.07 crystallinity	
10-30	1.26 crystallinity			1.18 crystallinity	
37-31	2.20 crystallinity			1.83 crystallinity	
48-32	1.41 crystallinity			1.03 crystallinity	
66-33	0.91 crystallinity			0.67 crystallinity	
71-33	0.87 crystallinity			0.58 crystallinity	
07-34	amorphous			amorphous	
42-34	amorphous			amorphous	
63-34	amorphous			amorphous	
81-34	amorphous			amorphous	
35-35	amorphous			amorphous	
21-36	amorphous			amorphous	
29-37	amorphous			amorphous	
02-38	amorphous			amorphous	
58-39	amorphous			amorphous	
05-40	amorphous			0.22 crystallinity	
24-41	amorphous			amorphous	
52-42	amorphous			0.07 crystallinity	
79-43	amorphous			amorphous	
04-44	amorphous			0.59 crystallinity	
28-45	amorphous			amorphous	
80-46	amorphous			amorphous	
40-47	amorphous			amorphous	
78-48	0.09 crystallinity			0.05 crystallinity	
65-49	0.59 crystallinity			0.29 crystallinity	
68-50	0.99 crystallinity			0.85 crystallinity	
84-51	0.38 crystallinity			0.25 crystallinity	
53-52	amorphous			amorphous	
38-53	amorphous			amorphous	
62-54	0.07 crystallinity			0.05 crystallinity	
70-55	amorphous			amorphous	
46-56	0.98 crystallinity			0.55 crystallinity	
11-57	0.07 crystallinity			0.07 crystallinity	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
03-15												1327	1399	3	
69-16												1187	1317	3	
85-16												1166	1307	3	
45-17												1191	1330	3	
34-18												1189	1343	3	
36-19												1112	1249	3	
60-20													1258	3	
17-21												758	870	3	
20-22												951	1073	3	
44-23															
82-24												820	886	3	
77-25													1043	3	
75-26													1195	3	
22-27												810	897	3	
55-27												807	910	3	
64-28												951	1055	3	
76-29															
10-30												1034	1064	3	
37-31															
48-32												1324	1513	3	
66-33															
71-33															
07-34												1052	1172	3	
42-34												1048	1183	3	
63-34												1078	1222	3	
81-34												1043	1195	3	
35-35												941	1039	3	
21-36												1265	1436	3	
29-37												1124	1297	3	
02-38												977	1062	3	
58-39												1180	1312	3	
05-40												919	1026	3	
24-41												1089	1240	3	
52-42												1006	1124	3	
79-43												1001	1126	3	
04-44												1122	1254	3	
28-45												1026	1168	3	
80-46												1067	1215	3	
40-47												1021	1147	3	
78-48													1231	3	
65-49															
68-50												1007	1114	3	
84-51												1060	1162	3	
53-52												1268	1416	3	
38-53												1191	1374	3	
62-54															
70-55													886	3	
46-56												1202	1317	3	
11-57													998	3	

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
03-15																					
69-16																					
85-16																					
45-17																					
34-18																					
36-19																					
60-20																					
17-21																					
20-22																					
44-23																					
82-24																					
77-25																					
75-26																					
22-27																					
55-27																					
64-28																					
76-29																					
10-30																					
37-31																					
48-32																					
66-33																					
71-33																					
07-34																					
42-34																					
63-34																					
81-34																					
35-35																					
21-36																					
29-37																					
02-38																					
58-39																					
05-40																					
24-41																					
52-42																					
79-43																					
04-44																					
28-45																					
80-46																					
40-47																					
78-48																					
65-49																					
68-50																					
84-51																					
53-52																					
38-53																					
62-54																					
70-55																					
46-56																					
11-57																					

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
03-15																
69-16																
85-16																
45-17																
34-18																
36-19																
60-20																
17-21																
20-22																
44-23																
82-24																
77-25																
75-26																
22-27																
55-27																
64-28																
76-29																
10-30																
37-31																
48-32																
66-33																
71-33																
07-34																
42-34																
63-34																
81-34																
35-35																
21-36																
29-37																
02-38																
58-39																
05-40																
24-41																
52-42																
79-43																
04-44																
28-45																
80-46																
40-47																
78-48																
65-49																
68-50																
84-51																
53-52																
38-53																
62-54																
70-55																
46-56																
11-57																

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
03-15												
69-16												
85-16												
45-17												
34-18												
36-19												
60-20												
17-21												
20-22												
44-23												
82-24												
77-25												
75-26												
22-27												
55-27												
64-28												
76-29												
10-30												
37-31												
48-32												
66-33												
71-33												
07-34												
42-34												
63-34												
81-34												
35-35												
21-36												
29-37												
02-38												
58-39												
05-40												
24-41												
52-42												
79-43												
04-44												
28-45												
80-46												
40-47												
78-48												
65-49												
68-50												
84-51												
53-52												
38-53												
62-54												
70-55												
46-56												
11-57												

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
16-58	0.0000	0.0700	0.1500	0.2400					0.1900			0.3500									
39-59	0.1200	0.0000	0.1300	0.0600		0.0009			0.0700	0.0021	0.0163	0.5600	0.0012								0.0007
13-60	0.0000	0.0900	0.0200	0.1550		0.0005			0.1600	0.0040	0.0313	0.4600	0.0023								0.0014
61-60	0.0000	0.0900	0.0200	0.1550		0.0005			0.1600	0.0040	0.0313	0.4600	0.0023								0.0014
23-61	0.0000	0.0650	0.0100	0.1550		0.0005			0.1350	0.0040	0.0313	0.5200	0.0023								0.0014
08-62	0.0550	0.1050	0.0100	0.1350					0.1650			0.5300									
41-63	0.1200	0.1050	0.0100	0.0700					0.1650			0.5300									
25-64	0.1200	0.1200	0.0000	0.0000					0.1600			0.6000									
12-65	0.0000	0.1200	0.0000	0.1200					0.1600			0.6000									
51-66	0.0600	0.1200	0.0000	0.0600					0.1600			0.6000									
14-67	0.0000	0.0900	0.0000	0.2400					0.0700			0.6000									
56-68	0.0000	0.0000	0.1100	0.0000		0.0009			0.0700	0.0077	0.0598	0.6000	0.0044								0.0026
18-69	0.1200	0.0000	0.0000	0.0000		0.0009			0.3000	0.0077	0.0598	0.3600	0.0044								0.0026
32-70	0.1200	0.2000	0.0000	0.0000		0.0009			0.1100	0.0077	0.0598	0.3500	0.0044								0.0026
06-71	0.1200	0.0000	0.1500	0.0800					0.3000			0.3500									
54-72	0.1200	0.2000	0.1500	0.0000					0.1800			0.3500									
19-73	0.1200	0.0900	0.1500	0.0000		0.0009			0.0700	0.0077	0.0598	0.3500	0.0044								0.0026
15-74	0.1200	0.2000	0.0000	0.2400					0.0900			0.3500									
67-75	0.1200	0.0000	0.0000	0.2350					0.2950			0.3500									
96-76	0.0000	0.0000	0.1330	0.0000					0.2670			0.6000									
89-77	0.0710	0.1770	0.0000	0.2120					0.1200			0.4200									
99-78	0.0000	0.1000	0.0000	0.2180					0.2720			0.4100									
98-79	0.0000	0.0000	0.0000	0.1130		0.0009			0.2610	0.0067	0.0519	0.4350	0.0038								0.0023
101-80	0.0690	0.1740	0.1300	0.0870					0.1200			0.4200									
93-81	0.0000	0.1530	0.0840	0.0000		0.0009			0.1200	0.0059	0.0457	0.4750	0.0034								0.0020
97-82	0.0000	0.0000	0.1150	0.0000		0.0009			0.2160	0.0059	0.0459	0.5000	0.0034								0.0020
103-83	0.0000	0.1450	0.1080	0.0000					0.2170			0.5300									
92-84	0.0313	0.0677	0.0527	0.0775		0.0009			0.1817	0.0056	0.0435	0.4293	0.0032								0.0019
90-85	0.0000	0.0000	0.1200	0.1600		0.0009			0.1200	0.0050	0.0391	0.4560	0.0029								0.0017
87-86	0.0730	0.0000	0.1360	0.0540		0.0009			0.2720	0.0019	0.0147	0.4110	0.0011								0.0006
102-87	0.1090	0.1820	0.0000	0.0000		0.0009			0.1000	0.0070	0.0544	0.4090	0.0040								0.0024
86-88	0.1200	0.0000	0.0000	0.0000					0.2800			0.6000									
91-89	0.1200	0.1000	0.0000	0.1200		0.0004			0.1500	0.0038	0.0294	0.4020	0.0022								0.0013
95-90	0.1200	0.0000	0.1000	0.1200		0.0004			0.1500	0.0038	0.0294	0.4020	0.0022								0.0013
88-91	0.0000	0.0600	0.1500	0.0300		0.0009			0.1800	0.0021	0.0163	0.5200	0.0012								0.0007
94-92	0.0300	0.0600	0.0000	0.0000		0.0009			0.1800	0.0074	0.0571	0.5200	0.0042								0.0025
100-93	0.0400	0.0000	0.0800	0.1280		0.0004			0.1000	0.0039	0.0299	0.5420	0.0022								0.0013

HWVP 85 (Bates 1985)

HW39	0.0430	0.0960	0.0290	0.1110			0.0380	0.0080	0.1040	0.0060		0.5120	0.0060			0.0010					0.0018

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG																					
SF10																					
TC27																					
WV205																					
WVCM42																					
WVCM44																					
WVCM45																					

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
16-58																					
39-59				0.0044	0.0009									0.0028			0.0011		0.0011		
13-60				0.0085	0.0017									0.0053			0.0022		0.0021		
61-60				0.0085	0.0017									0.0053			0.0022		0.0021		
23-61				0.0085	0.0017									0.0053			0.0022		0.0021		
08-62																					
41-63																					
25-64																					
12-65																					
51-66																					
14-67																					
56-68				0.0163	0.0033									0.0101			0.0042		0.0040		
18-69				0.0163	0.0033									0.0101			0.0042		0.0040		
32-70				0.0163	0.0033									0.0101			0.0042		0.0040		
06-71																					
54-72																					
19-73				0.0163	0.0033									0.0101			0.0042		0.0040		
15-74																					
67-75																					
96-76																					
89-77																					
99-78																					
98-79				0.0142	0.0029									0.0088			0.0036		0.0034		
101-80																					
93-81				0.0124	0.0025									0.0077			0.0032		0.0030		
97-82				0.0125	0.0025									0.0078			0.0032		0.0030		
103-83																					
92-84				0.0118	0.0024									0.0073			0.0030		0.0029		
90-85				0.0107	0.0022									0.0066			0.0027		0.0026		
87-86				0.0040	0.0008									0.0025			0.0010		0.0010		
102-87				0.0148	0.0030									0.0092			0.0038		0.0036		
86-88																					
91-89				0.0080	0.0016									0.0050			0.0021		0.0019		
95-90				0.0080	0.0016									0.0050			0.0021		0.0019		
88-91				0.0044	0.0009									0.0028			0.0011		0.0011		
94-92				0.0156	0.0032									0.0096			0.0040		0.0038		
100-93				0.0081	0.0017									0.0051			0.0021		0.0020		

HWVP 85 (Bates 1985)

HW39				0.0130	0.0020	0.0016		0.0030					0.0060		0.0018		0.0032		0.0050		

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG																					
SF10																					
TC27																					
WV205																					
WVCM42																					
WVCM44																					
WVCM45																					

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
16-58																					
39-59																	0.0009			0.0213	
13-60																	0.0017			0.0408	
61-60																	0.0017			0.0408	
23-61																	0.0017			0.0408	
08-62																					
41-63																					
25-64																					
12-65																					
51-66																					
14-67																					
56-68																	0.0033			0.0781	
18-69																	0.0033			0.0781	
32-70																	0.0033			0.0781	
06-71																					
54-72																					
19-73																	0.0033			0.0781	
15-74																					
67-75																					
96-76																					
89-77																					
99-78																					
98-79																	0.0029			0.0678	
101-80																					
93-81																	0.0025			0.0596	
97-82																	0.0025			0.0600	
103-83																					
92-84																	0.0024			0.0568	
90-85																	0.0022			0.0511	
87-86																	0.0008			0.0192	
102-87																	0.0030			0.0710	
86-88																					
91-89																	0.0016			0.0383	
95-90																	0.0016			0.0383	
88-91																	0.0009			0.0213	
94-92																	0.0032			0.0746	
100-93																	0.0017			0.0391	

HWVP 85 (Bates 1985)

HW39			0.0010						0.0016				0.0005			0.0040	0.0010				

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG																					
SF10																					
TC27																					
WV205																					
WVCM42																					
WVCM44																					
WVCM45																					

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
16-58										1.0000	0.0101	0.0717	0.1515	0.2121					0.1818		
39-59			0.0069							1.0006	0.1240	0.0000	0.1370	0.0430		0.0008			0.0700	0.0020	0.0152
13-60			0.0132							1.0000	0.0092	0.0898	0.0225	0.1348		0.0005			0.1613	0.0037	0.0290
61-60			0.0132							1.0000	0.0101	0.0891	0.0246	0.1281		0.0005			0.1629	0.0040	0.0309
23-61			0.0132							1.0000	0.0091	0.0637	0.0131	0.1344		0.0005			0.1344	0.0038	0.0299
08-62										1.0000	0.0564	0.1101	0.0123	0.1163					0.1639		
41-63										1.0000	0.1254	0.0973	0.0120	0.0602					0.1625		
25-64										1.0000	0.1249	0.1159	0.0042	0.0000					0.1563		
12-65										1.0000	0.0079	0.1186	0.0000	0.1090					0.1561		
51-66										1.0000	0.0563	0.1031	0.0053	0.0473					0.1454		
14-67										1.0000	0.0098	0.0859	0.0040	0.2063					0.0689		
56-68			0.0253							1.0000	0.0083	0.0000	0.1094	0.0000		0.0009			0.0733	0.0077	0.0597
18-69			0.0253							1.0000	0.1283	0.0000	0.0030	0.0000		0.0008			0.2921	0.0074	0.0573
32-70			0.0253							1.0000	0.1255	0.1983	0.0021	0.0000		0.0008			0.1123	0.0071	0.0555
06-71										1.0000	0.1230	0.0000	0.1516	0.0697					0.3002		
54-72										1.0000	0.1208	0.1974	0.1511	0.0000					0.1833		
19-73			0.0253							1.0000	0.1244	0.1455	0.0943	0.0000		0.0008			0.0752	0.0073	0.0563
15-74										1.0000	0.1221	0.2096	0.0000	0.1974					0.0926		
67-75										1.0000	0.1282	0.0000	0.0019	0.1968					0.3048		
96-76										1.0000	0.0032	0.0000	0.1297	0.0000					0.2654		
89-77										1.0000	0.0800	0.1666	0.0016	0.1798					0.1219		
99-78										1.0000	0.0092	0.0000	0.1217	0.1454					0.1279		
98-79			0.0220							1.0001	0.0061	0.0000	0.0044	0.0964		0.0009			0.2658	0.0065	0.0503
101-80										1.0000	0.0727	0.1707	0.1309	0.0747					0.1196		
93-81			0.0193							1.0002	0.0031	0.1749	0.0838	0.0000		0.0007			0.1288	0.0047	0.0365
97-82			0.0194							1.0002	0.0027	0.0000	0.1176	0.0000		0.0009			0.2270	0.0059	0.0460
103-83										1.0000	0.0033	0.1456	0.1084	0.0000					0.2210		
92-84			0.0184							1.0003	0.0364	0.0673	0.0512	0.0664		0.0008			0.1871	0.0052	0.0407
90-85			0.0166							1.0003	0.0070	0.0000	0.1228	0.1264		0.0011			0.1218	0.0060	0.0468
87-86			0.0062							1.0007	0.0791	0.0000	0.1384	0.0462		0.0010			0.2811	0.0021	0.0161
102-87			0.0230							1.0000	0.1165	0.1689	0.0019	0.0000		0.0008			0.0997	0.0065	0.0504
86-88										1.0000	0.1222	0.0000	0.0010	0.0000					0.2668		
91-89			0.0124							1.0000	0.1246	0.0961	0.0019	0.1014		0.0004			0.1513	0.0038	0.0293
95-90			0.0124							1.0000	0.1281	0.0000	0.0997	0.1027		0.0004			0.1525	0.0038	0.0297
88-91			0.0069							1.0006	0.0050	0.0592	0.1517	0.0256		0.0009			0.1819	0.0021	0.0166
94-92			0.0242							1.0000	0.0344	0.0587	0.0025	0.0000		0.0009			0.1875	0.0072	0.0557
100-93			0.0127							1.0000	0.0461	0.0000	0.0781	0.1086		0.0004			0.1026	0.0039	0.0301

HWVP 85 (Bates 1985)

HW39							0.0005														

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG											0.0669	0.0663		0.1040							0.0020
SF10											0.0636	0.0970		0.1145							0.0271
TC27											0.0650	0.0973		0.1176							0.0231
WV205											0.0330	0.0996		0.1180							0.0250
WVCM42											0.0499	0.0981	0.0096	0.1253		0.0187	0.0277	0.0129	0.1059		0.0247
WVCM44											0.0649	0.0903	0.0089	0.1155		0.0325	0.0275	0.0120	0.0988		0.0228
WVCM45											0.0797	0.0743	0.0075	0.1233		0.0157	0.0297	0.0131	0.1015		0.0250

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
16-58	0.3727																				
39-59	0.5699	0.0011								0.0007				0.0042	0.0008						
13-60	0.4757	0.0021								0.0013				0.0079	0.0016						
61-60	0.4714	0.0023								0.0014				0.0084	0.0017						
23-61	0.5355	0.0022								0.0013				0.0081	0.0016						
08-62	0.5410																				
41-63	0.5426																				
25-64	0.5988																				
12-65	0.6083																				
51-66	0.6057																				
14-67	0.6250																				
56-68	0.5894	0.0044								0.0026				0.0163	0.0033						
18-69	0.3658	0.0042								0.0025				0.0156	0.0032						
32-70	0.3577	0.0041								0.0024				0.0151	0.0031						
06-71	0.3555																				
54-72	0.3474																				
19-73	0.3533	0.0041								0.0025				0.0154	0.0031						
15-74	0.3784																				
67-75	0.3684																				
96-76	0.6017																				
89-77	0.4501																				
99-78	0.4889																				
98-79	0.4424	0.0037								0.0022				0.0137	0.0028						
101-80	0.4314																				
93-81	0.4754	0.0027								0.0016				0.0099	0.0020						
97-82	0.4834	0.0034								0.0020				0.0125	0.0025						
103-83	0.5216																				
92-84	0.4417	0.0030								0.0018				0.0111	0.0022						
90-85	0.4497	0.0034								0.0021				0.0128	0.0026						
87-86	0.3959	0.0012								0.0007				0.0044	0.0009						
102-87	0.4276	0.0037								0.0022				0.0137	0.0028						
86-88	0.6100																				
91-89	0.4170	0.0022								0.0013				0.0080	0.0016						
95-90	0.4077	0.0022								0.0013				0.0081	0.0016						
88-91	0.5154	0.0012								0.0007				0.0045	0.0009						
94-92	0.5117	0.0041								0.0025				0.0152	0.0031						
100-93	0.5541	0.0022								0.0013				0.0082	0.0017						

HWVP 85 (Bates 1985)

HW39																					

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG	0.5032																				
SF10	0.4676																				
TC27	0.4674																				
WV205	0.4522																				
WVCM42	0.4415				0.0022																
WVCM44	0.4480				0.0021																
WVCM45	0.4469				0.0018																

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
16-58																					
39-59			0.0026			0.0011		0.0010													
13-60			0.0049			0.0020		0.0019													
61-60			0.0052			0.0022		0.0021													
23-61			0.0051			0.0021		0.0020													
08-62																					
41-63																					
25-64																					
12-65																					
51-66																					
14-67																					
56-68			0.0101			0.0042		0.0040													
18-69			0.0097			0.0040		0.0038													
32-70			0.0094			0.0039		0.0037													
06-71																					
54-72																					
19-73			0.0095			0.0039		0.0037													
15-74																					
67-75																					
96-76																					
89-77																					
99-78																					
98-79			0.0085			0.0035		0.0033													
101-80																					
93-81			0.0062			0.0025		0.0024													
97-82			0.0078			0.0032		0.0030													
103-83																					
92-84			0.0069			0.0028		0.0027													
90-85			0.0079			0.0033		0.0031													
87-86			0.0027			0.0011		0.0011													
102-87			0.0085			0.0035		0.0033													
86-88																					
91-89			0.0050			0.0021		0.0019													
95-90			0.0051			0.0021		0.0019													
88-91			0.0028			0.0012		0.0011													
94-92			0.0094			0.0039		0.0037													
100-93			0.0051			0.0021		0.0020													

HWVP 85 (Bates 1985)

HW39																					

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG			0.0177																		
SF10			0.0092																		
TC27			0.0114																		
WV205			0.0136																		
WVCM42			0.0142																		
WVCM44			0.0131																		
WVCM45			0.0130																		

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
16-58																				0.9999
39-59						0.0008			0.0199				0.0065							1.0006
13-60						0.0016			0.0379				0.0122							1.0000
61-60						0.0017			0.0403				0.0131							0.9999
23-61						0.0016			0.0390				0.0126							1.0001
08-62																				1.0000
41-63																				1.0000
25-64																				1.0001
12-65																				0.9999
51-66																				0.9631
14-67																				0.9999
56-68						0.0033			0.0780				0.0253							1.0000
18-69						0.0032			0.0748				0.0242							0.9999
32-70						0.0031			0.0724				0.0235							0.9999
06-71																				1.0000
54-72																				1.0000
19-73						0.0031			0.0736				0.0238							1.0000
15-74																				1.0001
67-75																				1.0001
96-76																				1.0000
89-77																				1.0000
99-78																				0.8931
98-79						0.0028			0.0656				0.0213							1.0001
101-80																				1.0000
93-81						0.0020			0.0476				0.0154							1.0002
97-82						0.0025			0.0601				0.0195							1.0001
103-83																				0.9999
92-84						0.0022			0.0532				0.0172							1.0002
90-85						0.0026			0.0612				0.0198							1.0003
87-86						0.0009			0.0211				0.0068							1.0007
102-87						0.0028			0.0658				0.0213							0.9999
86-88																				1.0000
91-89						0.0016			0.0382				0.0124							1.0001
95-90						0.0016			0.0388				0.0125							1.0000
88-91						0.0009			0.0217				0.0070							1.0006
94-92						0.0031			0.0728				0.0236							0.9999
100-93						0.0017			0.0393				0.0127							1.0001

HWVP 85 (Bates 1985)

HW39																				0.0000

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG									0.0000				0.0301						0.2109	1.0011
SF10									0.0000				0.0000						0.2205	0.9995
TC27									0.0000				0.0000						0.2523	1.0341
WV205									0.0000				0.0000						0.2551	0.9965
WVCM42									0.0356				0.0059						0.0274	0.9996
WVCM44									0.0326				0.0054						0.0254	0.9998
WVCM45									0.0358				0.0059						0.0267	0.9999

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
16-58					0.04 crystallinity			
39-59					amorphous			
13-60					amorphous			
61-60					amorphous			
23-61					amorphous			
08-62					amorphous			
41-63					amorphous			
25-64					amorphous			
12-65					amorphous			
51-66					amorphous			
14-67					amorphous			
56-68					0.10 crystallinity			
18-69					0.47 crystallinity			
32-70					amorphous			
06-71					0.06 crystallinity			
54-72					amorphous			
19-73					0.07 crystallinity			
15-74					0.39 crystallinity			
67-75					amorphous			
96-76					amorphous			
89-77					amorphous			
99-78					amorphous			
98-79					amorphous			
101-80					amorphous			
93-81					0.03 crystallinity			
97-82					amorphous			
103-83					amorphous			
92-84					amorphous			
90-85					amorphous			
87-86					0.01 crystallinity			
102-87					amorphous			
86-88					amorphous			
91-89					amorphous			
95-90					amorphous			
88-91					amorphous			
94-92					amorphous			
100-93					amorphous			

HWVP 85 (Bates 1985)

HW39								

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG								
SF10								
TC27								
WV205								
WVCM42								
WVCM44								
WVCM45								

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
16-58	1.20 crystallinity			0.65 crystallinity	
39-59	amorphous			amorphous	
13-60	amorphous			amorphous	
61-60	amorphous			amorphous	
23-61	amorphous			amorphous	
08-62	amorphous			amorphous	
41-63	amorphous			amorphous	
25-64	amorphous			amorphous	
12-65	amorphous			amorphous	
51-66	0.05 crystallinity			amorphous	
14-67	0.31 crystallinity			0.06 crystallinity	
56-68	0.47 crystallinity			0.24 crystallinity	
18-69	0.80 crystallinity			0.65 crystallinity	
32-70	0.88 crystallinity			0.58 crystallinity	
06-71	1.07 crystallinity			0.73 crystallinity	
54-72	amorphous			amorphous	
19-73	0.59 crystallinity			amorphous	
15-74	0.47 crystallinity			0.21 crystallinity	
67-75	1.01 crystallinity			amorphous	
96-76	0.66 crystallinity			0.47 crystallinity	
89-77	0.23 crystallinity			0.11 crystallinity	
99-78	amorphous			0.04 crystallinity	
98-79	0.07 crystallinity			0.03 crystallinity	
101-80	amorphous			amorphous	
93-81	amorphous			0.04 crystallinity	
97-82	amorphous			0.06 crystallinity	
103-83	amorphous			amorphous	
92-84	0.05 crystallinity			amorphous	
90-85	0.06 crystallinity			.013 crystallinity	
87-86	1.51 crystallinity			1.64 crystallinity	
102-87	0.75 crystallinity			0.53 crystallinity	
86-88	amorphous			amorphous	
91-89	0.05 crystallinity			0.16 crystallinity	
95-90	0.26 crystallinity			0.24 crystallinity	
88-91	amorphous			0.05 crystallinity	
94-92	0.14 crystallinity			0.03 crystallinity	
100-93	0.04 crystallinity			0.01 crystallinity	

HWVP 85 (Bates 1985)

HW39					

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG					
SF10					
TC27					
WV205					
WVCM42					
WVCM44					
WVCM45					

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
16-58												854	960	3	
39-59												1481	1632	3	
13-60												1078	1224	3	
61-60												1110	1222	3	
23-61												1238	1419	3	
08-62												1215	1391	3	
41-63												1366	1555	3	
25-64												1380	1582	3	
12-65												1180	1335	3	
51-66												1335	1542	3	
14-67												1497	1699	3	
56-68												1436	1582	3	
18-69												1231	1337	3	
32-70												1233	1457	3	
06-71												1031	1147	3	
54-72												962	1057	3	
19-73												1217	1343	3	
15-74												1285	1350	3	
67-75												1191	1335	3	
96-76												1152	1324	3	
89-77												1231	1422	3	
99-78												874	1006	3	
98-79												1110	1261	3	
101-80												1060	1183	3	
93-81													1224	3	
97-82												1131	1290	3	
103-83												965	1086	3	
92-84												1106	1282	3	
90-85												1152	1287	3	
87-86												1078	1200	3	
102-87												1388	1562	3	
86-88												1348	1542	3	
91-89												1327	1469	3	
95-90												1275	1428	3	
88-91												1060	1204	3	
94-92												1277	1451	3	
100-93												1383	1545	3	

HWVP 85 (Bates 1985)

HW39		2.65					-11.178	18794.4	7.61				960	60.00	1060

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG															
SF10															
TC27															
WV205															
WVCM42															
WVCM44															
WVCM45															

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
16-58																					
39-59																					
13-60																					
61-60																					
23-61																					
08-62																					
41-63																					
25-64																					
12-65																					
51-66																					
14-67																					
56-68																					
18-69																					
32-70																					
06-71																					
54-72																					
19-73																					
15-74																					
67-75																					
96-76																					
89-77																					
99-78																					
98-79																					
101-80																					
93-81																					
97-82																					
103-83																					
92-84																					
90-85																					
87-86																					
102-87																					
86-88																					
91-89																					
95-90																					
88-91																					
94-92																					
100-93																					

HWVP 85 (Bates 1985)

HW39	18.00	1125	9.20	1200	5.10																

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG																					
SF10																					
TC27																					
WV205																					
WVCM42																					
WVCM44																					
WVCM45																					

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
16-58																
39-59																
13-60																
61-60																
23-61																
08-62																
41-63																
25-64																
12-65																
51-66																
14-67																
56-68																
18-69																
32-70																
06-71																
54-72																
19-73																
15-74																
67-75																
96-76																
89-77																
99-78																
98-79																
101-80																
93-81																
97-82																
103-83																
92-84																
90-85																
87-86																
102-87																
86-88																
91-89																
95-90																
88-91																
94-92																
100-93																

HWVP 85 (Bates 1985)

HW39																

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG					0.345											
SF10					0.237											
TC27					0.331											
WV205					0.705											
WVCM42					0.482											
WVCM44					0.413											
WVCM45					0.202											

Comp. Vs Properties Study (Chick et al. 1981)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
16-58												
39-59												
13-60												
61-60												
23-61												
08-62												
41-63												
25-64												
12-65												
51-66												
14-67												
56-68												
18-69												
32-70												
06-71												
54-72												
19-73												
15-74												
67-75												
96-76												
89-77												
99-78												
98-79												
101-80												
93-81												
97-82												
103-83												
92-84												
90-85												
87-86												
102-87												
86-88												
91-89												
95-90												
88-91												
94-92												
100-93												

HWVP 85 (Bates 1985)

HW39												

WV Glasses by CUA and PNL (Johnston et al. 1990)

DWRG												
SF10												
TC27												
WV205												
WVCM42												
WVCM44												
WVCM45												

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
WVCM46																					
WVCM47																					
WVCM48																					
WVCM50																					
WVCM53																					
WVCM55																					
WVCM56																					
WVCM57																					
WVCM59																					
WVUTH7																					
WVUTH8																					
WVUTH12																					
WVUTH13																					
WVUTH14																					
WVUTH15																					
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WVUTH61																					
WVUTH62																					
WVUTH63																					
WVUTH64																					

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
WVCM46																					
WVCM47																					
WVCM48																					
WVCM50																					
WVCM53																					
WVCM55																					
WVCM56																					
WVCM57																					
WVCM59																					
WVUTH7																					
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WVUTH12																					
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WVUTH62																					
WVUTH63																					
WVUTH64																					

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
WVCM46																					
WVCM47																					
WVCM48																					
WVCM50																					
WVCM53																					
WVCM55																					
WVCM56																					
WVCM57																					
WVCM59																					
WVUTH7																					
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WVUTH64																					

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
WVCM46											0.0796	0.0992	0.0068	0.1214		0.0157	0.0202	0.0131	0.0890		0.0250
WVCM47											0.0798	0.1243	0.0060	0.1212		0.0128	0.0202	0.0132	0.0921		0.0250
WVCM48											0.0861	0.0960	0.0096	0.1311		0.0245	0.0293	0.0093	0.1071		0.0064
WVCM50											0.0986	0.1227	0.0082	0.1193		0.0160	0.0222	0.0079	0.0979		0.0247
WVCM53											0.1021	0.1262	0.0024	0.1223		0.0095	0.0204		0.1087		0.0261
WVCM55											0.1044	0.1336	0.0069	0.1264		0.0135	0.0459	0.0067	0.0857		0.0264
WVCM56											0.0883	0.1403	0.0081	0.1086		0.0158	0.0240	0.0088	0.0887		0.0055
WVCM57											0.0480	0.0944		0.1287							0.0252
WVCM59											0.0647	0.1029	0.0068	0.1204		0.0362	0.0316	0.0089	0.1117		0.0238
WVUTH7											0.0815	0.0931	0.0092	0.1163		0.0334	0.0282	0.0122	0.1018		0.0234
WVUTH8											0.0285	0.0934	0.0092	0.1166		0.0335	0.0283	0.0122	0.1021		0.0235
WVUTH12											0.0995	0.1234	0.0087	0.1197		0.0249	0.0268	0.0124	0.0978		0.0058
WVUTH13											0.1194	0.1234	0.0087	0.1196		0.0249	0.0268	0.0125	0.0978		0.0058
WVUTH14											0.0995	0.1236	0.0088	0.1198		0.0249	0.0268	0.0125	0.0979		0.0244
WVUTH15											0.0997	0.1036	0.0087	0.1198		0.0249	0.0268	0.0125	0.0979		0.0246
WVUTH17											0.0986	0.1227	0.0082	0.1193		0.0160	0.0222	0.0079	0.0979		0.0247
WVUTH18											0.0969	0.1206	0.0080	0.1172		0.0157	0.0218	0.0078	0.0962		0.0243
WVUTH19											0.0967	0.1203	0.0080	0.1169		0.0157	0.0217	0.0078	0.1156		0.0242
WVUTH21											0.1010	0.1249	0.0083	0.1217		0.0162	0.0229	0.0080	0.0998		0.0254
WVUTH22											0.0966	0.1408	0.0080	0.1168		0.0156	0.0217	0.0078	0.0958		0.0242
WVUTH23											0.0948	0.1180	0.0079	0.1531		0.0154	0.0213	0.0076	0.0941		0.0238
WVUTH28											0.0986	0.1027	0.0071	0.1194		0.0191	0.0195	0.0126	0.1175		0.0247
WVUTH30											0.0981	0.1220	0.0081	0.1186		0.0159	0.0220	0.0079	0.0973		0.0246
WVUTH31											0.0983	0.1223	0.0071	0.1190		0.0190	0.0211	0.0125	0.0891		0.0346
WVUTH32											0.1011	0.1250	0.0083	0.1217		0.0162	0.0229	0.0080	0.0998		0.0254
WVUTH34											0.1004	0.1241	0.0084	0.1202		0.0093	0.0207	0.0081	0.1069		0.0257
WVUTH35											0.1004	0.1241	0.0084	0.1203		0.0093	0.0207		0.1069		0.0257
WVUTH36											0.0987	0.1264	0.0081	0.1196		0.0128	0.0434	0.0088	0.0811		0.0249
WVUTH37											0.1005	0.1287	0.0083	0.1217		0.0130	0.0442	0.0089	0.0825		0.0254
WVUTH38											0.0987	0.1264	0.0081	0.1196		0.0128	0.0434	0.0088	0.0810		0.0249
WVUTH39											0.1006	0.1288	0.0083	0.1218		0.0130	0.0442	0.0089	0.0826		0.0254
WVUTH40											0.1384	0.1222	0.0080	0.1192		0.0157	0.0227	0.0078	0.0977		0.0251
WVUTH41											0.0992	0.1221	0.0080	0.1591		0.0157	0.0227	0.0078	0.0976		0.0250
WVUTH42											0.0988	0.1221	0.0083	0.1184		0.0092	0.0204	0.0159	0.1052		0.0253
WVUTH48											0.0993	0.1221	0.0080	0.1192		0.0157	0.0227	0.0078	0.0977		0.0251
WVUTH49											0.0992	0.1221	0.0080	0.1191		0.0157	0.0227	0.0078	0.0976		0.0250
WVUTH51											0.0996	0.1231	0.0084	0.1193		0.0092	0.0205	0.0081	0.1060		0.0255
WVUTH52											0.0996	0.1231	0.0024	0.1193		0.0092	0.0205	0.0141	0.1060		0.0255
WVUTH53											0.0994	0.1272	0.0082	0.1204		0.0129	0.0437	0.0088	0.0816		0.0251
WVUTH54											0.1004	0.1286	0.0083	0.1214		0.0142	0.0216	0.0079	0.0850		0.0252
WVUTH55											0.0807	0.1283	0.0083	0.1212		0.0162	0.0225	0.0080	0.1021		0.0251
WVUTH56											0.0993	0.1273	0.0082	0.1203		0.0161	0.0223	0.0080	0.1000		0.0148
WVUTH57											0.0983	0.1252	0.0088	0.1190		0.0336	0.0289	0.0096	0.1047		0.0247
WVUTH58											0.0984	0.1224	0.0081	0.1190		0.0159	0.0221	0.0079	0.0977		0.0247
WVUTH59											0.0967	0.1202	0.0080	0.1369		0.0157	0.0217	0.0078	0.0959		0.0242
WVUTH61											0.0963	0.1198	0.0080	0.1165		0.0156	0.0216	0.0077	0.0956		0.0241
WVUTH62											0.0450	0.1137	0.0082	0.1205		0.0405	0.0348	0.0090	0.1261		0.0236
WVUTH63											0.0450	0.0957	0.0082	0.1205		0.0341	0.0292	0.0090	0.1061		0.0236
WVUTH64											0.0650	0.1065	0.0082	0.1205		0.0379	0.0326	0.0090	0.1181		0.0236

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
WVCM46	0.4473				0.0016																
WVCM47	0.4230				0.0013																
WVCM48	0.4101				0.0022																
WVCM50	0.3960				0.0019																
WVCM53	0.4112																				
WVCM55	0.4199				0.0016																
WVCM56	0.4202				0.0019																
WVCM57	0.4260																				
WVCM59	0.4093				0.0016																
WVUTH7	0.4191				0.0021																
WVUTH8	0.4204				0.0022																
WVUTH12	0.3984				0.0020																
WVUTH13	0.3784				0.0020																
WVUTH14	0.3790				0.0020																
WVUTH15	0.3987				0.0020																
WVUTH17	0.3960				0.0019																
WVUTH18	0.3891				0.0019																
WVUTH19	0.3882				0.0019																
WVUTH21	0.3848				0.0019																
WVUTH22	0.3878				0.0019																
WVUTH23	0.3807				0.0180																
WVUTH28	0.3960				0.0017																
WVUTH30	0.3937				0.0019																
WVUTH31	0.3946				0.0017																
WVUTH32	0.3849				0.0019																
WVUTH34	0.4043																				
WVUTH35	0.4043																				
WVUTH36	0.3972				0.0015																
WVUTH37	0.4043				0.0016																
WVUTH38	0.3971				0.0015																
WVUTH39	0.4046				0.0016																
WVUTH40	0.3592				0.0019																
WVUTH41	0.3588				0.0019																
WVUTH42	0.3979																				
WVUTH48	0.3984				0.0019																
WVUTH49	0.3588				0.0019																
WVUTH51	0.4010				0.0000																
WVUTH52	0.4010				0.0000																
WVUTH53	0.3997				0.0015																
WVUTH54	0.4033				0.0017																
WVUTH55	0.4023				0.0017																
WVUTH56	0.3991				0.0017																
WVUTH57	0.3751				0.0021																
WVUTH58	0.3952				0.0019																
WVUTH59	0.3880				0.0019																
WVUTH61	0.4101				0.0019																
WVUTH62	0.3991				0.0019																
WVUTH63	0.4491				0.0019																
WVUTH64	0.3991				0.0019																

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
WVCM46			0.0130																		
WVCM47			0.0131																		
WVCM48			0.0142																		
WVCM50			0.0121																		
WVCM53			0.0100																		
WVCM55			0.0103																		
WVCM56			0.0120																		
WVCM57			0.0130																		
WVCM59			0.0101																		
WVUTH7			0.0136																		
WVUTH8			0.0136																		
WVUTH12			0.0129																		
WVUTH13			0.0129																		
WVUTH14			0.0130																		
WVUTH15			0.0130																		
WVUTH17			0.0121																		
WVUTH18			0.0119																		
WVUTH19			0.0119																		
WVUTH21			0.0122																		
WVUTH22			0.0118																		
WVUTH23			0.0116																		
WVUTH28			0.0128																		
WVUTH30			0.0120																		
WVUTH31			0.0128																		
WVUTH32			0.0122																		
WVUTH34			0.0099																		
WVUTH35			0.0099																		
WVUTH36			0.0121																		
WVUTH37			0.0123																		
WVUTH38			0.0121																		
WVUTH39			0.0123																		
WVUTH40			0.0119																		
WVUTH41			0.0119																		
WVUTH42			0.0097																		
WVUTH48			0.0119																		
WVUTH49			0.0119																		
WVUTH51			0.0098																		
WVUTH52			0.0098																		
WVUTH53			0.0098																		
WVUTH54			0.0123																		
WVUTH55			0.0123																		
WVUTH56			0.0122																		
WVUTH57			0.0121																		
WVUTH58			0.0121																		
WVUTH59			0.0119																		
WVUTH61			0.0118																		
WVUTH62			0.0122																		
WVUTH63			0.0122																		
WVUTH64			0.0122																		

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
WVCM46									0.0357				0.0059						0.0261	0.9996
WVCM47									0.0358				0.0060						0.0261	0.9999
WVCM48									0.0387				0.0064						0.0286	0.9996
WVCM50									0.0352				0.0061						0.0308	0.9996
WVCM53									0.0361				0.0059						0.0190	0.9999
WVCM55									0.0000				0.0000						0.0186	0.9999
WVCM56									0.0391				0.0066						0.0319	0.9998
WVCM57									0.0380				0.0062						0.2221	1.0016
WVCM59									0.0360				0.0058						0.0297	0.9995
WVUTH7									0.0338				0.0056						0.0264	0.9997
WVUTH8									0.0339				0.0056						0.0767	0.9997
WVUTH12									0.0353				0.0059						0.0262	0.9997
WVUTH13									0.0353				0.0059						0.0262	0.9996
WVUTH14									0.0354				0.0059						0.0263	0.9998
WVUTH15									0.0354				0.0059						0.0262	0.9997
WVUTH17									0.0352				0.0061						0.0308	0.9996
WVUTH18									0.0519				0.0060						0.0303	0.9996
WVUTH19									0.0345				0.0060						0.0303	0.9997
WVUTH21									0.0359				0.0061						0.0303	0.9994
WVUTH22									0.0345				0.0060						0.0303	0.9996
WVUTH23									0.0339				0.0059						0.0298	1.0159
WVUTH28									0.0352				0.0058						0.0274	1.0001
WVUTH30									0.0350				0.0119						0.0307	0.9997
WVUTH31									0.0351				0.0058						0.0271	1.0001
WVUTH32									0.0359				0.0061						0.0301	0.9995
WVUTH34									0.0355				0.0058						0.0207	1.0000
WVUTH35									0.0355				0.0058						0.0288	1.0001
WVUTH36									0.0349				0.0000						0.0300	0.9995
WVUTH37									0.0178				0.0000						0.0306	0.9998
WVUTH38									0.0000				0.0000						0.0652	0.9996
WVUTH39									0.0000				0.0000						0.0475	0.9996
WVUTH40									0.0352				0.0058						0.0290	0.9998
WVUTH41									0.0352				0.0058						0.0289	0.9997
WVUTH42									0.0349				0.0057						0.0283	1.0001
WVUTH48									0.0352				0.0058						0.0290	0.9998
WVUTH49									0.0352				0.0058						0.0689	0.9997
WVUTH51									0.0352				0.0058						0.0285	1.0000
WVUTH52									0.0352				0.0058						0.0285	1.0000
WVUTH53									0.0351				0.0060						0.0205	0.9999
WVUTH54									0.0352				0.0060						0.0288	0.9999
WVUTH55									0.0358				0.0061						0.0292	0.9998
WVUTH56									0.0355				0.0060						0.0290	0.9998
WVUTH57									0.0349				0.0059						0.0285	1.0114
WVUTH58									0.0351				0.0061						0.0327	0.9993
WVUTH59									0.0345				0.0060						0.0303	0.9997
WVUTH61									0.0344				0.0060						0.0302	0.9996
WVUTH62									0.0356				0.0058						0.0304	1.0064
WVUTH63									0.0356				0.0058						0.0304	1.0064
WVUTH64									0.0356				0.0058						0.0304	1.0064

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
WVCM46								
WVCM47								
WVCM48								
WVCM50								
WVCM53								
WVCM55								
WVCM56								
WVCM57								
WVCM59								
WVUTH7								
WVUTH8								
WVUTH12								
WVUTH13								
WVUTH14								
WVUTH15								
WVUTH17								
WVUTH18								
WVUTH19								
WVUTH21								
WVUTH22								
WVUTH23								
WVUTH28								
WVUTH30								
WVUTH31								
WVUTH32								
WVUTH34								
WVUTH35								
WVUTH36								
WVUTH37								
WVUTH38								
WVUTH39								
WVUTH40								
WVUTH41								
WVUTH42								
WVUTH48								
WVUTH49								
WVUTH51								
WVUTH52								
WVUTH53								
WVUTH54								
WVUTH55								
WVUTH56								
WVUTH57								
WVUTH58								
WVUTH59								
WVUTH61								
WVUTH62								
WVUTH63								
WVUTH64								

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
WVCM46					
WVCM47					
WVCM48					
WVCM50					
WVCM53					
WVCM55					
WVCM56					
WVCM57					
WVCM59					
WVUTH7					
WVUTH8					
WVUTH12					
WVUTH13					
WVUTH14					
WVUTH15					
WVUTH17					
WVUTH18					
WVUTH19					
WVUTH21					
WVUTH22					
WVUTH23					
WVUTH28					
WVUTH30					
WVUTH31					
WVUTH32					
WVUTH34					
WVUTH35					
WVUTH36					
WVUTH37					
WVUTH38					
WVUTH39					
WVUTH40					
WVUTH41					
WVUTH42					
WVUTH48					
WVUTH49					
WVUTH51					
WVUTH52					
WVUTH53					
WVUTH54					
WVUTH55					
WVUTH56					
WVUTH57					
WVUTH58					
WVUTH59					
WVUTH61					
WVUTH62					
WVUTH63					
WVUTH64					

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
WVCM46															
WVCM47															
WVCM48															
WVCM50															
WVCM53															
WVCM55															
WVCM56															
WVCM57															
WVCM59															
WVUTH7															
WVUTH8															
WVUTH12															
WVUTH13															
WVUTH14															
WVUTH15															
WVUTH17															
WVUTH18															
WVUTH19															
WVUTH21															
WVUTH22															
WVUTH23															
WVUTH28															
WVUTH30															
WVUTH31															
WVUTH32															
WVUTH34															
WVUTH35															
WVUTH36															
WVUTH37															
WVUTH38															
WVUTH39															
WVUTH40															
WVUTH41															
WVUTH42															
WVUTH48															
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WVUTH56															
WVUTH57															
WVUTH58															
WVUTH59															
WVUTH61															
WVUTH62															
WVUTH63															
WVUTH64															

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
WVCM46																					
WVCM47																					
WVCM48																					
WVCM50																					
WVCM53																					
WVCM55																					
WVCM56																					
WVCM57																					
WVCM59																					
WVUTH7																					
WVUTH8																					
WVUTH12																					
WVUTH13																					
WVUTH14																					
WVUTH15																					
WVUTH17																					
WVUTH18																					
WVUTH19																					
WVUTH21																					
WVUTH22																					
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WVUTH28																					
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WVUTH56																					
WVUTH57																					
WVUTH58																					
WVUTH59																					
WVUTH61																					
WVUTH62																					
WVUTH63																					
WVUTH64																					

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
WVCM46					0.146											
WVCM47					0.163											
WVCM48					0.282											
WVCM50					0.206											
WVCM53					0.268											
WVCM55					0.286											
WVCM56					0.189											
WVCM57					0.334											
WVCM59					0.622											
WVUTH7					0.249											
WVUTH8					0.349											
WVUTH12					0.215											
WVUTH13					0.238											
WVUTH14					0.25											
WVUTH15					0.201											
WVUTH17					0.174											
WVUTH18					0.194											
WVUTH19					0.268											
WVUTH21					0.236											
WVUTH22					0.243											
WVUTH23					0.206											
WVUTH28					0.213											
WVUTH30					0.216											
WVUTH31					0.234											
WVUTH32					0.416											
WVUTH34					0.251											
WVUTH35					0.221											
WVUTH36					0.223											
WVUTH37					0.298											
WVUTH38					0.231											
WVUTH39					0.211											
WVUTH40					0.227											
WVUTH41					0.222											
WVUTH42					0.228											
WVUTH48					0.208											
WVUTH49					0.177											
WVUTH51					0.23											
WVUTH52					0.244											
WVUTH53					0.244											
WVUTH54					0.168											
WVUTH55					0.285											
WVUTH56					0.197											
WVUTH57					0.25											
WVUTH58					0.201											
WVUTH59					0.208											
WVUTH61					0.201											
WVUTH62					0.926											
WVUTH63					0.408											
WVUTH64					0.469											

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
WVCM46												
WVCM47												
WVCM48												
WVCM50												
WVCM53												
WVCM55												
WVCM56												
WVCM57												
WVCM59												
WVUTH7												
WVUTH8												
WVUTH12												
WVUTH13												
WVUTH14												
WVUTH15												
WVUTH17												
WVUTH18												
WVUTH19												
WVUTH21												
WVUTH22												
WVUTH23												
WVUTH28												
WVUTH30												
WVUTH31												
WVUTH32												
WVUTH34												
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WVUTH41												
WVUTH42												
WVUTH48												
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WVUTH56												
WVUTH57												
WVUTH58												
WVUTH59												
WVUTH61												
WVUTH62												
WVUTH63												
WVUTH64												

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
WVUTH65																					
WVUTH66																					
WVUTH67																					
WVUTH68																					
WVUTH69																					
WVUTH70																					
WVUTH71																					
WVUTH72																					
WVUTH73																					
WVUTH74																					
WVUTH75																					
WVUTH77																					
WVUTH78																					
WVUTH79																					
WVUTH80																					
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WVUTH89																					
WVUTH90																					
WVUTH91																					
WVUTH92																					
WVUTH93																					
WVUTH94																					
WVUTH96																					
WVUTH98																					
WVUTH99																					
WVUTH100																					
WVUTH102																					
WVUTH103																					
CUOD																					
CUOI																					
CUOJ																					
CUOK																					
CUOL																					
CUOB	0.0670	0.0960	0.0060	0.1140		0.0340	0.0300	0.0130	0.1070	0.0070	0.0240	0.4380	0.0300			0.0060					0.0020
CUOC	0.0310	0.0930	0.0060	0.1110		0.0330	0.0290	0.0120	0.1030	0.0070	0.0230	0.4240	0.0950			0.0060					0.0020
CUOE	0.0320	0.0970	0.0060	0.1150		0.0340	0.0300	0.0130	0.1070	0.0070	0.0240	0.4700	0.0300			0.0060					0.0020
CUOF	0.0310	0.0940	0.0060	0.1120		0.0330	0.0290	0.0120	0.1040	0.0070	0.0240	0.4850	0.0290			0.0060					0.0020
CUOG	0.0320	0.0980	0.0060	0.1160		0.0340	0.0300	0.0130	0.1080	0.0070	0.0250	0.4450	0.0500			0.0060					0.0020
CUOH	0.0320	0.0970	0.0060	0.1400		0.0340	0.0300	0.0130	0.1080	0.0070	0.0240	0.4430	0.0300			0.0060					0.0020
CUOO	0.0330	0.1000	0.0060	0.1180		0.0350	0.0310	0.0130	0.1100	0.0070	0.0250	0.4520	0.0310			0.0060					0.0020
CUOP	0.0310	0.0940	0.0060	0.1120		0.0330	0.0290	0.0120	0.1040	0.0070	0.0240	0.4850	0.0290			0.0060					0.0020
CUOR	0.0320	0.0980	0.0060	0.1160		0.0340	0.0300	0.0130	0.1080	0.0070	0.0250	0.4640	0.0300			0.0060					0.0020
CUOU	0.0330	0.0990	0.0060	0.1170		0.0350	0.0310	0.0130	0.1090	0.0070	0.0250	0.4490	0.0410			0.0060					0.0020
CUOV	0.0320	0.0970	0.0060	0.1150		0.0340	0.0300	0.0130	0.1070	0.0070	0.0240	0.4400	0.0590			0.0060					0.0020
CU30	0.0520	0.0980	0.0060	0.1160		0.0340	0.0300	0.0130	0.1080	0.0070	0.0250	0.4450	0.0300			0.0060					0.0020
CU31	0.0610	0.0970	0.0060	0.1150		0.0340	0.0300	0.0130	0.1070	0.0070	0.0240	0.4400	0.0300			0.0060					0.0020

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
WVUTH65																					
WVUTH66																					
WVUTH67																					
WVUTH68																					
WVUTH69																					
WVUTH70																					
WVUTH71																					
WVUTH72																					
WVUTH73																					
WVUTH74																					
WVUTH75																					
WVUTH77																					
WVUTH78																					
WVUTH79																					
WVUTH80																					
WVUTH81																					
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WVUTH84																					
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WVUTH90																					
WVUTH91																					
WVUTH92																					
WVUTH93																					
WVUTH94																					
WVUTH96																					
WVUTH98																					
WVUTH99																					
WVUTH100																					
WVUTH102																					
WVUTH103																					
CUOD																					
CUOI																					
CUOJ																					
CUOK																					
CUOL																					
CUOB				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CUOC				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CUOE				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CUOF				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CUOG				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CUOH				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CUOO				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CUOP				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CUOR				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CUOU				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CUOV				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CU30				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CU31				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
WVUTH65																					
WVUTH66																					
WVUTH67																					
WVUTH68																					
WVUTH69																					
WVUTH70																					
WVUTH71																					
WVUTH72																					
WVUTH73																					
WVUTH74																					
WVUTH75																					
WVUTH77																					
WVUTH78																					
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WVUTH81																					
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WVUTH92																					
WVUTH93																					
WVUTH94																					
WVUTH96																					
WVUTH98																					
WVUTH99																					
WVUTH100																					
WVUTH102																					
WVUTH103																					
CUOD																					
CUOI																					
CUOJ																					
CUOK																					
CUOL																					
CUOB																0.0010				0.0000	0.0100
CUOC																0.0010				0.0000	0.0090
CUOE																0.0010				0.0000	0.0100
CUOF																0.0010				0.0000	0.0090
CUOG																0.0010				0.0000	0.0100
CUOH																0.0010				0.0000	0.0100
CUOO																0.0010				0.0000	0.0100
CUOP																0.0010				0.0000	0.0090
CUOR																0.0010				0.0000	0.0100
CUOU																0.0010				0.0000	0.0100
CUOV																0.0010				0.0000	0.0100
CU30																0.0010				0.0000	0.0100
CU31																0.0010				0.0000	0.0100

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
WVUTH65											0.0644	0.0879	0.0082	0.1197		0.0313	0.0269	0.0089	0.0974		0.0235
WVUTH66											0.0445	0.1031	0.0081	0.1194		0.0359	0.0306	0.0089	0.1107		0.0234
WVUTH67											0.0741	0.1055	0.0081	0.1193		0.0364	0.0311	0.0089	0.1126		0.0234
WVUTH68											0.0545	0.0923	0.0082	0.1196		0.0326	0.0279	0.0089	0.1012		0.0235
WVUTH69											0.0840	0.1012	0.0082	0.1194		0.0352	0.0301	0.0089	0.1088		0.0234
WVUTH70											0.0842	0.0923	0.0082	0.1196		0.0326	0.0279	0.0089	0.1012		0.0235
WVUTH71											0.0989	0.0945	0.0082	0.1196		0.0332	0.0285	0.0089	0.1032		0.0235
WVUTH72											0.0447	0.0878	0.0082	0.1197		0.0313	0.0269	0.0089	0.0974		0.0235
WVUTH73											0.0445	0.1099	0.0081	0.1192		0.0378	0.0322	0.0089	0.1163		0.0234
WVUTH74											0.0444	0.1186	0.0081	0.1190		0.0403	0.0343	0.0089	0.1238		0.0233
WVUTH75											0.0637	0.1481	0.0081	0.1182		0.0309	0.0265	0.0088	0.0962		0.0232
WVUTH77											0.0637	0.1482	0.0081	0.1182		0.0309	0.0265	0.0088	0.0962		0.0232
WVUTH78											0.0645	0.0878	0.0082	0.1694		0.0313	0.0269	0.0089	0.0974		0.0235
WVUTH79											0.0632	0.0862	0.0080	0.1175		0.0307	0.0264	0.0088	0.0956		0.0230
WVUTH80											0.0447	0.0879	0.0082	0.1198		0.0313	0.0269	0.0089	0.0975		0.0235
WVUTH81											0.0447	0.0879	0.0082	0.1197		0.0313	0.0269	0.0089	0.0974		0.0235
WVUTH82											0.0447	0.0879	0.0082	0.1395		0.0313	0.0269	0.0089	0.0975		0.0235
WVUTH83											0.0650	0.0885	0.0082	0.1206		0.0420	0.0283	0.0090	0.1286		0.0236
WVUTH84											0.0450	0.1201	0.0082	0.1206		0.0409	0.0348	0.0090	0.1259		0.0236
WVUTH89											0.0550	0.1045	0.0082	0.1206		0.0361	0.0310	0.0090	0.1120		0.0236
WVUTH90											0.0650	0.0976	0.0082	0.1506		0.0342	0.0293	0.0090	0.1060		0.0236
WVUTH91											0.0450	0.1203	0.0082	0.1206		0.0700	0.0348	0.0090	0.0981		0.0236
WVUTH92											0.0649	0.1018	0.0069	0.1205		0.0371	0.0313	0.0089	0.1134		0.0238
WVUTH93											0.0648	0.1241	0.0068	0.0905		0.0442	0.0382	0.0089	0.1366		0.0238
WVUTH94											0.0580	0.1058	0.0076	0.1106		0.0382	0.0323	0.0083	0.1234		0.0217
WVUTH96											0.0510	0.1476	0.0081	0.1191		0.0330	0.0281	0.0089	0.1015		0.0233
WVUTH98											0.0648	0.1175	0.0068	0.1106		0.0416	0.0360	0.0089	0.1286		0.0238
WVUTH99											0.0510	0.1162	0.0081	0.1191		0.0395	0.0335	0.0089	0.1211		0.0233
WVUTH100											0.0649	0.1019	0.0068	0.1205		0.0371	0.0313	0.0089	0.1135		0.0239
WVUTH102											0.0648	0.1017	0.0080	0.1202		0.0370	0.0312	0.0087	0.1131		0.0229
WVUTH103											0.0509	0.0872	0.0081	0.1189		0.0455	0.0381	0.0089	0.1396		0.0233
CUOD											0.0681	0.0947		0.1122							0.0238
CUOI											0.0602	0.0951		0.1127							0.0239
CUOJ											0.0321	0.0970		0.1149							0.0244
CUOK											0.0648	0.0950		0.1125							0.0238
CUOL											0.0312	0.0942		0.1117							0.0237
CUOB			0.0000					0.0000		1.0010	0.0668	0.0964		0.1142							0.0242
CUOC			0.0000					0.0000		1.0010	0.0309	0.0933		0.1105							0.0234
CUOE			0.0000					0.0000		1.0010	0.0321	0.0970		0.1149							0.0244
CUOF			0.0000					0.0000		1.0000	0.0312	0.0942		0.1117							0.0237
CUOG			0.0000					0.0000		1.0000	0.0325	0.0980		0.1160							0.0246
CUOH			0.0000					0.0000		1.0000	0.0323	0.0975		0.1399							0.0245
CUOO			0.0000					0.0000		0.9970											
CUOP			0.0000					0.0000		1.0000	0.0312	0.0942		0.1117							0.0237
CUOR			0.0000					0.0000		0.9990	0.0325	0.0980		0.1160							0.0246
CUOU			0.0000					0.0000		1.0010											
CUOV			0.0000					0.0000		1.0000											
CU30			0.0000					0.0000		1.0000											
CU31			0.0000					0.0000		1.0000											

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
WVUTH65	0.4461				0.0019																
WVUTH66	0.4299				0.0019																
WVUTH67	0.3951				0.0019																
WVUTH68	0.4457				0.0019																
WVUTH69	0.3954				0.0019																
WVUTH70	0.4160				0.0019																
WVUTH71	0.3960				0.0019																
WVUTH72	0.4660				0.0019																
WVUTH73	0.4145				0.0019																
WVUTH74	0.3940				0.0019																
WVUTH75	0.3916				0.0019																
WVUTH77	0.3915				0.0019																
WVUTH78	0.3964				0.0019																
WVUTH79	0.4375				0.0019																
WVUTH80	0.4462				0.0019																
WVUTH81	0.4461				0.0019																
WVUTH82	0.4460				0.0019																
WVUTH83	0.3992				0.0020																
WVUTH84	0.3992				0.0020																
WVUTH89	0.4242				0.0020																
WVUTH90	0.3992				0.0020																
WVUTH91	0.3992				0.0020																
WVUTH92	0.4096				0.0016																
WVUTH93	0.3801				0.0016																
WVUTH94	0.4151				0.0018																
WVUTH96	0.3941				0.0019																
WVUTH98	0.3801				0.0016																
WVUTH99	0.3941				0.0019																
WVUTH100	0.4097				0.0016																
WVUTH102	0.4087				0.0019																
WVUTH103	0.3937				0.0019																
CUOD	0.4298																				
CUOI	0.4320																				
CUOJ	0.4501																				
CUOK	0.4473																				
CUOL	0.4468																				
CUOB	0.4378																				
CUOC	0.4235																				
CUOE	0.4696																				
CUOF	0.4846																				
CUOG	0.4447																				
CUOH	0.4425																				
CUOO																					
CUOP	0.4846																				
CUOR	0.4644																				
CUOU																					
CUOV																					
CU30																					
CU31																					

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
WVUTH65			0.0121																		
WVUTH66			0.0121																		
WVUTH67			0.0121																		
WVUTH68			0.0121																		
WVUTH69			0.0121																		
WVUTH70			0.0121																		
WVUTH71			0.0121																		
WVUTH72			0.0121																		
WVUTH73			0.0121																		
WVUTH74			0.0120																		
WVUTH75			0.0120																		
WVUTH77			0.0120																		
WVUTH78			0.0121																		
WVUTH79			0.0119																		
WVUTH80			0.0121																		
WVUTH81			0.0121																		
WVUTH82			0.0121																		
WVUTH83			0.0122																		
WVUTH84			0.0122																		
WVUTH89			0.0122																		
WVUTH90			0.0122																		
WVUTH91			0.0122																		
WVUTH92			0.0102																		
WVUTH93			0.0102																		
WVUTH94			0.0112																		
WVUTH96			0.0120																		
WVUTH98			0.0102																		
WVUTH99			0.0120																		
WVUTH100			0.0102																		
WVUTH102			0.0118																		
WVUTH103			0.0120																		
CUOD			0.0132																		
CUOI			0.0133																		
CUOJ			0.0135																		
CUOK			0.0132																		
CUOL			0.0131																		
CUOB			0.0134																		
CUOC			0.0130																		
CUOE			0.0135																		
CUOF			0.0131																		
CUOG			0.0136																		
CUOH			0.0136																		
CUOO																					
CUOP			0.0131																		
CUOR			0.0136																		
CUOU																					
CUOV																					
CU30																					
CU31																					

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
WVUTH65									0.0353				0.0058						0.0302	0.9996
WVUTH66									0.0352				0.0058						0.0301	0.9996
WVUTH67									0.0352				0.0058						0.0301	0.9996
WVUTH68									0.0353				0.0058						0.0302	0.9997
WVUTH69									0.0352				0.0058						0.0301	0.9997
WVUTH70									0.0353				0.0058						0.0302	0.9997
WVUTH71									0.0353				0.0058						0.0302	0.9998
WVUTH72									0.0353				0.0058						0.0302	0.9997
WVUTH73									0.0352				0.0058						0.0301	0.9999
WVUTH74									0.0351				0.0058						0.0300	0.9995
WVUTH75									0.0349				0.0057						0.0297	0.9995
WVUTH77									0.0349				0.0057						0.0297	0.9995
WVUTH78									0.0353				0.0058						0.0302	0.9996
WVUTH79									0.0538				0.0057						0.0297	0.9999
WVUTH80									0.0549				0.0058						0.0302	0.9998
WVUTH81									0.0353				0.0058						0.0500	0.9997
WVUTH82									0.0353				0.0058						0.0302	0.9997
WVUTH83									0.0356				0.0058						0.0306	0.9992
WVUTH84									0.0356				0.0058						0.0306	1.0135
WVUTH89									0.0356				0.0058						0.0306	1.0104
WVUTH90									0.0356				0.0058						0.0306	1.0089
WVUTH91									0.0356				0.0058						0.0306	1.0150
WVUTH92									0.0351				0.0058						0.0290	0.9999
WVUTH93									0.0351				0.0058						0.0289	0.9996
WVUTH94									0.0327				0.0053						0.0277	0.9997
WVUTH96									0.0352				0.0057						0.0301	0.9996
WVUTH98									0.0351				0.0058						0.0290	1.0004
WVUTH99									0.0352				0.0052						0.0301	0.9992
WVUTH100									0.0351				0.0058						0.0289	1.0001
WVUTH102									0.0346				0.0056						0.0297	0.9999
WVUTH103									0.0351				0.0057						0.0313	1.0002
CUOD									0.0000				0.0000						0.2586	1.0004
CUOI									0.0000				0.0000						0.2628	1.0000
CUOJ									0.0000				0.0000						0.2680	1.0000
CUOK									0.0000				0.0000						0.2434	1.0000
CUOL									0.0000				0.0000						0.2794	1.0001
CUOB									0.0000				0.0000						0.2472	1.0000
CUOC									0.0000				0.0000						0.3054	1.0000
CUOE									0.0000				0.0000						0.2485	1.0000
CUOF									0.0000				0.0000						0.2415	1.0000
CUOG									0.0000				0.0000						0.2708	1.0002
CUOH									0.0000				0.0000						0.2500	1.0003
CUOO																				
CUOP									0.0000				0.0000						0.2415	1.0000
CUOR									0.0000				0.0000						0.2511	1.0002
CUOU																				
CUOV																				
CU30																				
CU31																				

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
WVUTH65								
WVUTH66								
WVUTH67								
WVUTH68								
WVUTH69								
WVUTH70								
WVUTH71								
WVUTH72								
WVUTH73								
WVUTH74								
WVUTH75								
WVUTH77								
WVUTH78								
WVUTH79								
WVUTH80								
WVUTH81								
WVUTH82								
WVUTH83								
WVUTH84								
WVUTH89								
WVUTH90								
WVUTH91								
WVUTH92								
WVUTH93								
WVUTH94								
WVUTH96								
WVUTH98								
WVUTH99								
WVUTH100								
WVUTH102								
WVUTH103								
CUOD								
CUOI								
CUOJ								
CUOK								
CUOL								
CUOB								
CUOC								
CUOE								
CUOF								
CUOG								
CUOH								
CUOO								
CUOP								
CUOR								
CUOU								
CUOV								
CU30								
CU31								

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
WVUTH65					
WVUTH66					
WVUTH67					
WVUTH68					
WVUTH69					
WVUTH70					
WVUTH71					
WVUTH72					
WVUTH73					
WVUTH74					
WVUTH75					
WVUTH77					
WVUTH78					
WVUTH79					
WVUTH80					
WVUTH81					
WVUTH82					
WVUTH83					
WVUTH84					
WVUTH89					
WVUTH90					
WVUTH91					
WVUTH92					
WVUTH93					
WVUTH94					
WVUTH96					
WVUTH98					
WVUTH99					
WVUTH100					
WVUTH102					
WVUTH103					
CUOD					
CUOI					
CUOJ					
CUOK					
CUOL					
CUOB					
CUOC					
CUOE					
CUOF					
CUOG					
CUOH					
CUOO					
CUOP					
CUOR					
CUOU					
CUOV					
CU30					
CU31					

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
WVUTH65															
WVUTH66															
WVUTH67															
WVUTH68															
WVUTH69															
WVUTH70															
WVUTH71															
WVUTH72															
WVUTH73															
WVUTH74															
WVUTH75															
WVUTH77															
WVUTH78															
WVUTH79															
WVUTH80															
WVUTH81															
WVUTH82															
WVUTH83															
WVUTH84															
WVUTH89															
WVUTH90															
WVUTH91															
WVUTH92															
WVUTH93															
WVUTH94															
WVUTH96															
WVUTH98															
WVUTH99															
WVUTH100															
WVUTH102															
WVUTH103															
CUOD															
CUOI															
CUOJ															
CUOK															
CUOL															
CUOB															
CUOC															
CUOE															
CUOF															
CUOG															
CUOH															
CUOO															
CUOP															
CUOR															
CUOU															
CUOV															
CU30															
CU31															

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
WVUTH65																					
WVUTH66																					
WVUTH67																					
WVUTH68																					
WVUTH69																					
WVUTH70																					
WVUTH71																					
WVUTH72																					
WVUTH73																					
WVUTH74																					
WVUTH75																					
WVUTH77																					
WVUTH78																					
WVUTH79																					
WVUTH80																					
WVUTH81																					
WVUTH82																					
WVUTH83																					
WVUTH84																					
WVUTH89																					
WVUTH90																					
WVUTH91																					
WVUTH92																					
WVUTH93																					
WVUTH94																					
WVUTH96																					
WVUTH98																					
WVUTH99																					
WVUTH100																					
WVUTH102																					
WVUTH103																					
CUOD																					
CUOI																					
CUOJ																					
CUOK																					
CUOL																					
CUOB																					
CUOC																					
CUOE																					
CUOF																					
CUOG																					
CUOH																					
CUOO																					
CUOP																					
CUOR																					
CUOU																					
CUOV																					
CU30																					
CU31																					

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
WVUTH65					0.246											
WVUTH66					0.408											
WVUTH67					0.314											
WVUTH68					0.298											
WVUTH69					0.251											
WVUTH70					0.245											
WVUTH71					0.231											
WVUTH72					0.253											
WVUTH73					0.548											
WVUTH74					0.807											
WVUTH75					0.281											
WVUTH77					0.358											
WVUTH78					0.325											
WVUTH79					0.275											
WVUTH80					0.363											
WVUTH81					0.315											
WVUTH82					0.385											
WVUTH83					0.478											
WVUTH84					1.113											
WVUTH89					0.452											
WVUTH90					0.349											
WVUTH91					0.864											
WVUTH92					0.304											
WVUTH93					1.294											
WVUTH94					0.421											
WVUTH96					0.393											
WVUTH98					0.684											
WVUTH99					0.629											
WVUTH100					0.346											
WVUTH102					0.327											
WVUTH103					0.878											
CUOD					0.220											
CUOI					0.211											
CUOJ					0.374											
CUOK					0.202											
CUOL					0.271											
CUOB					0.213	0.226	0.202	0.107	9.6							
CUOC					0.218	0.241	0.204	0.092	9.8							
CUOE					0.412	0.395	0.346	0.135	9.8							
CUOF					0.351	0.419	0.313	0.135	9.8							
CUOG					0.414	0.391	0.343	0.123	9.9							
CUOH					0.672	0.581	0.502	0.167	10.1							
CUOO					0.617	0.521	0.338	0.159	10.0							
CUOP					0.334	0.386	0.299	0.132	9.8							
CUOR					0.522	0.552	0.453	0.163	10.0							
CUOU					0.364	0.371	0.344	0.130	9.8							
CUOV					0.249	0.305	0.270	0.103	9.8							
CU30					0.276	0.330	0.276	0.111	9.8							
CU31					0.266	0.301	0.288	0.121	9.8							

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
WVUTH65												
WVUTH66												
WVUTH67												
WVUTH68												
WVUTH69												
WVUTH70												
WVUTH71												
WVUTH72												
WVUTH73												
WVUTH74												
WVUTH75												
WVUTH77												
WVUTH78												
WVUTH79												
WVUTH80												
WVUTH81												
WVUTH82												
WVUTH83												
WVUTH84												
WVUTH89												
WVUTH90												
WVUTH91												
WVUTH92												
WVUTH93												
WVUTH94												
WVUTH96												
WVUTH98												
WVUTH99												
WVUTH100												
WVUTH102												
WVUTH103												
CUOD												
CUOI												
CUOJ												
CUOK												
CUOL												
CUOB												
CUOC												
CUOE												
CUOF												
CUOG												
CUOH												
CUOO												
CUOP												
CUOR												
CUOU												
CUOV												
CU30												
CU31												

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
CU33	0.0790	0.0950	0.0060	0.1130		0.0330	0.0300	0.0120	0.1050	0.0070	0.0240	0.4320	0.0300			0.0060					0.0020
CU34	0.0880	0.0940	0.0060	0.1120		0.0330	0.0290	0.0120	0.1040	0.0070	0.0240	0.4280	0.0290			0.0060					0.0020
CU35	0.0320	0.0980	0.0060	0.1160		0.0340	0.0300	0.0130	0.1080	0.0070	0.0250	0.4450	0.0300			0.0060					0.0020
CU36	0.0320	0.0960	0.0060	0.1140		0.0340	0.0300	0.0130	0.1060	0.0070	0.0240	0.4360	0.0300			0.0060					0.0020
CU37	0.0310	0.0940	0.0060	0.1120		0.0330	0.0290	0.0120	0.1040	0.0070	0.0240	0.4280	0.0290			0.0060					0.0020
CU38	0.0320	0.0980	0.0060	0.1160		0.0340	0.0300	0.0130	0.1080	0.0070	0.0250	0.4450	0.0300			0.0060					0.0020
CU39	0.0320	0.0960	0.0060	0.1140		0.0340	0.0300	0.0130	0.1060	0.0070	0.0240	0.4360	0.0300			0.0060					0.0020
CU40	0.0310	0.0940	0.0060	0.1120		0.0330	0.0290	0.0120	0.1040	0.0070	0.0240	0.4280	0.0290			0.0060					0.0020
CU41	0.0320	0.0980	0.0060	0.1160		0.0340	0.0300	0.0130	0.1080	0.0070	0.0250	0.4450	0.0300			0.0060					0.0020
CU42	0.0320	0.0960	0.0060	0.1140		0.0340	0.0300	0.0130	0.1060	0.0070	0.0240	0.4360	0.0300			0.0060					0.0020
CU43	0.0310	0.0940	0.0060	0.1120		0.0330	0.0290	0.0120	0.1040	0.0070	0.0240	0.4280	0.0290			0.0060					0.0020
CU44	0.0320	0.0980	0.0060	0.1160		0.0340	0.0300	0.0130	0.1080	0.0070	0.0250	0.4450	0.0300			0.0060					0.0020
CU46	0.0310	0.0940	0.0060	0.1120		0.0330	0.0290	0.0120	0.1040	0.0070	0.0240	0.4280	0.0290			0.0060					0.0020
CU47	0.0320	0.0980	0.0060	0.1160		0.0340	0.0300	0.0130	0.1080	0.0270	0.0250	0.4450	0.0300			0.0060					0.0020
CU49	0.0310	0.0940	0.0060	0.1120		0.0330	0.0290	0.0120	0.1040	0.0630	0.0240	0.4280	0.0290			0.0060					0.0020
CU50	0.0320	0.0980	0.0060	0.1160		0.0340	0.0300	0.0130	0.1080	0.0070	0.0250	0.4450	0.0300			0.0060					0.0020
CU52	0.0310	0.0940	0.0060	0.1120		0.0330	0.0290	0.0120	0.1040	0.0070	0.0240	0.4280	0.0290			0.0060					0.0020
CU53																					
CU54																					
CU55																					
CU56																					
CU57																					
CU58																					

WVDP Support (Olson 1993 and 1994)

PNL 1	0.0771	0.1656	0.0048	0.1545		0.0313	0.0232	0.0089	0.0572	0.0025	0.0120	0.3949	0.0132			0.0026				0.0031	
PNL 2	0.0429	0.1656	0.0048	0.0859		0.0688	0.0232	0.0089	0.1028	0.0025	0.0120	0.4146	0.0132			0.0026				0.0031	
PNL 3	0.0771	0.1656	0.0048	0.0859		0.0688	0.0510	0.0089	0.1028	0.0025	0.0120	0.3526	0.0132			0.0026				0.0031	
PNL 4	0.0429	0.0922	0.0048	0.1545		0.0688	0.0232	0.0089	0.0572	0.0025	0.0120	0.4650	0.0132			0.0026				0.0031	
PNL 5	0.0429	0.1656	0.0048	0.0859		0.0313	0.0510	0.0089	0.0572	0.0025	0.0120	0.4699	0.0132			0.0026				0.0031	
PNL 6	0.0771	0.0922	0.0048	0.0859		0.0313	0.0432	0.0089	0.1028	0.0025	0.0120	0.4713	0.0132			0.0026				0.0031	
PNL 7	0.0771	0.0922	0.0048	0.0859		0.0688	0.0232	0.0089	0.0572	0.0025	0.0120	0.4638	0.0132			0.0026				0.0031	
PNL 8	0.0429	0.1652	0.0048	0.1545		0.0313	0.0232	0.0089	0.1028	0.0025	0.0120	0.3483	0.0132			0.0026				0.0031	
PNL 9	0.0771	0.0922	0.0048	0.1545		0.0688	0.0245	0.0089	0.1028	0.0025	0.0120	0.3483	0.0132			0.0026				0.0031	
PNL 10	0.0429	0.0922	0.0048	0.0859		0.0313	0.0510	0.0089	0.1028	0.0025	0.0120	0.4621	0.0132			0.0026				0.0031	
Alkali1	0.0657	0.1050	0.0048	0.1250		0.0470	0.0360	0.0089	0.0740	0.0025	0.0120	0.4276	0.0145			0.0026				0.0031	
Alkali2	0.0590	0.1460	0.0048	0.1242		0.0460	0.0410	0.0089	0.0760	0.0025	0.0120	0.3880	0.0144			0.0026				0.0031	
Alkali3	0.0596	0.1330	0.0048	0.1300		0.0480	0.0340	0.0089	0.0820	0.0025	0.0120	0.4000	0.0152			0.0026				0.0031	
Alkali4	0.0635	0.1110	0.0048	0.1150		0.0450	0.0350	0.0089	0.0780	0.0025	0.0120	0.4350	0.0153			0.0026				0.0031	
Alkali5	0.0620	0.1450	0.0048	0.1100		0.0460	0.0365	0.0089	0.0800	0.0025	0.0120	0.4043	0.0125			0.0026				0.0031	
Alkali6	0.0644	0.1180	0.0048	0.1350		0.0510	0.0380	0.0089	0.0775	0.0025	0.0120	0.4025	0.0139			0.0026				0.0031	
Alkali7	0.0580	0.1390	0.0048	0.1150		0.0540	0.0400	0.0089	0.0815	0.0025	0.0120	0.3900	0.0160			0.0026				0.0031	
Alkali8	0.0560	0.1250	0.0048	0.1150		0.0550	0.0330	0.0089	0.0900	0.0025	0.0120	0.4070	0.0144			0.0026				0.0031	
Alkali9	0.0667	0.1250	0.0048	0.1065		0.0510	0.0340	0.0089	0.0720	0.0025	0.0120	0.4215	0.0162			0.0026				0.0031	
Ref6Qtr2	0.0600	0.1289	0.0048	0.1202		0.0500	0.0371	0.0089	0.0800	0.0025	0.0120	0.4098	0.0132			0.0026				0.0031	

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
CU33				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CU34				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CU35				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CU36				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CU37				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CU38				0.0220	0.0010	0.0000							0.0000	0.0140					0.0000		
CU39				0.0410	0.0010	0.0000							0.0000	0.0130					0.0000		
CU40				0.0590	0.0010	0.0000							0.0000	0.0130					0.0000		
CU41				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CU42				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CU43				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CU44				0.0020	0.0010	0.0200							0.0000	0.0140					0.0000		
CU46				0.0020	0.0010	0.0570							0.0000	0.0130					0.0000		
CU47				0.0020	0.0010	0.0000							0.0000	0.0140					0.0000		
CU49				0.0020	0.0010	0.0000							0.0000	0.0130					0.0000		
CU50				0.0020	0.0010	0.0000							0.0200	0.0140					0.0000		
CU52				0.0020	0.0010	0.0000							0.0570	0.0130					0.0000		
CU53																					
CU54																					
CU55																					
CU56																					
CU57																					
CU58																					

WVDP Support (Olson 1993 and 1994)

PNL 1				0.0014											0.0082						
PNL 2				0.0014											0.0082						
PNL 3				0.0014											0.0082						
PNL 4				0.0014											0.0082						
PNL 5				0.0014											0.0082						
PNL 6				0.0014											0.0082						
PNL 7				0.0014											0.0082						
PNL 8				0.0014											0.0082						
PNL 9				0.0014											0.0082						
PNL 10				0.0014											0.0082						
Alkali1				0.0014											0.0082						
Alkali2				0.0014											0.0082						
Alkali3				0.0014											0.0082						
Alkali4				0.0014											0.0082						
Alkali5				0.0014											0.0082						
Alkali6				0.0014											0.0082						
Alkali7				0.0014											0.0082						
Alkali8				0.0014											0.0082						
Alkali9				0.0014											0.0082						
Ref6Qtr2				0.0014	0.0000	0.0000							0.0000		0.0082		0.0000		0.0000		

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
CU33																0.0010				0.0000	0.0100
CU34																0.0010				0.0000	0.0090
CU35																0.0010				0.0000	0.0300
CU36																0.0010				0.0000	0.0480
CU37																0.0010				0.0000	0.0660
CU38																0.0010				0.0000	0.0100
CU39																0.0010				0.0000	0.0100
CU40																0.0010				0.0000	0.0090
CU41																0.0010				0.0000	0.0100
CU42																0.0010				0.0000	0.0100
CU43																0.0010				0.0000	0.0090
CU44																0.0010				0.0000	0.0100
CU46																0.0010				0.0000	0.0090
CU47																0.0010				0.0000	0.0100
CU49																0.0010				0.0000	0.0090
CU50																0.0010				0.0000	0.0100
CU52																0.0010				0.0000	0.0090
CU53																					
CU54																					
CU55																					
CU56																					
CU57																					
CU58																					

WVDP Support (Olson 1993 and 1994)

PNL 1																0.0023	0.0025			0.0178	0.0080
PNL 2																0.0023	0.0025			0.0178	0.0080
PNL 3																0.0023	0.0025			0.0178	0.0080
PNL 4																0.0023	0.0025			0.0178	0.0080
PNL 5																0.0023	0.0025			0.0178	0.0080
PNL 6																0.0023	0.0025			0.0178	0.0080
PNL 7																0.0023	0.0025			0.0534	0.0080
PNL 8																0.0023	0.0025			0.0534	0.0080
PNL 9																0.0023	0.0025			0.0534	0.0080
PNL 10																0.0023	0.0025			0.0534	0.0080
Alkali1																0.0023	0.0025			0.0400	0.0080
Alkali2																0.0023	0.0025			0.0402	0.0080
Alkali3																0.0023	0.0025			0.0330	0.0080
Alkali4																0.0023	0.0025			0.0370	0.0080
Alkali5																0.0023	0.0025			0.0385	0.0080
Alkali6																0.0023	0.0025			0.0345	0.0080
Alkali7																0.0023	0.0025			0.0413	0.0080
Alkali8																0.0023	0.0025			0.0394	0.0080
Alkali9																0.0023	0.0025			0.0419	0.0080
Ref6Qtr2	0.0000		0.0000					0.0000	0.0000				0.0000			0.0023	0.0025			0.0356	0.0080

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
CU33			0.0000					0.0000		1.0010											
CU34			0.0000					0.0000		1.0000											
CU35			0.0000					0.0000		1.0000											
CU36			0.0000					0.0000		1.0010											
CU37			0.0000					0.0000		1.0000											
CU38			0.0000					0.0000		1.0000											
CU39			0.0000					0.0000		1.0020											
CU40			0.0000					0.0000		1.0000											
CU41			0.0000					0.0200		1.0000											
CU42			0.0000					0.0390		1.0020											
CU43			0.0000					0.0570		1.0000											
CU44			0.0000					0.0000		1.0000											
CU46			0.0000					0.0000		1.0000											
CU47			0.0000					0.0000		1.0000											
CU49			0.0000					0.0000		0.9990											
CU50			0.0000					0.0000		1.0000											
CU52			0.0000					0.0000		1.0000											
CU53										0.0000	0.0594	0.0949		0.1125							0.0238
CU54										0.0000	0.0586	0.0942		0.1115							0.0236
CU55										0.0000	0.0569	0.0923		0.1094							0.0232
CU56										0.0000	0.0584	0.0939		0.1112							0.0236
CU57										0.0000	0.0599	0.0955		0.1131							0.0240
CU58										0.0000	0.0330	0.0996		0.1180							0.0250

WVDP Support (Olson 1993 and 1994)

PNL 1				0.0063				0.0026		1.0000	0.0824	0.1656	0.0051	0.1611		0.0274	0.0233	0.0082	0.0574	0.0028	0.0128
PNL 2				0.0063				0.0026		1.0000	0.0469	0.1656	0.0055	0.0943		0.0655	0.0233	0.0083	0.1003	0.0029	0.0132
PNL 3				0.0063				0.0026		1.0000	0.0870	0.1656	0.0082	0.0897		0.0644	0.0466	0.0079	0.1119	0.0027	0.0105
PNL 4				0.0063				0.0026		1.0000	0.0448	0.0922	0.0058	0.1633		0.0623	0.0222	0.0078	0.0564	0.0027	0.0137
PNL 5				0.0063				0.0026		1.0000	0.0453	0.1657	0.0061	0.0919		0.0279	0.0487	0.0080	0.0551	0.0028	0.0130
PNL 6				0.0063				0.0026		1.0000	0.0804	0.0922	0.0052	0.0910		0.0289	0.0415	0.0080	0.0988	0.0028	0.0120
PNL 7				0.0063				0.0026		1.0000	0.0806	0.0922	0.0059	0.0905		0.0622	0.0225	0.0078	0.0589	0.0028	0.0132
PNL 8				0.0063				0.0026		1.0000	0.0481	0.1652	0.0062	0.1605		0.0302	0.0221	0.0080	0.1031	0.0027	0.0119
PNL 9				0.0063				0.0026		1.0000	0.0818	0.0922	0.0068	0.1615		0.0644	0.0241	0.0079	0.1021	0.0027	0.0105
PNL 10				0.0063				0.0026		1.0000	0.0487	0.0922	0.0049	0.0928		0.0293	0.0500	0.0080	0.0996	0.0027	0.0136
Alkali1				0.0063				0.0026		1.0000	0.0654	0.1050	0.0085	0.1271		0.0449	0.0372	0.0080	0.0754	0.0027	0.0099
Alkali2				0.0063				0.0026		1.0000	0.0600	0.1460	0.0088	0.1269		0.0436	0.0424	0.0082	0.0818	0.0027	0.0103
Alkali3				0.0063				0.0026		1.0000	0.0607	0.1330	0.0073	0.1351		0.0470	0.0365	0.0082	0.0823	0.0028	0.0084
Alkali4				0.0063				0.0026		1.0000	0.0640	0.1110	0.0085	0.1195		0.0435	0.0363	0.0080	0.0779	0.0027	0.0118
Alkali5				0.0063				0.0026		1.0000	0.0626	0.1450	0.0073	0.1151		0.0429	0.0385	0.0081	0.0810	0.0028	0.0106
Alkali6				0.0063				0.0026		1.0000	0.0654	0.1180	0.0075	0.1407		0.0501	0.0405	0.0081	0.0785	0.0027	0.0114
Alkali7				0.0063				0.0026		1.0000	0.0587	0.1390	0.0084	0.1211		0.0517	0.0421	0.0080	0.0807	0.0027	0.0120
Alkali8				0.0063				0.0026		1.0000	0.0569	0.1251	0.0078	0.1205		0.0544	0.0352	0.0082	0.0889	0.0027	0.0112
Alkali9				0.0063				0.0026		1.0000	0.0676	0.1250	0.0089	0.1122		0.0506	0.0362	0.0080	0.0718	0.0027	0.0110
Ref6Qtr2				0.0063			0.0000	0.0026		1.0000	0.0620	0.1289	0.0064	0.1250		0.0499	0.0392	0.0080	0.0797	0.0028	0.0117

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
CU33																					
CU34																					
CU35																					
CU36																					
CU37																					
CU38																					
CU39																					
CU40																					
CU41																					
CU42																					
CU43																					
CU44																					
CU46																					
CU47																					
CU49																					
CU50																					
CU52																					
CU53	0.4310																				
CU54	0.4275																				
CU55	0.4191																				
CU56	0.4261																				
CU57	0.4334																				
CU58	0.4522																				

WVDP Support (Olson 1993 and 1994)

PNL 1	0.3857	0.0133			0.0027				0.0031					0.0012							
PNL 2	0.4048	0.0136			0.0027				0.0031					0.0015							
PNL 3	0.3385	0.0125			0.0026				0.0031					0.0014							
PNL 4	0.4614	0.0131			0.0025				0.0031					0.0014							
PNL 5	0.4669	0.0140			0.0026				0.0031					0.0015							
PNL 6	0.4712	0.0133			0.0026				0.0031					0.0014							
PNL 7	0.4602	0.0134			0.0025				0.0031					0.0014							
PNL 8	0.3385	0.0133			0.0026				0.0031					0.0014							
PNL 9	0.3429	0.0131			0.0027				0.0031					0.0014							
PNL 10	0.4541	0.0136			0.0027				0.0031					0.0015							
Alkali1	0.4252	0.0128			0.0025				0.0031					0.0015							
Alkali2	0.3792	0.0119			0.0026				0.0031					0.0015							
Alkali3	0.3984	0.0090			0.0026				0.0031					0.0015							
Alkali4	0.4302	0.0119			0.0025				0.0031					0.0015							
Alkali5	0.3993	0.0104			0.0025				0.0031					0.0015							
Alkali6	0.3933	0.0112			0.0025				0.0031					0.0015							
Alkali7	0.3831	0.0137			0.0025				0.0031					0.0015							
Alkali8	0.3995	0.0121			0.0026				0.0031					0.0015							
Alkali9	0.4148	0.0116			0.0025				0.0031					0.0014							
Ref6Qtr2	0.4022	0.0109			0.0025				0.0031					0.0015							

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
CU33																					
CU34																					
CU35																					
CU36																					
CU37																					
CU38																					
CU39																					
CU40																					
CU41																					
CU42																					
CU43																					
CU44																					
CU46																					
CU47																					
CU49																					
CU50																					
CU52																					
CU53			0.0132																		
CU54			0.0131																		
CU55			0.0129																		
CU56			0.0131																		
CU57			0.0133																		
CU58			0.0136																		

WVDP Support (Olson 1993 and 1994)

PNL 1				0.0087																	
PNL 2				0.0089																	
PNL 3				0.0083																	
PNL 4				0.0085																	
PNL 5				0.0084																	
PNL 6				0.0085																	
PNL 7				0.0083																	
PNL 8				0.0084																	
PNL 9				0.0083																	
PNL 10				0.0085																	
Alkali1				0.0094																	
Alkali2				0.0093																	
Alkali3				0.0095																	
Alkali4				0.0093																	
Alkali5				0.0093																	
Alkali6				0.0095																	
Alkali7				0.0093																	
Alkali8				0.0093																	
Alkali9				0.0092																	
Ref6Qtr2				0.0091																	

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
CU33																				
CU34																				
CU35																				
CU36																				
CU37																				
CU38																				
CU39																				
CU40																				
CU41																				
CU42																				
CU43																				
CU44																				
CU46																				
CU47																				
CU49																				
CU50																				
CU52																				
CU53									0.0000				0.0000						0.2652	1.0000
CU54									0.0000				0.0000						0.2716	1.0001
CU55									0.0000				0.0000						0.2864	1.0002
CU56									0.0000				0.0000						0.2739	1.0002
CU57									0.0000				0.0000						0.2611	1.0003
CU58									0.0000				0.0000						0.2551	0.9965

WVDP Support (Olson 1993 and 1994)

PNL 1					0.0023	0.0025			0.0178	0.0076				0.0063				0.0027		1.0000
PNL 2					0.0023	0.0026			0.0178	0.0079				0.0063				0.0027		1.0000
PNL 3					0.0023	0.0024			0.0178	0.0073				0.0063				0.0030		1.0000
PNL 4					0.0023	0.0024			0.0178	0.0074				0.0063				0.0026		1.0000
PNL 5					0.0023	0.0024			0.0178	0.0075				0.0063				0.0027		1.0000
PNL 6					0.0023	0.0025			0.0178	0.0076				0.0063				0.0026		1.0000
PNL 7					0.0023	0.0025			0.0534	0.0074				0.0063				0.0026		1.0000
PNL 8					0.0023	0.0025			0.0534	0.0074				0.0063				0.0028		1.0000
PNL 9					0.0023	0.0025			0.0534	0.0074				0.0063				0.0026		1.0000
PNL 10					0.0023	0.0024			0.0534	0.0076				0.0063				0.0027		1.0000
Alkali1					0.0023	0.0025			0.0400	0.0076				0.0063				0.0027		1.0000
Alkali2					0.0023	0.0025			0.0402	0.0076				0.0063				0.0028		1.0000
Alkali3					0.0023	0.0025			0.0330	0.0078				0.0063				0.0027		1.0000
Alkali4					0.0023	0.0024			0.0370	0.0076				0.0063				0.0027		1.0000
Alkali5					0.0023	0.0025			0.0385	0.0077				0.0063				0.0027		1.0000
Alkali6					0.0023	0.0025			0.0345	0.0077				0.0063				0.0027		1.0000
Alkali7					0.0023	0.0024			0.0413	0.0076				0.0063				0.0026		1.0001
Alkali8					0.0023	0.0025			0.0394	0.0078				0.0063				0.0027		1.0000
Alkali9					0.0023	0.0025			0.0419	0.0076				0.0063				0.0028		1.0000
Ref6Qtr2					0.0023	0.0025			0.0356	0.0076				0.0063				0.0028		1.0000

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
CU33								
CU34								
CU35								
CU36								
CU37								
CU38								
CU39								
CU40								
CU41								
CU42								
CU43								
CU44								
CU46								
CU47								
CU49								
CU50								
CU52								
CU53								
CU54								
CU55								
CU56								
CU57								
CU58								

WVDP Support (Olson 1993 and 1994)

PNL 1								
PNL 2								
PNL 3								
PNL 4								
PNL 5								
PNL 6								
PNL 7								
PNL 8								
PNL 9								
PNL 10								
Alkali1								
Alkali2								
Alkali3								
Alkali4								
Alkali5								
Alkali6								
Alkali7								
Alkali8								
Alkali9								
Ref6Qtr2								

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
CU33					
CU34					
CU35					
CU36					
CU37					
CU38					
CU39					
CU40					
CU41					
CU42					
CU43					
CU44					
CU46					
CU47					
CU49					
CU50					
CU52					
CU53					
CU54					
CU55					
CU56					
CU57					
CU58					

WVDP Support (Olson 1993 and 1994)

PNL 1					
PNL 2					
PNL 3					
PNL 4					
PNL 5					
PNL 6					
PNL 7					
PNL 8					
PNL 9					
PNL 10					
Alkali1					
Alkali2					
Alkali3					
Alkali4					
Alkali5					
Alkali6					
Alkali7					
Alkali8					
Alkali9					
Ref6Qtr2					

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
CU33															
CU34															
CU35															
CU36															
CU37															
CU38															
CU39															
CU40															
CU41															
CU42															
CU43															
CU44															
CU46															
CU47															
CU49															
CU50															
CU52															
CU53															
CU54															
CU55															
CU56															
CU57															
CU58															

WVDP Support (Olson 1993 and 1994)

PNL 1													1237	3.75	1145
PNL 2							-10.648	16505.6	2.59				1140	2.81	1051
PNL 3							-10.072	14240.3	0.94				1141	1.01	1052
PNL 4							-11.093	19472.6	13.35				1143	12.74	(1052)
PNL 5							-10.165	16344.4	3.75				1144	3.81	1052
PNL 6							-10.164	17073.5	6.26				1147	6.43	1051
PNL 7							-11.608	20887.1	21.55				1138	20.62	1238
PNL 8							-10.837	16210.4	1.74				1141	1.95	1046
PNL 9							-10.574	16798.6	3.42				1140	3.42	1241
PNL 10							-9.327	14981.6	3.32				1143	2.84	1051
Alkali1							-10.660	17664.8	5.78				1144	6.13	1241
Alkali2							-10.481	16203.9	2.47				1145	2.53	1054
Alkali3							-10.680	16755.4	2.99				1138	3.15	1050
Alkali4							-10.578	17572.1	5.87				1143	5.96	1050
Alkali5							-10.391	16467.0	3.26				1144	3.4	1053
Alkali6							-10.727	16900.4	3.16				1138	3.26	1051
Alkali7							-10.145	15626.3	2.31				1140	2.46	1045
Alkali8							-10.471	16491.7	3.06				1141	3.12	1052
Alkali9							-10.632	17553.9	5.50				1142	5.47	1052
Ref6Qtr2							-10.727	16958.7	3.29				1130	3.83	1049

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
CU33																					
CU34																					
CU35																					
CU36																					
CU37																					
CU38																					
CU39																					
CU40																					
CU41																					
CU42																					
CU43																					
CU44																					
CU46																					
CU47																					
CU49																					
CU50																					
CU52																					
CU53																					
CU54																					
CU55																					
CU56																					
CU57																					
CU58																					

WVDP Support (Olson 1993 and 1994)

PNL 1	7.21																				
PNL 2	6.09	1239	1.35	1147	2.56	945	18.55														
PNL 3	1.92	1237	0.53	1147	0.95	945	5.11														
PNL 4	(15.9)	1241	6.42	1147	13.57	944	140.22														
PNL 5	8.07	1242	1.97	1148	3.81	950	25.98														
PNL 6	13.89	1147	6.16	1242	3.24	948	48.96														
PNL 7	10.69	1145	22.04	1046	66.26	946	271.96														
PNL 8	4.19	1237	0.91	1146	1.73	946	11.85														
PNL 9	1.73	1148	3.72	1042	8.65	946	25.53														
PNL 10	6.11	1239	1.51	1148	5.76	945	19.98														
Alkali1	2.87	1148	5.65	1047	14.39	945	48.72														
Alkali2	5.53	1242	1.27	1148	2.5	947	16.75														
Alkali3	6.9	1236	1.58	1147	3.15	946	22.25														
Alkali4	13.87	1240	2.98	1147	6.1	945	49.58														
Alkali5	7.27	1242	1.67	1148	3.26	947	23.08														
Alkali6	7.22	1237	1.7	1145	3.33	946	24.29														
Alkali7	5.35	1238	1.25	1137	2.54	943	15.35														
Alkali8	6.93	1241	1.61	1148	3.11	945	22.37														
Alkali9	12.87	1241	2.82	1149	5.58	945	46.36														
Ref6Qtr2	7.92	1131	3.78	1237	1.72	948	24.36														

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
CU33					0.230	0.251	0.234	0.116	9.9							
CU34					0.207	0.256	0.224	0.104	9.9							
CU35					0.973	0.825	0.808	0.229	10.2							
CU36					0.444	0.491	0.413	0.158	10.1							
CU37					0.379	0.382	0.367	0.159	10.0							
CU38					0.578	0.538	0.501	0.191	9.9							
CU39					0.481	0.445	0.463	0.166	10.0							
CU40					0.540	0.497	0.525	0.184	10.1							
CU41					1.955	1.471	1.510	0.312	10.2							
CU42					1.566	1.245	1.303	0.265	10.2							
CU43					1.764	1.499	1.321	0.322	10.4							
CU44					0.879	0.703	0.693	0.216	10.1							
CU46					0.579	0.560	0.542	0.157	9.6							
CU47					2.891	2.038	1.747	0.382	10.4							
CU49					3.331	2.490	2.390	0.356	10.4							
CU50					0.706	0.825	0.849	0.185	7.7							
CU52					1.040	0.935	0.929	0.218	10.2							
CU53					0.268											
CU54					0.349											
CU55					0.361											
CU56					0.349											
CU57					0.332											
CU58					0.823											

WVDP Support (Olson 1993 and 1994)

PNL 1					0.544	0.504	0.328	0.102	9.26							
PNL 2					4.044	2.702	2.426	0.189	9.96							
PNL 3					3.266	2.265	1.897	0.184	11.45							
PNL 4					0.239	0.25	0.19	0.113	9.89							
PNL 5					1.267	0.881	0.658	0.152	9.73							
PNL 6					0.269	0.266	0.225	0.131	10.24							
PNL 7					0.186	0.2	0.145	0.092	9.87							
PNL 8					1.575	1.197	0.962	0.112	9.75							
PNL 9					0.431	0.385	0.377	0.138	10.79							
PNL 10					0.757	0.495	0.467	0.195	10.98							
Alkali1					0.251	0.217	0.28	0.128	10.24							
Alkali2					0.647	0.43	0.474	0.115	10.18							
Alkali3					0.454	0.316	0.355	0.111	10.13							
Alkali4					0.274	0.195	0.257	0.111	10.13							
Alkali5					0.636	0.421	0.477	0.105	10.09							
Alkali6					0.328	0.24	0.302	0.116	10.27							
Alkali7					0.889	0.567	0.586	0.117	10.33							
Alkali8					0.468	0.35	0.412	0.124	10.28							
Alkali9					0.284	0.208	0.271	0.111	10.00							
Ref6Qtr2					0.415	0.353	0.317	0.113	10.21							

WV Glasses by CUA and PNL (Johnston et al. 1990)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
CU33												
CU34												
CU35												
CU36												
CU37												
CU38												
CU39												
CU40												
CU41												
CU42												
CU43												
CU44												
CU46												
CU47												
CU49												
CU50												
CU52												
CU53												
CU54												
CU55												
CU56												
CU57												
CU58												

WVDP Support (Olson 1993 and 1994)

PNL 1												
PNL 2												
PNL 3												
PNL 4												
PNL 5												
PNL 6												
PNL 7												
PNL 8												
PNL 9												
PNL 10												
Alkali1												
Alkali2												
Alkali3												
Alkali4												
Alkali5												
Alkali6												
Alkali7												
Alkali8												
Alkali9												
Ref6Qtr2												

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
WVDG-1																					
WVDG-2																					
WVDG-3																					
WVDG-4																					
WVDG-5																					
WVDG-6																					
WVDG-7																					
WVDG-8																					
WVDG-11R																					
WVDG-12R																					
WVDG-13R																					
WVDG-14R																					
WVDG-15																					
WVDG-16																					
WVDG-17																					
WVDG-18																					
WVDG-19																					
WVDG-20																					
WVDG-21																					
WVDG-22																					
WVDG-23																					
WVDG-24																					
WVDG-25																					
WVDG-26																					
WVDG-27																					
WVDG-28																					
WVDG-29																					
WVDG-30																					
WVDG-33																					
WVDG-34																					
WVDG-35																					
WVDG-36																					
WVDG-37																					
WVDG-38																					
WVDG-39																					
WVDG-40																					
WVDG-41																					
WVDG-42																					
WVDG-43																					
WVDG-44																					
WVDG-45																					
WVDG-46																					
WVDG-47																					
WVDG-48																					

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
WVDG-1																					
WVDG-2																					
WVDG-3																					
WVDG-4																					
WVDG-5																					
WVDG-6																					
WVDG-7																					
WVDG-8																					
WVDG-11R																					
WVDG-12R																					
WVDG-13R																					
WVDG-14R																					
WVDG-15																					
WVDG-16																					
WVDG-17																					
WVDG-18																					
WVDG-19																					
WVDG-20																					
WVDG-21																					
WVDG-22																					
WVDG-23																					
WVDG-24																					
WVDG-25																					
WVDG-26																					
WVDG-27																					
WVDG-28																					
WVDG-29																					
WVDG-30																					
WVDG-33																					
WVDG-34																					
WVDG-35																					
WVDG-36																					
WVDG-37																					
WVDG-38																					
WVDG-39																					
WVDG-40																					
WVDG-41																					
WVDG-42																					
WVDG-43																					
WVDG-44																					
WVDG-45																					
WVDG-46																					
WVDG-47																					
WVDG-48																					

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
WVDG-1																					
WVDG-2																					
WVDG-3																					
WVDG-4																					
WVDG-5																					
WVDG-6																					
WVDG-7																					
WVDG-8																					
WVDG-11R																					
WVDG-12R																					
WVDG-13R																					
WVDG-14R																					
WVDG-15																					
WVDG-16																					
WVDG-17																					
WVDG-18																					
WVDG-19																					
WVDG-20																					
WVDG-21																					
WVDG-22																					
WVDG-23																					
WVDG-24																					
WVDG-25																					
WVDG-26																					
WVDG-27																					
WVDG-28																					
WVDG-29																					
WVDG-30																					
WVDG-33																					
WVDG-34																					
WVDG-35																					
WVDG-36																					
WVDG-37																					
WVDG-38																					
WVDG-39																					
WVDG-40																					
WVDG-41																					
WVDG-42																					
WVDG-43																					
WVDG-44																					
WVDG-45																					
WVDG-46																					
WVDG-47																					
WVDG-48																					

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
WVDG-1											0.0874	0.1215	0.0068	0.1174		0.0116	0.0174	0.0132	0.0913	0.0031	0.0258
WVDG-2											0.0861	0.1217	0.0083	0.1172		0.0091	0.0176	0.0130	0.0904	0.0027	0.0260
WVDG-3											0.0716	0.0933	0.0063	0.1081		0.0192	0.0234	0.0170	0.0982	0.0036	0.0241
WVDG-4											0.0838	0.1177	0.0068	0.1106		0.0171	0.0171	0.0129	0.1147	0.0027	0.0254
WVDG-5											0.0690	0.1241	0.0068	0.1191		0.0150	0.0176	0.0135	0.0910	0.0030	0.0263
WVDG-6											0.0855	0.1215	0.0069	0.1155		0.0070	0.0171	0.0129	0.0913	0.0028	0.0356
WVDG-7											0.0884	0.1215	0.0065	0.1155		0.0127	0.0171	0.0128	0.0868	0.0028	0.0251
WVDG-8											0.0901	0.0751	0.0067	0.1229		0.0171	0.0184	0.0139	0.0938	0.0030	0.0268
WVDG-11R											0.1046	0.1097	0.0062	0.1190		0.0267	0.0263	0.0125	0.0952	0.0031	0.0248
WVDG-12R											0.1052	0.1082	0.0063	0.1182		0.0285	0.0257	0.0125	0.0958	0.0029	0.0252
WVDG-13R											0.1058	0.1078	0.0061	0.1190		0.0287	0.0259	0.0126	0.0938	0.0031	0.0250
WVDG-14R											0.1058	0.1098	0.0061	0.1199		0.0219	0.0261	0.0125	0.0951	0.0029	0.0250
WVDG-15											0.0960	0.1258	0.0136	0.0880		0.0164	0.0273	0.0127	0.1017	0.0053	0.0133
WVDG-16											0.0943	0.1261	0.0137	0.1442		0.0131	0.0191	0.0122	0.0864	0.0016	0.0323
WVDG-17											0.0943	0.0978	0.0143	0.0887		0.0207	0.0234	0.0129	0.1057	0.0058	0.0124
WVDG-18											0.0947	0.1062	0.0054	0.1444		0.0175	0.0244	0.0044	0.1114	0.0017	0.0155
WVDG-19											0.1223	0.1008	0.0131	0.1420		0.0197	0.0207	0.0128	0.0988	0.0016	0.0135
WVDG-20											0.1224	0.1062	0.0134	0.0875		0.0223	0.0204	0.0142	0.0863	0.0058	0.0334
WVDG-21											0.1251	0.1005	0.0050	0.1467		0.0123	0.0231	0.0053	0.1046	0.0017	0.0338
WVDG-22											0.1250	0.1157	0.0050	0.1403		0.0184	0.0182	0.0048	0.0831	0.0057	0.0143
WVDG-23											0.0942	0.1248	0.0050	0.1424		0.0186	0.0180	0.0054	0.0823	0.0018	0.0330
WVDG-24											0.1232	0.1322	0.0048	0.0867		0.0252	0.0205	0.0056	0.0956	0.0017	0.0141
WVDG-25											0.0930	0.1090	0.0050	0.0867		0.0202	0.0203	0.0053	0.0909	0.0019	0.0313
WVDG-26											0.1227	0.1338	0.0134	0.0867		0.0264	0.0200	0.0135	0.0909	0.0019	0.0162
WVDG-27											0.1217	0.1258	0.0049	0.0868		0.0245	0.0228	0.0062	0.1014	0.0062	0.0348
WVDG-28											0.0968	0.1066	0.0048	0.1211		0.0135	0.0205	0.0062	0.0886	0.0059	0.0153
WVDG-29											0.0928	0.1145	0.0133	0.0874		0.0184	0.0257	0.0136	0.1074	0.0019	0.0327
WVDG-30											0.1007	0.1188	0.0084	0.1148		0.0181	0.0210	0.0101	0.0963	0.0035	0.0242
WVDG-33											0.0822	0.0903	0.0040	0.1145		0.0344	0.0291	0.0098	0.1051	0.0029	0.0247
WVDG-34											0.0517	0.1081	0.0018	0.0977		0.0362	0.0307	0.0045	0.1107	0.0082	0.0187
WVDG-35											0.1002	0.0715	0.0070	0.1498		0.0371	0.0314	0.0174	0.1134	0.0014	0.0006
WVDG-36											0.0569	0.1080	0.0016	0.1466		0.0254	0.0215	0.0040	0.0775	0.0081	0.0059
WVDG-37											0.0998	0.0778	0.0014	0.0977		0.0390	0.0330	0.0036	0.1191	0.0080	0.0050
WVDG-38											0.1024	0.0758	0.0016	0.0967		0.0326	0.0276	0.0039	0.0995	0.0083	0.0060
WVDG-39											0.1005	0.1122	0.0066	0.0928		0.0362	0.0306	0.0164	0.1104	0.0022	0.0381
WVDG-40											0.0609	0.0753	0.0072	0.1535		0.0317	0.0269	0.0178	0.0968	0.0018	0.0060
WVDG-41											0.0592	0.0726	0.0020	0.0948		0.0375	0.0317	0.0051	0.1144	0.0021	0.0380
WVDG-42											0.0555	0.0675	0.0068	0.0953		0.0347	0.0294	0.0017	0.1060	0.0080	0.0368
WVDG-43											0.1004	0.1243	0.0020	0.0953		0.0268	0.0227	0.0049	0.0817	0.0018	0.0239
WVDG-44											0.0832	0.1150	0.0019	0.1581		0.0353	0.0299	0.0048	0.1079	0.0017	0.0062
WVDG-45											0.1021	0.0713	0.0016	0.1551		0.0384	0.0325	0.0040	0.1173	0.0018	0.0390
WVDG-46											0.0700	0.1223	0.0068	0.1039		0.0337	0.0286	0.0167	0.1030	0.0016	0.0059
WVDG-47											0.0569	0.1121	0.0016	0.1494		0.0267	0.0226	0.0040	0.0818	0.0015	0.0393
WVDG-48											0.0943	0.1056	0.0068	0.0924		0.0268	0.0227	0.0167	0.0818	0.0088	0.0428

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
WVDG-1	0.4325	0.0059			0.0005					0.0007				0.0019	0.0005	0.0000					
WVDG-2	0.4360	0.0056			0.0005					0.0007				0.0020	0.0005	0.0000					
WVDG-3	0.4546	0.0064			0.0007					0.0010				0.0029	0.0006	0.0000					
WVDG-4	0.4194	0.0054			0.0005					0.0007				0.0020	0.0005	0.0000					
WVDG-5	0.4443	0.0060			0.0005					0.0009				0.0021	0.0005	0.0000					
WVDG-6	0.4342	0.0056			0.0005					0.0005				0.0019	0.0005	0.0000					
WVDG-7	0.4303	0.0062			0.0005					0.0007				0.0020	0.0004	0.0000					
WVDG-8	0.4583	0.0057			0.0005					0.0010				0.0019	0.0014	0.0000					
WVDG-11R	0.4061	0.0046			0.0005					0.0007				0.0017	0.0009	0.0000					
WVDG-12R	0.4016	0.0054			0.0005					0.0007				0.0017	0.0010	0.0000					
WVDG-13R	0.4018	0.0052			0.0005					0.0007				0.0017	0.0012	0.0000					
WVDG-14R	0.4020	0.0073			0.0005					0.0007				0.0017	0.0013	0.0000					
WVDG-15	0.3979	0.0069			0.0033					0.0124				0.0024	0.0012	0.0002					
WVDG-16	0.3995	0.0021			0.0032					0.0038				0.0007	0.0004	0.0008					
WVDG-17	0.3957	0.0075			0.0032					0.0136				0.0026	0.0013	0.0002					
WVDG-18	0.4320	0.0022			0.0011					0.0039				0.0008	0.0004	0.0002					
WVDG-19	0.3601	0.0021			0.0032					0.0038				0.0007	0.0004	0.0007					
WVDG-20	0.3995	0.0075			0.0031					0.0135				0.0026	0.0013	0.0002					
WVDG-21	0.3754	0.0022			0.0011					0.0039				0.0008	0.0004	0.0007					
WVDG-22	0.3738	0.0073			0.0011					0.0132				0.0026	0.0013	0.0002					
WVDG-23	0.3931	0.0024			0.0011					0.0042				0.0008	0.0004	0.0000					
WVDG-24	0.4210	0.0022			0.0011					0.0040				0.0008	0.0004	0.0002					
WVDG-25	0.4500	0.0024			0.0010					0.0044				0.0008	0.0004	0.0002					
WVDG-26	0.4095	0.0025			0.0030					0.0045				0.0009	0.0004	0.0003					
WVDG-27	0.3672	0.0080			0.0011					0.0144				0.0028	0.0014	0.0008					
WVDG-28	0.4338	0.0077			0.0011					0.0138				0.0027	0.0013	0.0008					
WVDG-29	0.4468	0.0024			0.0032					0.0044				0.0008	0.0004	0.0002					
WVDG-30	0.4006	0.0045			0.0020					0.0080				0.0016	0.0008	0.0004					
WVDG-33	0.4250	0.0037			0.0006					0.0067				0.0013	0.0007	0.0004					
WVDG-34	0.4000	0.0106			0.0003					0.0191				0.0037	0.0019	0.0011					
WVDG-35	0.3800	0.0018			0.0010					0.0032				0.0006	0.0003	0.0002					
WVDG-36	0.4110	0.0104			0.0002					0.0188				0.0037	0.0018	0.0010					
WVDG-37	0.4200	0.0103			0.0002					0.0186				0.0036	0.0018	0.0010					
WVDG-38	0.4090	0.0107			0.0000					0.0193				0.0037	0.0019	0.0011					
WVDG-39	0.3800	0.0028			0.0009					0.0051				0.0010	0.0005	0.0003					
WVDG-40	0.4436	0.0023			0.0010					0.0042				0.0008	0.0004	0.0002					
WVDG-41	0.4500	0.0027			0.0003					0.0048				0.0009	0.0005	0.0003					
WVDG-42	0.4000	0.0103			0.0010					0.0185				0.0036	0.0018	0.0010					
WVDG-43	0.4200	0.0023			0.0003					0.0041				0.0008	0.0004	0.0002					
WVDG-44	0.3800	0.0022			0.0003					0.0040				0.0008	0.0004	0.0002					
WVDG-45	0.3800	0.0023			0.0002					0.0041				0.0008	0.0004	0.0002					
WVDG-46	0.4500	0.0021			0.0010					0.0037				0.0007	0.0004	0.0002					
WVDG-47	0.4500	0.0020			0.0002					0.0036				0.0007	0.0004	0.0002					
WVDG-48	0.3800	0.0114			0.0010					0.0205				0.0040	0.0020	0.0011					

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Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
WVDG-1		0.0004	0.0130			0.0001		0.0000		0.0000			0.0003					0.0000	0.0000		
WVDG-2		0.0004	0.0132			0.0001		0.0000		0.0001			0.0003					0.0001	0.0008		
WVDG-3		0.0005	0.0176			0.0000		0.0000		0.0001			0.0000					0.0001	0.0007		
WVDG-4		0.0004	0.0130			0.0001		0.0000		0.0000			0.0003					0.0000	0.0000		
WVDG-5		0.0004	0.0136			0.0001		0.0000		0.0000			0.0003					0.0000	0.0000		
WVDG-6		0.0004	0.0130			0.0001		0.0000		0.0000			0.0003					0.0000	0.0000		
WVDG-7		0.0004	0.0129			0.0001		0.0000		0.0000			0.0003					0.0000	0.0000		
WVDG-8		0.0004	0.0137			0.0001		0.0000		0.0000			0.0003					0.0000	0.0000		
WVDG-11R		0.0003	0.0132			0.0001		0.0000		0.0001			0.0003					0.0001	0.0008		
WVDG-12R		0.0003	0.0131			0.0001		0.0000		0.0001			0.0003					0.0001	0.0008		
WVDG-13R		0.0003	0.0131			0.0001		0.0000		0.0001			0.0003					0.0001	0.0008		
WVDG-14R		0.0003	0.0131			0.0001		0.0000		0.0001			0.0003					0.0001	0.0008		
WVDG-15		0.0007	0.0251			0.0007		0.0024					0.0007								
WVDG-16		0.0002	0.0223			0.0002		0.0007					0.0002								
WVDG-17		0.0008	0.0249			0.0008		0.0026					0.0008								
WVDG-18		0.0002	0.0054			0.0002		0.0008					0.0002								
WVDG-19		0.0002	0.0050			0.0002		0.0007					0.0002								
WVDG-20		0.0007	0.0052			0.0007		0.0026					0.0007								
WVDG-21		0.0002	0.0250			0.0002		0.0008					0.0002								
WVDG-22		0.0007	0.0246			0.0007		0.0026					0.0007								
WVDG-23		0.0002	0.0051			0.0002		0.0008					0.0002								
WVDG-24		0.0002	0.0244			0.0002		0.0008					0.0002								
WVDG-25		0.0002	0.0240			0.0002		0.0008					0.0002								
WVDG-26		0.0003	0.0055			0.0003		0.0009					0.0003								
WVDG-27		0.0008	0.0051			0.0008		0.0028					0.0008								
WVDG-28		0.0008	0.0052			0.0008		0.0027					0.0008								
WVDG-29		0.0002	0.0050			0.0002		0.0008					0.0002								
WVDG-30		0.0004	0.0120			0.0004		0.0016					0.0004								
WVDG-33		0.0004	0.0128			0.0004		0.0013		0.0000			0.0004					0.0000	0.0000		
WVDG-34		0.0011	0.0198			0.0011		0.0037		0.0000			0.0011					0.0000	0.0000		
WVDG-35		0.0002	0.0195			0.0002		0.0006		0.0000			0.0002					0.0000	0.0000		
WVDG-36		0.0010	0.0012			0.0010		0.0037		0.0000			0.0010					0.0000	0.0000		
WVDG-37		0.0010	0.0013			0.0010		0.0036		0.0000			0.0010					0.0000	0.0000		
WVDG-38		0.0011	0.0161			0.0011		0.0037		0.0000			0.0011					0.0000	0.0000		
WVDG-39		0.0003	0.0011			0.0003		0.0010		0.0000			0.0003					0.0000	0.0000		
WVDG-40		0.0002	0.0012			0.0002		0.0008					0.0002								
WVDG-41		0.0003	0.0012			0.0003		0.0009		0.0000			0.0003					0.0000	0.0000		
WVDG-42		0.0010	0.0195			0.0010		0.0036		0.0000			0.0010					0.0000	0.0000		
WVDG-43		0.0002	0.0194			0.0002		0.0008		0.0000			0.0002					0.0000	0.0000		
WVDG-44		0.0002	0.0013			0.0002		0.0008		0.0000			0.0002					0.0000	0.0000		
WVDG-45		0.0002	0.0201			0.0002		0.0008		0.0000			0.0002					0.0000	0.0000		
WVDG-46		0.0002	0.0196			0.0002		0.0007					0.0002								
WVDG-47		0.0002	0.0194			0.0002		0.0007		0.0000			0.0002					0.0000	0.0000		
WVDG-48		0.0011	0.0012			0.0011		0.0040		0.0000			0.0011					0.0000	0.0000		

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
WVDG-1		0.0003			0.0030	0.0003			0.0286	0.0096			0.0054				0.0002	0.0000		0.9987
WVDG-2		0.0003			0.0030	0.0003			0.0280	0.0096			0.0053				0.0002	0.0000		0.9991
WVDG-3		0.0000			0.0027	0.0004			0.0273	0.0122			0.0054				0.0003	0.0000		0.9983
WVDG-4		0.0003			0.0029	0.0003			0.0294	0.0090			0.0054				0.0002	0.0000		0.9986
WVDG-5		0.0003			0.0031	0.0003			0.0311	0.0097			0.0057				0.0002	0.0000		1.0045
WVDG-6		0.0003			0.0030	0.0003			0.0275	0.0093			0.0053				0.0002	0.0000		0.9990
WVDG-7		0.0003			0.0029	0.0003			0.0383	0.0096			0.0046				0.0002	0.0000		0.9992
WVDG-8		0.0003			0.0032	0.0003			0.0275	0.0101			0.0058				0.0002	0.0005		0.9990
WVDG-11R		0.0003			0.0031	0.0003			0.0220	0.0095			0.0063				0.0002	0.0002		0.9994
WVDG-12R		0.0003			0.0030	0.0003			0.0253	0.0094			0.0065				0.0001	0.0006		0.9997
WVDG-13R		0.0003			0.0031	0.0003			0.0248	0.0096			0.0069				0.0002	0.0000		0.9989
WVDG-14R		0.0003			0.0030	0.0003			0.0259	0.0096			0.0064				0.0002	0.0000		0.9991
WVDG-15		0.0003			0.0040	0.0003			0.0166	0.0144			0.0092				0.0003	0.0002		0.9993
WVDG-16		0.0001			0.0012	0.0001			0.0160	0.0044			0.0013				0.0001	0.0002		1.0005
WVDG-17		0.0004			0.0043	0.0004			0.0469	0.0158			0.0008				0.0004	0.0006		0.9996
WVDG-18		0.0001			0.0013	0.0001			0.0196	0.0046			0.0009				0.0001	0.0000		0.9997
WVDG-19		0.0001			0.0012	0.0001			0.0524	0.0044			0.0093				0.0001	0.0000		0.9902
WVDG-20		0.0004			0.0043	0.0004			0.0187	0.0157			0.0095				0.0004	0.0002		0.9991
WVDG-21		0.0001			0.0012	0.0001			0.0159	0.0046			0.0092				0.0001	0.0006		1.0008
WVDG-22		0.0004			0.0042	0.0004			0.0175	0.0154			0.0011				0.0004	0.0002		0.9989
WVDG-23		0.0001			0.0014	0.0001			0.0495	0.0050			0.0093				0.0001	0.0002		0.9997
WVDG-24		0.0001			0.0013	0.0001			0.0188	0.0047			0.0093				0.0001	0.0002		0.9997
WVDG-25		0.0001			0.0014	0.0001			0.0436	0.0051			0.0010				0.0001	0.0000		0.9996
WVDG-26		0.0001			0.0014	0.0001			0.0380	0.0053			0.0010				0.0001	0.0002		1.0001
WVDG-27		0.0004			0.0046	0.0004			0.0346	0.0168			0.0011				0.0004	0.0006		1.0000
WVDG-28		0.0004			0.0044	0.0004			0.0172	0.0161			0.0096				0.0004	0.0006		0.9999
WVDG-29		0.0001			0.0014	0.0001			0.0193	0.0051			0.0010				0.0001	0.0002		0.9996
WVDG-30		0.0002			0.0026	0.0002			0.0326	0.0094			0.0059				0.0002	0.0003		1.0000
WVDG-33		0.0002			0.0021	0.0002			0.0337	0.0078			0.0050				0.0002	0.0003		1.0002
WVDG-34		0.0005			0.0061	0.0005			0.0192	0.0223			0.0183				0.0005	0.0008		1.0000
WVDG-35		0.0001			0.0010	0.0001			0.0278	0.0038			0.0240				0.0001	0.0001		0.9946
WVDG-36		0.0005			0.0060	0.0005			0.0581	0.0219			0.0013				0.0005	0.0008		0.9999
WVDG-37		0.0005			0.0060	0.0005			0.0209	0.0216			0.0014				0.0005	0.0008		1.0000
WVDG-38		0.0005			0.0061	0.0005			0.0413	0.0225			0.0009				0.0005	0.0008		0.9963
WVDG-39		0.0001			0.0016	0.0001			0.0511	0.0060			0.0010				0.0001	0.0002		0.9998
WVDG-40		0.0001			0.0013	0.0001			0.0419	0.0049			0.0182				0.0001	0.0002		0.9998
WVDG-41		0.0001			0.0015	0.0001			0.0527	0.0056			0.0199				0.0001	0.0002		1.0001
WVDG-42		0.0005			0.0059	0.0005			0.0500	0.0216			0.0012				0.0005	0.0008		0.9850
WVDG-43		0.0001			0.0013	0.0001			0.0414	0.0048			0.0192				0.0001	0.0002		0.9999
WVDG-44		0.0001			0.0013	0.0001			0.0371	0.0047			0.0215				0.0001	0.0002		0.9997
WVDG-45		0.0001			0.0013	0.0001			0.0179	0.0048			0.0010				0.0001	0.0002		0.9981
WVDG-46		0.0001			0.0012	0.0001			0.0216	0.0042			0.0011				0.0001	0.0002		1.0001
WVDG-47		0.0001			0.0011	0.0001			0.0195	0.0042			0.0012				0.0001	0.0002		1.0002
WVDG-48		0.0006			0.0066	0.0006			0.0206	0.0239			0.0190				0.0006	0.0009		1.0000

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Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
WVDG-1								
WVDG-2								
WVDG-3								
WVDG-4								
WVDG-5								
WVDG-6								
WVDG-7								
WVDG-8								
WVDG-11R								
WVDG-12R								
WVDG-13R								
WVDG-14R								
WVDG-15								
WVDG-16								
WVDG-17								
WVDG-18								
WVDG-19								
WVDG-20								
WVDG-21								
WVDG-22								
WVDG-23								
WVDG-24								
WVDG-25								
WVDG-26								
WVDG-27								
WVDG-28								
WVDG-29								
WVDG-30								
WVDG-33								
WVDG-34								
WVDG-35								
WVDG-36								
WVDG-37								
WVDG-38								
WVDG-39								
WVDG-40								
WVDG-41								
WVDG-42								
WVDG-43								
WVDG-44								
WVDG-45								
WVDG-46								
WVDG-47								
WVDG-48								

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
WVDG-1					
WVDG-2					
WVDG-3					
WVDG-4					
WVDG-5					
WVDG-6					
WVDG-7					
WVDG-8					
WVDG-11R					
WVDG-12R					
WVDG-13R					
WVDG-14R					
WVDG-15					
WVDG-16					
WVDG-17					
WVDG-18					
WVDG-19					
WVDG-20					
WVDG-21					
WVDG-22					
WVDG-23					
WVDG-24					
WVDG-25					
WVDG-26					
WVDG-27					
WVDG-28					
WVDG-29					
WVDG-30					
WVDG-33					
WVDG-34					
WVDG-35					
WVDG-36					
WVDG-37					
WVDG-38					
WVDG-39					
WVDG-40					
WVDG-41					
WVDG-42					
WVDG-43					
WVDG-44					
WVDG-45					
WVDG-46					
WVDG-47					
WVDG-48					

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
WVDG-1															
WVDG-2															
WVDG-3															
WVDG-4															
WVDG-5															
WVDG-6															
WVDG-7															
WVDG-8															
WVDG-11R															
WVDG-12R															
WVDG-13R															
WVDG-14R															
WVDG-15															
WVDG-16															
WVDG-17															
WVDG-18															
WVDG-19															
WVDG-20															
WVDG-21															
WVDG-22															
WVDG-23															
WVDG-24															
WVDG-25															
WVDG-26															
WVDG-27															
WVDG-28															
WVDG-29															
WVDG-30															
WVDG-33															
WVDG-34															
WVDG-35															
WVDG-36															
WVDG-37															
WVDG-38															
WVDG-39															
WVDG-40															
WVDG-41															
WVDG-42															
WVDG-43															
WVDG-44															
WVDG-45															
WVDG-46															
WVDG-47															
WVDG-48															

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
WVDG-1																					
WVDG-2																					
WVDG-3																					
WVDG-4																					
WVDG-5																					
WVDG-6																					
WVDG-7																					
WVDG-8																					
WVDG-11R																					
WVDG-12R																					
WVDG-13R																					
WVDG-14R																					
WVDG-15																					
WVDG-16																					
WVDG-17																					
WVDG-18																					
WVDG-19																					
WVDG-20																					
WVDG-21																					
WVDG-22																					
WVDG-23																					
WVDG-24																					
WVDG-25																					
WVDG-26																					
WVDG-27																					
WVDG-28																					
WVDG-29																					
WVDG-30																					
WVDG-33																					
WVDG-34																					
WVDG-35																					
WVDG-36																					
WVDG-37																					
WVDG-38																					
WVDG-39																					
WVDG-40																					
WVDG-41																					
WVDG-42																					
WVDG-43																					
WVDG-44																					
WVDG-45																					
WVDG-46																					
WVDG-47																					
WVDG-48																					

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
WVDG-1					0.180	0.250	0.159	0.127	9.40							
WVDG-2					0.207	0.311	0.181	0.133	9.34							
WVDG-3					0.238	0.291	0.233	0.139	9.77							
WVDG-4					0.261	0.303	0.266	0.134	9.78							
WVDG-5					0.214	0.285	0.198	0.128	9.46							
WVDG-6					0.199	0.303	0.169	0.131	9.50							
WVDG-7					0.180	0.267	0.169	0.125	9.37							
WVDG-8					0.173	0.273	0.174	0.121	9.73							
WVDG-11R					0.205	0.246	0.204	0.122	9.81							
WVDG-12R					0.217	0.263	0.214	0.123	9.81							
WVDG-13R					0.237	0.279	0.243	0.128	9.74							
WVDG-14R					0.288	0.333	0.302	0.136	9.95							
WVDG-15					0.296	0.3	0.264	0.132	9.89							
WVDG-16					0.189	0.235	0.165	0.09	9.42							
WVDG-17					0.292	0.292	0.273	0.128	10.12							
WVDG-18					0.225	0.269	0.219	0.137	9.94							
WVDG-19					0.214	0.282	0.207	0.124	9.97							
WVDG-20					0.16	0.242	0.139	0.113	9.46							
WVDG-21					0.225	0.252	0.222	0.152	9.71							
WVDG-22					0.21	0.3	0.179	0.145	9.39							
WVDG-23					0.253	0.307	0.187	0.146	9.3							
WVDG-24					0.213	0.286	0.173	0.124	9.45							
WVDG-25					0.188	0.253	0.164	0.131	9.58							
WVDG-26					0.185	0.257	0.156	0.105	9.48							
WVDG-27					0.309	0.327	0.243	0.154	9.55							
WVDG-28					0.201	0.289	0.169	0.139	9.51							
WVDG-29					0.217	0.018	0.214	0.12	9.79							
WVDG-30					0.209	0.007	0.196	0.126	9.63							
WVDG-33					0.247	0.263	0.245	0.138	10.17							
WVDG-34					0.417	0.388	0.363	0.168	10.14							
WVDG-35					0.400	0.394	0.399	0.185	10.83							
WVDG-36					0.244	0.251	0.164	0.134	9.68							
WVDG-37					0.231	0.267	0.267	0.148	10.38							
WVDG-38					0.197	0.240	0.197	0.133	10.23							
WVDG-39					0.271	0.249	0.247	0.128	9.9							
WVDG-40					0.305	0.305	0.289	0.154	10.32							
WVDG-41					0.314	0.299	0.369	0.161	10.52							
WVDG-42					0.380	0.355	0.364	0.173	10.44							
WVDG-43					0.208	0.257	0.138	0.138	9.35							
WVDG-44					0.357	0.358	0.331	0.152	10.29							
WVDG-45					0.260	0.265	0.300	0.155	10.57							
WVDG-46					0.372	0.317	0.299	0.145	10.01							
WVDG-47					0.224	0.233	0.156	0.14	9.3							
WVDG-48					0.179	0.206	0.129	0.123	9.32							

West Valley CVS Glasses PCT (Olson et al. 1994)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
WVDG-1												
WVDG-2												
WVDG-3												
WVDG-4												
WVDG-5												
WVDG-6												
WVDG-7												
WVDG-8												
WVDG-11R												
WVDG-12R												
WVDG-13R												
WVDG-14R												
WVDG-15												
WVDG-16												
WVDG-17												
WVDG-18												
WVDG-19												
WVDG-20												
WVDG-21												
WVDG-22												
WVDG-23												
WVDG-24												
WVDG-25												
WVDG-26												
WVDG-27												
WVDG-28												
WVDG-29												
WVDG-30												
WVDG-33												
WVDG-34												
WVDG-35												
WVDG-36												
WVDG-37												
WVDG-38												
WVDG-39												
WVDG-40												
WVDG-41												
WVDG-42												
WVDG-43												
WVDG-44												
WVDG-45												
WVDG-46												
WVDG-47												
WVDG-48												

West Valley WQR (West Valley Nuclear Services 1995)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
WVDG-40																					
WVDG-46																					
FY92#5																					
FY92#6																					
FY92#7																					
FY92#9																					
FY92#10																					
FY92Ref5																					
Ratio2																					
Ratio4																					
Ratio5																					
LoTh2																					
LoTh4																					
LoTh5																					
HiFe2																					
HiFe3																					
HiFe4																					
PNL190																					
FY93#1																					
FY93#2																					
FY93#3																					
FY93#4																					
FY93#5																					
FY93#6																					
FY93#7																					
FY93#8																					
FY93#9																					
FY93#10																					
FY94#1																					
FY94#2																					
FY94#3																					
FY94#4																					
FY94#5																					
FY94#6																					
FY94#7																					
FY94#8																					
FY94#9																					
FY94#10																					
Sigma1																					
Sigma2																					
Sigma3																					
Sigma4																					
Sigma5																					
Sigma6																					
Sigma7																					
Sigma8																					
Sigma9																					
Sigma10																					

West Valley WQR (West Valley Nuclear Services 1995)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
WVDG-40																					
WVDG-46																					
FY92#5																					
FY92#6																					
FY92#7																					
FY92#9																					
FY92#10																					
FY92Ref5																					
Ratio2																					
Ratio4																					
Ratio5																					
LoTh2																					
LoTh4																					
LoTh5																					
HiFe2																					
HiFe3																					
HiFe4																					
PNL190																					
FY93#1																					
FY93#2																					
FY93#3																					
FY93#4																					
FY93#5																					
FY93#6																					
FY93#7																					
FY93#8																					
FY93#9																					
FY93#10																					
FY94#1																					
FY94#2																					
FY94#3																					
FY94#4																					
FY94#5																					
FY94#6																					
FY94#7																					
FY94#8																					
FY94#9																					
FY94#10																					
Sigma1																					
Sigma2																					
Sigma3																					
Sigma4																					
Sigma5																					
Sigma6																					
Sigma7																					
Sigma8																					
Sigma9																					
Sigma10																					

West Valley WQR (West Valley Nuclear Services 1995)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
WVDG-40																					
WVDG-46																					
FY92#5																					
FY92#6																					
FY92#7																					
FY92#9																					
FY92#10																					
FY92Ref5																					
Ratio2																					
Ratio4																					
Ratio5																					
LoTh2																					
LoTh4																					
LoTh5																					
HiFe2																					
HiFe3																					
HiFe4																					
PNL190																					
FY93#1																					
FY93#2																					
FY93#3																					
FY93#4																					
FY93#5																					
FY93#6																					
FY93#7																					
FY93#8																					
FY93#9																					
FY93#10																					
FY94#1																					
FY94#2																					
FY94#3																					
FY94#4																					
FY94#5																					
FY94#6																					
FY94#7																					
FY94#8																					
FY94#9																					
FY94#10																					
Sigma1																					
Sigma2																					
Sigma3																					
Sigma4																					
Sigma5																					
Sigma6																					
Sigma7																					
Sigma8																					
Sigma9																					
Sigma10																					

West Valley WQR (West Valley Nuclear Services 1995)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
WVDG-40											0.0609	0.0753	0.0072	0.1535		0.0317	0.0269	0.0178	0.0968	0.0018	0.0060
WVDG-46											0.0700	0.1223	0.0068	0.1039		0.0337	0.0286	0.0167	0.1030	0.0016	0.0059
FY92#5											0.0714	0.1044	0.0048	0.1430		0.0688	0.0510	0.0089	0.0875	0.0025	0.0120
FY92#6											0.0486	0.1044	0.0048	0.0974		0.0688	0.0232	0.0089	0.1028	0.0025	0.0120
FY92#7											0.0486	0.1044	0.0048	0.1430		0.0688	0.0232	0.0089	0.0572	0.0025	0.0120
FY92#9											0.0486	0.1044	0.0048	0.1430		0.0313	0.0510	0.0089	0.0572	0.0025	0.0120
FY92#10											0.0714	0.1534	0.0048	0.0974		0.0688	0.0232	0.0089	0.0572	0.0025	0.0120
FY92Ref5											0.0645	0.1289	0.0068	0.1202		0.0318	0.0271	0.0089	0.0982	0.0025	0.0237
Ratio2											0.0667	0.1100	0.0048	0.1606		0.0550	0.0370	0.0089	0.0880	0.0025	0.0120
Ratio4											0.0570	0.1120	0.0048	0.1008		0.0560	0.0410	0.0089	0.0720	0.0025	0.0120
Ratio5											0.0520	0.1460	0.0048	0.1298		0.0500	0.0410	0.0089	0.0900	0.0025	0.0120
LoTh2											0.0621	0.1170	0.0048	0.1300		0.0450	0.0392	0.0089	0.0890	0.0025	0.0120
LoTh4											0.0608	0.1380	0.0048	0.1050		0.0480	0.0330	0.0089	0.0890	0.0025	0.0120
LoTh5											0.0548	0.1433	0.0048	0.1380		0.0437	0.0325	0.0089	0.0700	0.0025	0.0120
HiFe2											0.0534	0.1100	0.0048	0.1550		0.0540	0.0400	0.0089	0.0880	0.0025	0.0120
HiFe3											0.0555	0.1123	0.0048	0.1470		0.0575	0.0424	0.0089	0.0920	0.0025	0.0120
HiFe4											0.0545	0.1470	0.0048	0.1360		0.0435	0.0415	0.0089	0.0830	0.0025	0.0120
PNL190											0.0490	0.1040	0.0048	0.0970		0.0688	0.0510	0.0089	0.1030	0.0025	0.0120
FY93#1											0.0771	0.1656	0.0048	0.1545		0.0313	0.0232	0.0089	0.0572	0.0025	0.0120
FY93#2											0.0429	0.1656	0.0048	0.0859		0.0688	0.0232	0.0089	0.1028	0.0025	0.0120
FY93#3											0.0771	0.1656	0.0048	0.0859		0.0688	0.0510	0.0089	0.1028	0.0025	0.0120
FY93#4											0.0429	0.0922	0.0048	0.1545		0.0688	0.0232	0.0089	0.0572	0.0025	0.0120
FY93#5											0.0429	0.1656	0.0048	0.0859		0.0313	0.0510	0.0089	0.0572	0.0025	0.0120
FY93#6											0.0771	0.0922	0.0048	0.0859		0.0313	0.0432	0.0089	0.1028	0.0025	0.0120
FY93#7											0.0771	0.0922	0.0048	0.0859		0.0688	0.0232	0.0089	0.0572	0.0025	0.0120
FY93#8											0.0429	0.1652	0.0048	0.1545		0.0313	0.0232	0.0089	0.1028	0.0025	0.0120
FY93#9											0.0771	0.0922	0.0048	0.1545		0.0688	0.0245	0.0089	0.1028	0.0025	0.0120
FY93#10											0.0429	0.0922	0.0048	0.0859		0.0313	0.0510	0.0089	0.1028	0.0025	0.0120
FY94#1											0.0740	0.0900	0.0048	0.0661		0.0600	0.0280	0.0089	0.0840	0.0025	0.0120
FY94#2											0.0740	0.0709	0.0048	0.1743		0.0590	0.0400	0.0089	0.0520	0.0025	0.0120
FY94#3											0.0566	0.1869	0.0048	0.1100		0.0460	0.0280	0.0089	0.1100	0.0025	0.0120
FY94#4											0.0430	0.1710	0.0048	0.1695		0.0530	0.0460	0.0089	0.0910	0.0025	0.0120
FY94#5											0.0550	0.0709	0.0048	0.0661		0.0660	0.0445	0.0089	0.1070	0.0025	0.0120
FY94#6											0.0771	0.0709	0.0048	0.1743		0.0420	0.0470	0.0089	0.0600	0.0025	0.0120
FY94#7											0.0630	0.1753	0.0048	0.0661		0.0400	0.0240	0.0089	0.0660	0.0025	0.0120
FY94#8											0.0440	0.1800	0.0048	0.1743		0.0380	0.0380	0.0089	0.0854	0.0025	0.0120
FY94#9											0.0460	0.1350	0.0048	0.1400		0.0640	0.0340	0.0089	0.0612	0.0025	0.0120
FY94#10											0.0612	0.1869	0.0048	0.0661		0.0313	0.0480	0.0089	0.0780	0.0025	0.0120
Sigma1											0.0429	0.1869	0.0048	0.1168		0.0688	0.0510	0.0089	0.1100	0.0025	0.0120
Sigma2											0.0429	0.1869	0.0048	0.0741		0.0688	0.0510	0.0089	0.1100	0.0025	0.0120
Sigma3											0.0460	0.0761	0.0048	0.1743		0.0670	0.0490	0.0089	0.1090	0.0025	0.0120
Sigma4											0.0490	0.1850	0.0048	0.1107		0.0640	0.0500	0.0089	0.1030	0.0025	0.0120
Sigma5											0.0460	0.1800	0.0048	0.1208		0.0670	0.0490	0.0089	0.1050	0.0025	0.0120
Sigma6											0.0470	0.1750	0.0048	0.1036		0.0650	0.0480	0.0089	0.1010	0.0025	0.0120
Sigma7											0.0510	0.1700	0.0048	0.1125		0.0660	0.0495	0.0089	0.1070	0.0025	0.0120
Sigma8											0.0480	0.1600	0.0048	0.1299		0.0630	0.0485	0.0089	0.0970	0.0025	0.0120
Sigma9											0.0520	0.1550	0.0048	0.0938		0.0610	0.0475	0.0089	0.0990	0.0025	0.0120
Sigma10											0.0500	0.1580	0.0048	0.0845		0.0620	0.0470	0.0089	0.0950	0.0025	0.0120

West Valley WQR (West Valley Nuclear Services 1995)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
WVDG-40	0.4436	0.0023			0.0010				0.0040					0.0008	0.0004	0.0002					
WVDG-46	0.4500	0.0021			0.0010				0.0035					0.0007	0.0004	0.0002					
FY92#5	0.3688	0.0132			0.0026				0.0031					0.0014	0.0000	0.0000					
FY92#6	0.4497	0.0132			0.0026				0.0031					0.0014	0.0000	0.0000					
FY92#7	0.4497	0.0132			0.0026				0.0031					0.0014	0.0000	0.0000					
FY92#9	0.4416	0.0132			0.0026				0.0031					0.0014	0.0000	0.0000					
FY92#10	0.4057	0.0132			0.0026				0.0031					0.0014	0.0000	0.0000					
FY92Ref5	0.4116	0.0032			0.0016				0.0015					0.0014	0.0008	0.0003					
Ratio2	0.3900	0.0120			0.0026				0.0031					0.0014	0.0000	0.0000					
Ratio4	0.4340	0.0190			0.0026				0.0031					0.0014	0.0000	0.0000					
Ratio5	0.3880	0.0100			0.0026				0.0031					0.0014	0.0000	0.0000					
LoTh2	0.4250	0.0135			0.0026				0.0031					0.0014	0.0000	0.0000					
LoTh4	0.4310	0.0120			0.0026				0.0031					0.0014	0.0000	0.0000					
LoTh5	0.4170	0.0115			0.0026				0.0031					0.0014	0.0000	0.0000					
HiFe2	0.3926	0.0114			0.0026				0.0031					0.0014	0.0000	0.0000					
HiFe3	0.3879	0.0112			0.0026				0.0031					0.0014	0.0000	0.0000					
HiFe4	0.3880	0.0093			0.0026				0.0031					0.0014	0.0000	0.0000					
PNL190	0.4040	0.0130			0.0026				0.0031					0.0014	0.0000	0.0000					
FY93#1	0.3949	0.0132			0.0026				0.0031					0.0014							
FY93#2	0.4146	0.0132			0.0026				0.0031					0.0014							
FY93#3	0.3526	0.0132			0.0026				0.0031					0.0014							
FY93#4	0.4650	0.0132			0.0026				0.0031					0.0014							
FY93#5	0.4699	0.0132			0.0026				0.0031					0.0014							
FY93#6	0.4713	0.0132			0.0026				0.0031					0.0014							
FY93#7	0.4638	0.0132			0.0026				0.0031					0.0014							
FY93#8	0.3483	0.0132			0.0026				0.0031					0.0014							
FY93#9	0.3483	0.0132			0.0026				0.0031					0.0014							
FY93#10	0.4621	0.0132			0.0026				0.0031					0.0014							
FY94#1	0.4774	0.0073			0.0026				0.0031					0.0014	0.0000	0.0000					
FY94#2	0.4300	0.0073			0.0026				0.0031					0.0014	0.0000	0.0000					
FY94#3	0.3700	0.0073			0.0026				0.0031					0.0014	0.0000	0.0000					
FY94#4	0.3450	0.0073			0.0026				0.0031					0.0014	0.0000	0.0000					
FY94#5	0.4770	0.0173			0.0026				0.0031					0.0014	0.0000	0.0000					
FY94#6	0.3928	0.0191			0.0026				0.0031					0.0014	0.0000	0.0000					
FY94#7	0.4350	0.0184			0.0026				0.0031					0.0014	0.0000	0.0000					
FY94#8	0.3450	0.0191			0.0026				0.0031					0.0014	0.0000	0.0000					
FY94#9	0.4126	0.0180			0.0026				0.0031					0.0014	0.0000	0.0000					
FY94#10	0.4200	0.0073			0.0026				0.0031					0.0014	0.0000	0.0000					
Sigma1	0.3422	0.0073			0.0026				0.0031					0.0014	0.0000	0.0000					
Sigma2	0.3422	0.0073			0.0026				0.0031					0.0014	0.0000	0.0000					
Sigma3	0.3672	0.0078			0.0026				0.0031					0.0014	0.0000	0.0000					
Sigma4	0.3550	0.0081			0.0026				0.0031					0.0014	0.0000	0.0000					
Sigma5	0.3500	0.0080			0.0026				0.0031					0.0014	0.0000	0.0000					
Sigma6	0.3650	0.0082			0.0026				0.0031					0.0014	0.0000	0.0000					
Sigma7	0.3600	0.0078			0.0026				0.0031					0.0014	0.0000	0.0000					
Sigma8	0.3700	0.0084			0.0026				0.0031					0.0014	0.0000	0.0000					
Sigma9	0.3750	0.0085			0.0026				0.0031					0.0014	0.0000	0.0000					
Sigma10	0.3800	0.0083			0.0026				0.0031					0.0014	0.0000	0.0000					

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Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
WVDG-40		0.0002		0.0010		0.0002		0.0008			0.0000		0.0002					0.0000	0.0000		
WVDG-46		0.0002		0.0160		0.0002		0.0007			0.0000		0.0002					0.0000	0.0000		
FY92#5		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
FY92#6		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
FY92#7		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
FY92#9		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
FY92#10		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
FY92Ref5		0.0004		0.0082		0.0004		0.0014			0.0003		0.0004					0.0002	0.0008		
Ratio2		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
Ratio4		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
Ratio5		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
LoTh2		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
LoTh4		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
LoTh5		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
HiFe2		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
HiFe3		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
HiFe4		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
PNL190		0.0000		0.0082		0.0000		0.0000			0.0000		0.0000					0.0000	0.0000		
FY93#1				0.0082																	
FY93#2				0.0082																	
FY93#3				0.0082																	
FY93#4				0.0082																	
FY93#5				0.0082																	
FY93#6				0.0082																	
FY93#7				0.0082																	
FY93#8				0.0082																	
FY93#9				0.0082																	
FY93#10				0.0082																	
FY94#1		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
FY94#2		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
FY94#3		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
FY94#4		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
FY94#5		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
FY94#6		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
FY94#7		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
FY94#8		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
FY94#9		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
FY94#10		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
Sigma1		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
Sigma2		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
Sigma3		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
Sigma4		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
Sigma5		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
Sigma6		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
Sigma7		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
Sigma8		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
Sigma9		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		
Sigma10		0.0000		0.0082		0.0000					0.0000		0.0000					0.0000	0.0000		

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Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
WVDG-40		0.0001			0.0013	0.0001			0.0419	0.0049		0.0189					0.0001	0.0002		1.0001
WVDG-46		0.0001			0.0012	0.0001			0.0216	0.0043		0.0011					0.0001	0.0002		0.9965
FY92#5		0.0000			0.0023	0.0025			0.0267	0.0080		0.0062					0.0000	0.0026		0.9999
FY92#6		0.0000			0.0023	0.0025			0.0267	0.0080		0.0062					0.0000	0.0026		0.9999
FY92#7		0.0000			0.0023	0.0025			0.0267	0.0080		0.0062					0.0000	0.0026		0.9999
FY92#9		0.0000			0.0023	0.0025			0.0445	0.0080		0.0062					0.0000	0.0026		0.9999
FY92#10		0.0000			0.0023	0.0025			0.0445	0.0080		0.0062					0.0000	0.0026		0.9999
FY92Ref5		0.0003			0.0023	0.0025			0.0356	0.0080		0.0061					0.0002	0.0002		1.0004
Ratio2		0.0000			0.0023	0.0025			0.0130	0.0080		0.0062					0.0000	0.0026		0.9974
Ratio4		0.0000			0.0023	0.0025			0.0430	0.0080		0.0062					0.0000	0.0026		0.9999
Ratio5		0.0000			0.0023	0.0025			0.0280	0.0080		0.0062					0.0000	0.0026		0.9999
LoTh2		0.0000			0.0023	0.0025			0.0140	0.0080		0.0062					0.0000	0.0026		0.9999
LoTh4		0.0000			0.0023	0.0025			0.0180	0.0080		0.0062					0.0000	0.0026		0.9999
LoTh5		0.0000			0.0023	0.0025			0.0240	0.0080		0.0062					0.0000	0.0026		0.9999
HiFe2		0.0000			0.0023	0.0025			0.0304	0.0080		0.0062					0.0000	0.0026		0.9999
HiFe3		0.0000			0.0023	0.0025			0.0290	0.0080		0.0062					0.0000	0.0026		0.9999
HiFe4		0.0000			0.0023	0.0025			0.0320	0.0080		0.0062					0.0000	0.0026		0.9999
PNL190		0.0000			0.0023	0.0025			0.0450	0.0080		0.0062					0.0000	0.0026		0.9999
FY93#1					0.0023	0.0025			0.0178	0.0080		0.0062						0.0026		0.9999
FY93#2					0.0023	0.0025			0.0178	0.0080		0.0062						0.0026		0.9999
FY93#3					0.0023	0.0025			0.0178	0.0080		0.0062						0.0026		0.9999
FY93#4					0.0023	0.0025			0.0178	0.0080		0.0062						0.0026		0.9999
FY93#5					0.0023	0.0025			0.0178	0.0080		0.0062						0.0026		0.9999
FY93#6					0.0023	0.0025			0.0178	0.0080		0.0062						0.0026		0.9999
FY93#7					0.0023	0.0025			0.0534	0.0080		0.0062						0.0026		0.9999
FY93#8					0.0023	0.0025			0.0534	0.0080		0.0062						0.0026		0.9999
FY93#9					0.0023	0.0025			0.0534	0.0080		0.0062						0.0026		0.9999
FY93#10					0.0023	0.0025			0.0534	0.0080		0.0062						0.0026		0.9999
FY94#1		0.0000			0.0023	0.0025			0.0480	0.0080		0.0062					0.0000	0.0026		0.9999
FY94#2		0.0000			0.0023	0.0025			0.0273	0.0080		0.0062					0.0000	0.0026		0.9999
FY94#3		0.0000			0.0023	0.0025			0.0200	0.0080		0.0062					0.0000	0.0026		0.9999
FY94#4		0.0000			0.0023	0.0025			0.0090	0.0080		0.0062					0.0000	0.0026		0.9999
FY94#5		0.0000			0.0023	0.0025			0.0310	0.0080		0.0062					0.0000	0.0026		0.9999
FY94#6		0.0000			0.0023	0.0025			0.0516	0.0080		0.0062					0.0000	0.0026		0.9999
FY94#7		0.0000			0.0023	0.0025			0.0470	0.0080		0.0062					0.0000	0.0026		0.9999
FY94#8		0.0000			0.0023	0.0025			0.0110	0.0080		0.0062					0.0000	0.0026		0.9999
FY94#9		0.0000			0.0023	0.0025			0.0240	0.0080		0.0062					0.0000	0.0026		0.9999
FY94#10		0.0000			0.0023	0.0025			0.0360	0.0080		0.0062					0.0000	0.0026		0.9999
Sigma1		0.0000			0.0023	0.0025			0.0089	0.0080		0.0062					0.0000	0.0026		0.9999
Sigma2		0.0000			0.0023	0.0025			0.0516	0.0080		0.0062					0.0000	0.0026		0.9999
Sigma3		0.0000			0.0023	0.0025			0.0384	0.0080		0.0062					0.0000	0.0026		0.9999
Sigma4		0.0000			0.0023	0.0025			0.0100	0.0080		0.0062					0.0000	0.0026		0.9999
Sigma5		0.0000			0.0023	0.0025			0.0090	0.0080		0.0062					0.0000	0.0026		0.9999
Sigma6		0.0000			0.0023	0.0025			0.0220	0.0080		0.0062					0.0000	0.0026		0.9999
Sigma7		0.0000			0.0023	0.0025			0.0110	0.0080		0.0062					0.0000	0.0026		0.9999
Sigma8		0.0000			0.0023	0.0025			0.0100	0.0080		0.0062					0.0000	0.0026		0.9999
Sigma9		0.0000			0.0023	0.0025			0.0430	0.0080		0.0062					0.0000	0.0026		0.9999
Sigma10		0.0000			0.0023	0.0025			0.0500	0.0080		0.0062					0.0000	0.0026		0.9999

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Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
WVDG-40								
WVDG-46								
FY92#5								
FY92#6								
FY92#7								
FY92#9								
FY92#10								
FY92Ref5								
Ratio2								
Ratio4								
Ratio5								
LoTh2								
LoTh4								
LoTh5								
HiFe2								
HiFe3								
HiFe4								
PNL190								
FY93#1								
FY93#2								
FY93#3								
FY93#4								
FY93#5								
FY93#6								
FY93#7								
FY93#8								
FY93#9								
FY93#10								
FY94#1								
FY94#2								
FY94#3								
FY94#4								
FY94#5								
FY94#6								
FY94#7								
FY94#8								
FY94#9								
FY94#10								
Sigma1								
Sigma2								
Sigma3								
Sigma4								
Sigma5								
Sigma6								
Sigma7								
Sigma8								
Sigma9								
Sigma10								

West Valley WQR (West Valley Nuclear Services 1995)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
WVDG-40					
WVDG-46					
FY92#5					
FY92#6					
FY92#7					
FY92#9					
FY92#10					
FY92Ref5					
Ratio2					
Ratio4					
Ratio5					
LoTh2					
LoTh4					
LoTh5					
HiFe2					
HiFe3					
HiFe4					
PNL190					
FY93#1					
FY93#2					
FY93#3					
FY93#4					
FY93#5					
FY93#6					
FY93#7					
FY93#8					
FY93#9					
FY93#10					
FY94#1					
FY94#2					
FY94#3					
FY94#4					
FY94#5					
FY94#6					
FY94#7					
FY94#8					
FY94#9					
FY94#10					
Sigma1					
Sigma2					
Sigma3					
Sigma4					
Sigma5					
Sigma6					
Sigma7					
Sigma8					
Sigma9					
Sigma10					

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Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
WVDG-40															
WVDG-46															
FY92#5															
FY92#6															
FY92#7															
FY92#9															
FY92#10															
FY92Ref5															
Ratio2							-10.164	15260.5	1.75				1146	1.79	1052
Ratio4							-10.583	17165.6	4.39				1144	4.55	1051
Ratio5							-10.696	16675.3	2.78				1144	2.77	1100
LoTh2							-10.372	16482.7	3.36				1144	3.44	1099
LoTh4							-10.422	16805.5	4.01				1146	3.92	1051
LoTh5							-10.691	17189.8	4.01				1141	4.19	1049
HiFe2							-9.571	14750.1	2.21				1185	1.76	1241
HiFe3							-10.350	15917.1	2.31				1145	2.31	1052
HiFe4							-10.253	15473.3	1.86				1142	1.94	1099
PNL190							-10.013	14801.8	1.48				1144	1.49	1052
FY93#1															
FY93#2															
FY93#3															
FY93#4															
FY93#5															
FY93#6															
FY93#7															
FY93#8															
FY93#9															
FY93#10															
FY94#1															
FY94#2															
FY94#3															
FY94#4															
FY94#5															
FY94#6															
FY94#7															
FY94#8															
FY94#9															
FY94#10															
Sigma1															
Sigma2															
Sigma3															
Sigma4															
Sigma5															
Sigma6															
Sigma7															
Sigma8															
Sigma9															
Sigma10															

West Valley WQR (West Valley Nuclear Services 1995)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
WVDG-40																					
WVDG-46																					
FY92#5																					
FY92#6																					
FY92#7																					
FY92#9																					
FY92#10																					
FY92Ref5																					
Ratio2	3.74	1242	0.94	1149	1.74	946	10.81														
Ratio4	10.5	1239	2.23	1146	4.5	943	35.12														
Ratio5	4.21	1051	6.59	1146	2.8	1194	1.97	1243	1.42	1148	2.86	1003	10.95	952	18.74						
LoTh2	5.01	1050	7.7	1146	3.42	1195	2.35	1243	1.72	1148	3.5	1003	12.94	953	22.34						
LoTh4	8.96	1243	2.06	1148	4.14	946	30.62														
LoTh5	9.46	1238	2.08	1146	4.17	945	32.11														
HiFe2	1.21	1148	2.19	1051	4.61	944	13.16														
HiFe3	5.14	1240	1.23	1148	2.35	944	15.71														
HiFe4	2.73	1050	4.18	1145	1.93	1195	1.4	1243	0.97	1147	1.84	1002	6.56	951	11.22						
PNL190	3.09	1240	0.82	1148	1.51	944	8.8														
FY93#1																					
FY93#2																					
FY93#3																					
FY93#4																					
FY93#5																					
FY93#6																					
FY93#7																					
FY93#8																					
FY93#9																					
FY93#10																					
FY94#1																					
FY94#2																					
FY94#3																					
FY94#4																					
FY94#5																					
FY94#6																					
FY94#7																					
FY94#8																					
FY94#9																					
FY94#10																					
Sigma1																					
Sigma2																					
Sigma3																					
Sigma4																					
Sigma5																					
Sigma6																					
Sigma7																					
Sigma8																					
Sigma9																					
Sigma10																					

West Valley WQR (West Valley Nuclear Services 1995)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
WVDG-40					0.306	0.305	0.29									
WVDG-46					0.373	0.318	0.3									
FY92#5					0.694	0.584	0.529									
FY92#6					0.278	0.357	0.267									
FY92#7					0.211	0.264	0.208									
FY92#9					0.262	0.295	0.196									
FY92#10					0.822	0.711	0.569									
FY92Ref5					0.196	0.275	0.256									
Ratio2					1.546	1.129	0.909									
Ratio4					0.261	0.29	0.255									
Ratio5					0.244	0.305	0.297									
LoTh2					0.393	0.283	0.229									
LoTh4					0.644	0.577	0.487									
LoTh5					0.242	0.433	0.385									
HiFe2					0.588	0.555	0.498									
HiFe3					0.418	0.423	0.382									
HiFe4					0.741	0.652	0.572									
PNL190					1.227	1.069	1.014									
FY93#1					0.544	0.328	0.504									
FY93#2					4.044	2.426	2.702									
FY93#3					3.266	1.897	2.265									
FY93#4					0.239	0.19	0.25									
FY93#5					1.267	0.658	0.881									
FY93#6					0.269	0.225	0.266									
FY93#7					0.186	0.145	0.2									
FY93#8					1.575	0.962	1.197									
FY93#9					0.431	0.377	0.385									
FY93#10					0.757	0.467	0.495									
FY94#1					0.186	0.253	0.208									
FY94#2					0.215	0.297	0.222									
FY94#3					4.057	3.559	2.553									
FY94#4					3.336	2.605	2.296									
FY94#5					0.453	0.532	0.495									
FY94#6					0.288	0.364	0.266									
FY94#7					1.047	0.949	0.693									
FY94#8					2.242	1.92	1.565									
FY94#9					0.435	0.447	0.368									
FY94#10					3.385	2.885	2.151									
Sigma1					6.609	5.312	4.92									
Sigma2					10.278	7.535	7.965									
Sigma3					7.742	4.071	5.429									
Sigma4					4.655	3.839	3.551									
Sigma5					5.268	4.262	3.93									
Sigma6					4.921	3.969	3.683									
Sigma7					4.429	3.545	3.326									
Sigma8					3.407	2.73	2.559									
Sigma9					3.542	2.833	2.485									
Sigma10					4.028	3.245	2.913									

West Valley WQR (West Valley Nuclear Services 1995)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
WVDG-40												
WVDG-46												
FY92#5												
FY92#6												
FY92#7												
FY92#9												
FY92#10												
FY92Ref5												
Ratio2												
Ratio4												
Ratio5												
LoTh2												
LoTh4												
LoTh5												
HiFe2												
HiFe3												
HiFe4												
PNL190												
FY93#1												
FY93#2												
FY93#3												
FY93#4												
FY93#5												
FY93#6												
FY93#7												
FY93#8												
FY93#9												
FY93#10												
FY94#1												
FY94#2												
FY94#3												
FY94#4												
FY94#5												
FY94#6												
FY94#7												
FY94#8												
FY94#9												
FY94#10												
Sigma1												
Sigma2												
Sigma3												
Sigma4												
Sigma5												
Sigma6												
Sigma7												
Sigma8												
Sigma9												
Sigma10												

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
1	0.1545	0.1583	0.0000	0.0000					0.1409			0.5463									
2	0.1578	0.0539	0.0868	0.0000					0.1438			0.5578									
4	0.1563	0.0534	0.0000	0.0000					0.2376			0.5527									
5	0.0000	0.1701	0.0913	0.0000					0.1514			0.5872									
6	0.0000	0.1455	0.0000	0.2225					0.1296			0.5024									
7	0.0000	0.1685	0.0000	0.0000					0.2500			0.5816									
8	0.0000	0.0494	0.0797	0.2268					0.1320			0.5120									
9	0.0000	0.0574	0.0925	0.0000					0.2555			0.5946									
10	0.0000	0.0490	0.0000	0.2249					0.2182			0.5078									
11	0.1555	0.1592	0.0855	0.0000					0.1418			0.4581									
13	0.1541	0.1578	0.0000	0.0000					0.2341			0.4540									
15	0.1573	0.0537	0.0865	0.0000					0.2390			0.4635									
16	0.1356	0.0463	0.0000	0.2124					0.2061			0.3996									
17	0.0000	0.1463	0.0786	0.2238					0.1303			0.4210									
18	0.0000	0.1696	0.0911	0.0000					0.2516			0.4878									
19	0.0000	0.1451	0.0000	0.2220					0.2154			0.4175									
20	0.0000	0.0493	0.0794	0.2262					0.2195			0.4256									
21	0.0611	0.0938	0.0336	0.0956					0.1763			0.5397									
22	0.0877	0.1097	0.0482	0.1373					0.1865			0.4305									
23	0.1471	0.0904	0.0324	0.0922					0.1699			0.4681									
24	0.0000	0.1138	0.0500	0.1424					0.1935			0.5002									
25	0.0605	0.1550	0.0333	0.0948					0.1748			0.4816									
26	0.0884	0.0503	0.0486	0.1384					0.1881			0.4862									
27	0.0613	0.0941	0.0843	0.0960					0.1769			0.4875									
28	0.0874	0.1094	0.0000	0.1368					0.1859			0.4805									
29	0.0560	0.0861	0.0308	0.2194					0.1618			0.4458									
30	0.0959	0.1200	0.0527	0.0000					0.2040			0.5274									
31	0.0609	0.0936	0.0335	0.0955					0.2316			0.4849									
32	0.0878	0.1099	0.0483	0.1375					0.1334			0.4830									
33	0.0747	0.1019	0.0411	0.1169					0.1815			0.4839									

TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11	0.0627	0.0611	0.0695	0.0479		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.4093	0.0428			0.0001			0.0033		
LAWA12	0.0627	0.0611	0.0389	0.0479		0.0548	0.0000	0.0305	0.2004	0.0014	0.0174	0.4093	0.0428			0.0001			0.0033		
LAWA13	0.0932	0.0611	0.0695	0.0479		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3788	0.0428			0.0001			0.0033		
LAWA14	0.0627	0.0611	0.0695	0.0479		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3788	0.0428			0.0001			0.0033		
LAWA15	0.0627	0.0611	0.0695	0.0479		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.4093	0.0122			0.0001			0.0033		
LAWA16	0.0627	0.0916	0.0389	0.0479		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.4093	0.0428			0.0001			0.0033		
LAWA17	0.1482	0.0611	0.0206	0.0479		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3543	0.0305			0.0001			0.0033		
LAWA18	0.1237	0.0611	0.0206	0.0479		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3543	0.0305			0.0001			0.0033		
LAWA19	0.1237	0.0611	0.0206	0.0479		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3543	0.0305			0.0001			0.0033		
LAWA20	0.1482	0.0458	0.0206	0.0479		0.0548	0.0153	0.0000	0.2004	0.0014	0.0174	0.3543	0.0305			0.0001			0.0033		
LAWA21	0.0917	0.0290	0.0970	0.0601		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3873	0.0281			0.0001			0.0033		
LAWA22	0.0986	0.0292	0.0438	0.0730		0.0310	0.0204	0.0204	0.2000	0.0000	0.0008	0.4146	0.0299			0.0000			0.0000		
LAWA23	0.0986	0.0423	0.0438	0.0730		0.0310	0.0204	0.0204	0.2000	0.0000	0.0008	0.4015	0.0299			0.0000			0.0000		
LAWA24	0.1237	0.0611	0.0328	0.0601		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3543	0.0305			0.0001			0.0033		
LAWA25	0.1048	0.0178	0.0165	0.0560		0.0402	0.0000	0.0100	0.2506	0.0017	0.0199	0.3897	0.0278			0.0001			0.0038		

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
1																					
2																					
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TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA12	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA13	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA14	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA15	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA16	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA17	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA18	0.0085		0.0244	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA19	0.0085		0.0000	0.0034	0.0000	0.0244		0.0112					0.0001							0.0010	
LAWA20	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA21	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA22	0.0036		0.0000	0.0001	0.0000	0.0000		0.0012					0.0000							0.0000	
LAWA23	0.0036		0.0000	0.0001	0.0000	0.0000		0.0012					0.0000							0.0000	
LAWA24	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWA25	0.0097		0.0000	0.0039	0.0000	0.0000		0.0127					0.0001							0.0011	

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
1																					
2																					
4																					
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TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11															0.0000	0.0050					0.0000
LAWA12															0.0000	0.0050					0.0000
LAWA13															0.0000	0.0050					0.0000
LAWA14															0.0000	0.0050					0.0000
LAWA15															0.0000	0.0050					0.0305
LAWA16															0.0000	0.0050					
LAWA17															0.0000	0.0050					
LAWA18															0.0000	0.0050					
LAWA19															0.0000	0.0050					
LAWA20															0.0000	0.0050					
LAWA21															0.0000	0.0050					
LAWA22															0.0000	0.0004					
LAWA23															0.0000	0.0004					
LAWA24															0.0000	0.0050					
LAWA25															0.0000	0.0057					

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
1										1.0000	0.1614	0.1482	0.0000	0.0000	0.0000				0.1406		
2										1.0000	0.1633	0.0533	0.0895	0.0000	0.0000				0.1463		
4										1.0000	0.1721	0.0456	0.0000	0.0000	0.0000				0.2319		
5										1.0000	0.0568	0.1514	0.0859	0.0000	0.0000				0.1420		
6										1.0000	0.0421	0.1271	0.0000	0.1937	0.0256				0.1214		
7										1.0000	0.0101	0.1618	0.0000	0.0000	0.0000				0.2546		
8										1.0000	0.0367	0.0469	0.0748	0.1886	0.0297				0.1260		
9										1.0000	0.0020	0.0564	0.0926	0.0000	0.0000				0.2597		
10										1.0000	0.0240	0.0408	0.0000	0.1814	0.0302				0.2270		
11										1.0000	0.1675	0.1628	0.0884	0.0000	0.0000				0.1425		
13										1.0000	0.1826	0.1447	0.0000	0.0000	0.0000				0.2235		
15										1.0000	0.1751	0.0483	0.0843	0.0000	0.0000				0.2289		
16										1.0000	0.1484	0.0411	0.0000	0.1875	0.0218				0.1941		
17										1.0000	0.1145	0.1297	0.0696	0.1582	0.0338				0.1154		
18										1.0000	0.0094	0.1611	0.0931	0.0000	0.0000				0.2586		
19										1.0000	0.0368	0.1273	0.0000	0.1996	0.0146				0.2347		
20										1.0000	0.0096	0.0487	0.0786	0.2200	0.0136				0.2155		
21										1.0000	0.1126	0.0880	0.0316	0.0877	0.0084				0.1699		
22										1.0000	0.1843	0.0947	0.0416	0.1090	0.0166				0.1601		
23										1.0000	0.2261	0.0762	0.0279	0.0666	0.0164				0.1580		
24										1.0000	0.0742	0.1049	0.0457	0.1225	0.0173				0.1721		
25										1.0000	0.1296	0.1372	0.0300	0.0823	0.0116				0.1547		
26										1.0000	0.1116	0.0436	0.0458	0.1141	0.0254				0.1761		
27										1.0000	0.1450	0.0809	0.0768	0.0778	0.0129				0.1570		
28										1.0000	0.1463	0.0922	0.0000	0.1119	0.0215				0.1687		
29										1.0000	0.1148	0.0735	0.0266	0.1725	0.0298				0.1400		
30										1.0000	0.1070	0.1227	0.0552	0.0000	0.0000				0.1957		
31										1.0000	0.1484	0.0784	0.0299	0.0803	0.0113				0.2070		
32										1.0000	0.1634	0.0930	0.0430	0.1001	0.0288				0.1231		
33										1.0000	0.1793	0.0871	0.0343	0.0847	0.0185				0.1580		

TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11								0.0000		0.9999	0.0562	0.0640	0.0746	0.0519		0.0520	0.0006	0.0006	0.1902	0.0023	0.0172
LAWA12								0.0000		0.9998	0.0571	0.0665	0.0439	0.0525		0.0532	0.0004	0.0297	0.1898	0.0021	0.0175
LAWA13								0.0000		0.9999	0.0852	0.0658	0.0747	0.0525		0.0530	0.0006	0.0016	0.1906	0.0022	0.0180
LAWA14								0.0305		0.9999	0.0569	0.0630	0.0732	0.0536		0.0525	0.0006	0.0005	0.1918	0.0025	0.0177
LAWA15								0.0000		0.9998	0.0591	0.0644	0.0731	0.0520		0.0524	0.0007	0.0014	0.1845	0.0016	0.0180
LAWA16								0.0000		0.9998	0.0554	0.1035	0.0432	0.0496		0.0543	0.0004		0.1920	0.0017	0.0195
LAWA17								0.0305		0.9997	0.1410	0.0675	0.0241	0.0524		0.0527	0.0004		0.1910	0.0022	0.0185
LAWA18								0.0305		0.9996	0.1167	0.0667	0.0246	0.0473		0.0538	0.0004		0.1852	0.0016	0.0192
LAWA19								0.0305		0.9996	0.1151	0.0663	0.0252	0.0466		0.0556	0.0004		0.1915	0.0015	0.0197
LAWA20								0.0305		0.9997	0.1412	0.0490	0.0244	0.0561		0.0502	0.0187		0.1861	0.0025	0.0185
LAWA21								0.0000		0.9998	0.0899	0.0338	0.1066	0.0578		0.0501			0.1928	0.0016	0.0195
LAWA22								0.0328		0.9998	0.0957	0.0311	0.0430	0.0712		0.0308	0.0219	0.0187	0.1832	0.0010	0.0018
LAWA23								0.0328		0.9998	0.0978	0.0444	0.0440	0.0709		0.0303	0.0219	0.0194	0.1803	0.0001	0.0015
LAWA24								0.0305		0.9996	0.1124	0.0776	0.0355	0.0584		0.0499	0.0009	0.0008	0.1809	0.0024	0.0209
LAWA25								0.0278		0.9999	0.1024	0.0210	0.0209	0.0580		0.0376	0.0015	0.0111	0.2456	0.0021	0.0213

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
1	0.5498																				
2	0.5475																				
4	0.5504																				
5	0.5638																				
6	0.4900																				
7	0.5734																				
8	0.4973																				
9	0.5894																				
10	0.4966																				
11	0.4388																				
13	0.4492																				
15	0.4635																				
16	0.4072																				
17	0.3788																				
18	0.4778																				
19	0.3870																				
20	0.4140																				
21	0.5018																				
22	0.3937																				
23	0.4288																				
24	0.4634																				
25	0.4546																				
26	0.4835																				
27	0.4495																				
28	0.4594																				
29	0.4428																				
30	0.5193																				
31	0.4448																				
32	0.4486																				
33	0.4381																				

TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11	0.4305	0.0412			0.0002			0.0033			0.0050			0.0049							
LAWA12	0.4305	0.0389			0.0002			0.0035			0.0060			0.0045							
LAWA13	0.4008	0.0382			0.0002			0.0034			0.0070			0.0046							
LAWA14	0.4034	0.0378			0.0002			0.0033			0.0080			0.0052							
LAWA15	0.4294	0.0161			0.0002			0.0033			0.0050			0.0038							
LAWA16	0.4345	0.0299			0.0001			0.0036			0.0050		0.0000	0.0033		0.0000					
LAWA17	0.3764	0.0231			0.0003			0.0035			0.0050		0.0000	0.0044		0.0000					
LAWA18	0.3827	0.0303			0.0002						0.0060		0.0257	0.0032		0.0001					
LAWA19	0.3763	0.0269			0.0002						0.0060		0.0003	0.0058		0.0226					
LAWA20	0.3847	0.0235			0.0001			0.0032			0.0060			0.0053							
LAWA21	0.4187	0.0183			0.0002			0.0033			0.0060										
LAWA22	0.4395	0.0257			0.0001			0.0000			0.0000			0.0021							
LAWA23	0.4299	0.0245			0.0001			0.0000			0.0000			0.0001							
LAWA24	0.3835	0.0282			0.0003			0.0036			0.0050			0.0037							
LAWA25	0.4176	0.0169			0.0002			0.0039			0.0040			0.0043							

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
1																					
2																					
4																					
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TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11									0.0015												
LAWA12									0.0013												
LAWA13									0.0013												
LAWA14									0.0012												
LAWA15									0.0017												
LAWA16									0.0014												
LAWA17		0.0001							0.0012												
LAWA18									0.0014												
LAWA19									0.0013												
LAWA20									0.0011												
LAWA21									0.0014												
LAWA22									0.0003												
LAWA23									0.0002												
LAWA24		0.0001							0.0014												
LAWA25		0.0003							0.0014												

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
1																				1.0000
2																				0.9999
4																				1.0000
5																				0.9999
6																				0.9999
7																				0.9999
8																				1.0000
9																				1.0001
10																				1.0000
11																				1.0000
13																				1.0000
15																				1.0001
16																				1.0001
17																				1.0000
18																				1.0000
19																				1.0000
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25																				1.0000
26																				1.0001
27																				0.9999
28																				1.0000
29																				1.0000
30																				0.9999
31																				1.0001
32																				1.0000
33																				1.0000

TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11					0.0075					0.0003								0.0001		1.0041
LAWA12					0.0080					0.0002								0.0001		1.0059
LAWA13					0.0064					0.0002								0.0001		1.0064
LAWA14					0.0055					0.0002								0.0301		1.0072
LAWA15					0.0077					0.0297								0.0003		1.0044
LAWA16					0.0063													0.0001		1.0038
LAWA17					0.0074													0.0327		1.0039
LAWA18					0.0080													0.0328		1.0059
LAWA19					0.0133													0.0311		1.0057
LAWA20					0.0050													0.0289		1.0045
LAWA21					0.0031															1.0031
LAWA22					0.0015													0.0316		0.9992
LAWA23					0.0022													0.0317		0.9993
LAWA24					0.0058													0.0335		1.0048
LAWA25					0.0064													0.0266		1.0031

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
1								
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4								
5								
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TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11			<950					
LAWA12			<950					
LAWA13			<950					
LAWA14			<950					
LAWA15			<950					
LAWA16			<950					
LAWA17			950-1050					
LAWA18			<950					
LAWA19			<950					
LAWA20			~1050					
LAWA21			~950					
LAWA22			<950					
LAWA23			<950					
LAWA24			<950					
LAWA25								

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
1					
2					
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TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11					
LAWA12					
LAWA13					
LAWA14					
LAWA15					
LAWA16					
LAWA17					
LAWA18					
LAWA19					
LAWA20					
LAWA21					
LAWA22					
LAWA23					
LAWA24					
LAWA25					

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
1															
2															
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TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11	clear and uniform						-12.911	20199.5	3.61				(950)	(155)	(1000)
LAWA12	clear and uniform						-8.398	13960.3	4.11				(950)	(48.8)	(1000)
LAWA13	clear and uniform						-10.801	17263.1	3.78				950	27.4	1000
LAWA14	clear and uniform						-12.352	18720.3	2.23				(950)	(27.4)	1000
LAWA15	clear and uniform						-10.930	16861.4	2.51				(950)	(20.8)	1000
LAWA16	clear and uniform						-9.452	14920.7	2.81				950	15.6	1000
LAWA17	1.7 vol% spinel						-11.366	19308.7	9.05				950	83.1	1000
LAWA18	clear and uniform						-8.669	15183.9	7.40				(950)	(303.5)	(1000)
LAWA19	clear and uniform						-7.450	13292.0	6.62				(950)	(170.2)	(1000)
LAWA20	10 um voids showing Cr+S; Cr,Fe,Zn spinels						-11.144	18791.2	7.86				950	68.1	1000
LAWA21	~1.1 vol% mixed calcium phosphate and silicate						-12.734	20532.5	5.45				950	59.7	1000
LAWA22	clear and uniform						-12.307	20413.2	7.68				950	82.9	1000
LAWA23	clear and uniform	2.6843					-11.293	18488.6	5.47				950	50.2	1000
LAWA24	clear and uniform	2.6535					-11.939	19788.1	7.15				950	70.7	1000
LAWA25	clear and uniform														

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
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TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11	(37.4)	(1050)	(13.5)	1100	6.3	1150	3.5	1200	2.1	1250	1.5										
LAWA12	(19.6)	(1050)	(10.1)	1100	6	1150	4	1200	2.9	1250	2.2										
LAWA13	15.8	1050	9.5	1100	5.9	1150	3.8	1200	2.5	1250	1.7										
LAWA14	11.2	1050	5.7	1100	3.4	1150	2.2	1200	1.6	1250	0.9										
LAWA15	10.7	1050	6	1100	3.7	1150	2.4	1200	1.7	1250	1.2										
LAWA16	9.7	1050	6.2	1100	4.1	1150	2.8	1200	2	1250	1.4										
LAWA17	44.7	1050	25.3	1100	14.9	1150	9.1	1200	5.7	1250	3.7										
LAWA18	(58.5)	(1050)	(21.8)	1100	11.3	1150	7.1	1200	5	1250	3.8										
LAWA19	(40.4)	(1050)	(17)	1100	9.6	1150	6.4	1200	4.7	1250	3.7										
LAWA20	37.2	1050	21.3	1100	12.7	1150	7.9	1200	5	1250	3.3										
LAWA21	29.7	1050	15.8	1100	9	1150	5.4	1200	3.3	1250	2.2										
LAWA22	41.4	1050	22.2	1100	12.6	1150	7.6	1200	4.7	1250	3.1										
LAWA23	24.8	1050	13.7	1100	8.2	1150	5.3	1200	3.6	1250	2.5										
LAWA24	36.7	1050	20.2	1100	11.7	1150	7.1	1200	4.5	1250	2.9										
LAWA25																					

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
1					0.555		0.239	0.093	9.05							
2					0.075		0.187	0.045	10.92							
4					0.368		0.685	0.187	11.76							
5					0.361		0.364	0.179	10							
6					0.817		0.512	0.162	9.53							
7					29.834		25.044	15.029	11.39							
8					0.257		0.597	0.108	11.45							
9					38.709		27.827	16.036	12.63							
10					1.702		1.508	0.71	11.95							
11					0.254		0.286	0.047	10.18							
13					2.122		1.133	0.085	10.26							
15					0.174		0.762	0.126	12							
16					0.493		0.62	0.218	11.69							
17					0.184		0.481	0.078	11.18							
18					31.162		22.973	7.624	12.01							
19					5.016		2.621	0.367	10.97							
20					0.77		1.748	0.361	12.32							
21					0.275		0.378	0.126	11.06							
22					0.165		0.24	0.084	10.75							
23					0.152		0.205	0.086	10.47							
24					0.436		0.531	0.128	11.16							
25					0.417		0.353	0.103	10.05							
26					0.254		0.472	0.123	11.46							
27					0.137		0.277	0.058	11.04							
28					0.307		0.312	0.134	10.65							
29					0.276		0.382	0.12	10.95							
30					0.847		0.817	0.138	11.47							
31					0.31		0.469	0.147	11.49							
32					0.123		0.202	0.05	10.42							
33					0.168		0.237	0.088	10.72							

TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11															0.0735	
LAWA12															0.0672	
LAWA13															0.0511	
LAWA14															0.0868	
LAWA15															0.1113	
LAWA16															0.2044	
LAWA17															0.0168	
LAWA18															0.0231	
LAWA19															0.014	
LAWA20																
LAWA21																
LAWA22																
LAWA23																
LAWA24															0.028	
LAWA25																

Canonical Correlation (Ramsey) (Oksoy et al. 1994)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
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TWRS LAW Formulation (Muller and Pegg 1998)

LAWA11	0.0833	0.0252	9.35									
LAWA12	0.0672	0.0224	9.23									
LAWA13	0.0658	0.014	9.36									
LAWA14	0.0686	0.0168	9.35									
LAWA15	0.0882	0.0266	9.37									
LAWA16	0.182	0.0476	9.26									
LAWA17	0.042	0.0091	9.3									
LAWA18	0.056	0.0091	8.17									
LAWA19	0.0469	0.0084	8.86									
LAWA20	0.0532	0.0105	8.56									
LAWA21	1.2061	0.1638	8.58									
LAWA22	0.0378	0.0084	8.11									
LAWA23	0.0378	0.0077	8.15			<0.98	0.003	<0.0055	<0.0079	0.078		1.29
LAWA24	0.042	0.0098	8.32			<0.92	0.275	0.15	0.097	0.078		2.35
LAWA25	0.0875	0.0105	9.13									

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
LAWA25H	0.1067	0.0181	0.0168	0.0570		0.0409	0.0000	0.0102	0.2551	0.0017	0.0101	0.3967	0.0283			0.0001			0.0039		
LAWA26	0.1048	0.0000	0.0165	0.0393		0.0402	0.0111	0.0000	0.2506	0.0017	0.0199	0.4231	0.0278			0.0001			0.0038		
LAWA26H	0.1067	0.0000	0.0168	0.0400		0.0409	0.0113	0.0000	0.2551	0.0017	0.0101	0.4307	0.0283			0.0001			0.0039		
LAWB11	0.0642	0.0978	0.1032	0.0834		0.0205	0.0000	0.0326	0.0751	0.0005	0.0223	0.4237	0.0407			0.0000			0.0012		
LAWB12	0.0642	0.0978	0.0543	0.0834		0.0205	0.0000	0.0815	0.0751	0.0005	0.0223	0.4237	0.0407			0.0000			0.0012		
LAWB13	0.0642	0.0978	0.0543	0.0834		0.0205	0.0000	0.0815	0.0751	0.0005	0.0223	0.3830	0.0407			0.0000			0.0012		
LAWB14	0.0642	0.0978	0.0951	0.0834		0.0205	0.0000	0.0815	0.0751	0.0005	0.0223	0.3830	0.0407			0.0000			0.0012		
LAWB15	0.0642	0.1222	0.1032	0.0834		0.0205	0.0163	0.0326	0.0751	0.0005	0.0223	0.3830	0.0407			0.0000			0.0012		
LAWB16	0.0642	0.0978	0.0054	0.0834		0.0205	0.0000	0.0326	0.0751	0.0005	0.0223	0.4237	0.0407			0.0000			0.0012		
LAWB17	0.0642	0.0652	0.0543	0.0834		0.0205	0.0407	0.0326	0.0751	0.0005	0.0223	0.4237	0.0407			0.0000			0.0012		
LAWB18	0.0642	0.0652	0.0543	0.0834		0.0205	0.0407	0.0326	0.0751	0.0005	0.0223	0.4237	0.0407			0.0000			0.0012		
LAWB19	0.0988	0.0599	0.0364	0.0834		0.0205	0.0204	0.0204	0.1199	0.0005	0.0223	0.4189	0.0302			0.0000			0.0012		
LAWB20	0.0887	0.0599	0.0364	0.0834		0.0205	0.0302	0.0204	0.1301	0.0005	0.0223	0.4091	0.0302			0.0000			0.0012		
LAWB21	0.0887	0.0599	0.0364	0.0631		0.0205	0.0302	0.0204	0.1504	0.0005	0.0223	0.4091	0.0302			0.0000			0.0012		
LAWB22	0.0887	0.0599	0.0364	0.0631		0.0205	0.0000	0.0204	0.1806	0.0005	0.0223	0.4091	0.0302			0.0000			0.0012		
LAWB23	0.0901	0.0609	0.0370	0.0641		0.0209	0.0306	0.0207	0.1529	0.0006	0.0227	0.4157	0.0306			0.0000			0.0013		
LAWB24	0.0896	0.0605	0.0368	0.0637		0.0208	0.0305	0.0206	0.1521	0.0005	0.0226	0.4135	0.0305			0.0000			0.0013		
LAWB25	0.0891	0.0602	0.0366	0.0634		0.0206	0.0303	0.0205	0.1512	0.0005	0.0225	0.4113	0.0303			0.0000			0.0013		
LAWB26	0.0797	0.0807	0.0454	0.0635		0.0205	0.0407	0.0228	0.0852	0.0005	0.0223	0.4319	0.0302			0.0000			0.0012		
LAWB27	0.0797	0.0807	0.0454	0.0635		0.0205	0.0302	0.0228	0.1052	0.0005	0.0223	0.4225	0.0302			0.0000			0.0012		
LAWB28	0.0797	0.0807	0.0454	0.0635		0.0205	0.0200	0.0228	0.1252	0.0005	0.0223	0.4127	0.0302			0.0000			0.0012		
LAWB29	0.0803	0.0807	0.0703	0.0803		0.0036	0.0408	0.0300	0.1000	0.0000	0.0001	0.4393	0.0304			0.0000			0.0000		
LAWC1	0.0993	0.0610	0.0206	0.0967		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3540	0.0305			0.0001			0.0033		
LAWC2	0.0993	0.0610	0.0206	0.0479		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3540	0.0305			0.0001			0.0033		
LAWC3	0.0993	0.0610	0.0206	0.0479		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3540	0.0305			0.0001			0.0033		
LAWC4	0.0961	0.0300	0.1031	0.0647		0.0505	0.0000	0.0000	0.1845	0.0013	0.0080	0.3999	0.0300			0.0001			0.0031		
LAWC5	0.0916	0.0290	0.0682	0.0601		0.0548	0.0000	0.0000	0.2004	0.0014	0.0174	0.3869	0.0281			0.0001			0.0033		
LAWPC1	0.0987	0.0396	0.0271	0.0632		0.0401	0.0000	0.0198	0.2000	0.0011	0.0128	0.4094	0.0297			0.0001			0.0024		
LAWPC2	0.0987	0.0396	0.0271	0.0632		0.0401	0.0000	0.0198	0.2000	0.0011	0.0128	0.3797	0.0297			0.0001			0.0024		
LAWPC3	0.0987	0.0396	0.0271	0.0632		0.0401	0.0000	0.0198	0.2000	0.0011	0.0128	0.3797	0.0297			0.0001			0.0024		
LAWPC5	0.0987	0.0099	0.0271	0.0632		0.0401	0.0000	0.0198	0.2000	0.0011	0.0128	0.3995	0.0297			0.0001			0.0024		
LAWPC6	0.0987	0.0198	0.0271	0.0632		0.0401	0.0198	0.0198	0.2000	0.0011	0.0128	0.4094	0.0297			0.0001			0.0024		
LAWPC7	0.0988	0.0300	0.0479	0.0630		0.0012	0.0403	0.0300	0.2000	0.0004	0.0005	0.4192	0.0300			0.0000			0.0000		
LAWPC8	0.0988	0.0300	0.0479	0.0630		0.0012	0.0403	0.0300	0.2000	0.0004	0.0005	0.4192	0.0300			0.0000			0.0000		
LAWPC9	0.0984	0.0394	0.0467	0.0629		0.0401	0.0000	0.0197	0.2000	0.0011	0.0128	0.3873	0.0295			0.0001			0.0024		
LAWPC10	0.0988	0.0300	0.0479	0.0630		0.0012	0.0403	0.0300	0.2000	0.0004	0.0005	0.4192	0.0300			0.0000			0.0000		

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
LAWA25H	0.0049		0.0000	0.0039	0.0000	0.0000		0.0130					0.0001							0.0011	
LAWA26	0.0097		0.0000	0.0039	0.0000	0.0000		0.0127					0.0001							0.0011	
LAWA26H	0.0049		0.0000	0.0039	0.0000	0.0000		0.0130					0.0001							0.0011	
LAWB11	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB12	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB13	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB14	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB15	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB16	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB17	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB18	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB19	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB20	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB21	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB22	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB23	0.0019		0.0000	0.0037	0.0000	0.0000		0.0094					0.0000							0.0004	
LAWB24	0.0038		0.0000	0.0037	0.0000	0.0000		0.0093					0.0000							0.0004	
LAWB25	0.0057		0.0000	0.0037	0.0000	0.0000		0.0093					0.0000							0.0004	
LAWB26	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB27	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB28	0.0076		0.0000	0.0037	0.0000	0.0000		0.0092					0.0000							0.0004	
LAWB29	0.0029		0.0000	0.0010	0.0000	0.0000		0.0000					0.0000							0.0000	
LAWC1	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWC2	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0489							0.0010	
LAWC3	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWC4	0.0078		0.0000	0.0031	0.0000	0.0000		0.0103					0.0001							0.0009	
LAWC5	0.0085		0.0000	0.0034	0.0000	0.0000		0.0112					0.0001							0.0010	
LAWPC1	0.0062		0.0000	0.0025	0.0008	0.0000		0.0082					0.0000							0.0007	
LAWPC2	0.0062		0.0000	0.0025	0.0008	0.0297		0.0082					0.0000							0.0007	
LAWPC3	0.0062		0.0000	0.0025	0.0008	0.0000		0.0082					0.0000							0.0007	
LAWPC5	0.0062		0.0000	0.0025	0.0008	0.0198		0.0082					0.0000							0.0007	
LAWPC6	0.0062		0.0000	0.0025	0.0008	0.0000		0.0082					0.0000							0.0007	
LAWPC7	0.0010		0.0000	0.0001	0.0000	0.0000		0.0001					0.0000							0.0002	
LAWPC8	0.0010		0.0000	0.0001	0.0000	0.0000		0.0001					0.0000							0.0002	
LAWPC9	0.0062		0.0000	0.0025	0.0008	0.0000		0.0082					0.0000							0.0007	
LAWPC10	0.0010		0.0000	0.0001	0.0000	0.0000		0.0001					0.0000							0.0002	

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
LAWA25H															0.0000	0.0029					
LAWA26															0.0000	0.0057					
LAWA26H															0.0000	0.0029					
LAWB11															0.0000	0.0136					
LAWB12															0.0000	0.0136					
LAWB13															0.0000	0.0136					
LAWB14															0.0000	0.0136					
LAWB15															0.0000	0.0136					
LAWB16															0.0000	0.0136					
LAWB17															0.0000	0.0136	0.0000		0.0000	0.0000	0.0000
LAWB18															0.0000	0.0136	0.0000		0.0000	0.0000	0.0000
LAWB19															0.0000	0.0136	0.0000		0.0000	0.0000	0.0000
LAWB20															0.0000	0.0136	0.0000		0.0000	0.0000	0.0000
LAWB21															0.0000	0.0136	0.0000		0.0000	0.0000	0.0000
LAWB22															0.0000	0.0136	0.0000		0.0000	0.0000	0.0000
LAWB23															0.0000	0.0035	0.0000		0.0000	0.0000	0.0000
LAWB24															0.0000	0.0069	0.0000		0.0000	0.0000	0.0000
LAWB25															0.0000	0.0103	0.0000		0.0000	0.0000	0.0000
LAWB26															0.0000	0.0136	0.0000		0.0000	0.0000	0.0000
LAWB27															0.0000	0.0136	0.0000		0.0000	0.0000	0.0000
LAWB28															0.0000	0.0136	0.0000		0.0000	0.0000	0.0000
LAWB29															0.0000	0.0002	0.0000		0.0000	0.0000	0.0000
LAWC1															0.0000	0.0050	0.0007				
LAWC2															0.0000	0.0050	0.0007				
LAWC3															0.0488	0.0050	0.0007				
LAWC4															0.0000	0.0046	0.0006				
LAWC5															0.0000	0.0050	0.0007				
LAWPC1															0.0000	0.0037	0.0008		0.0000	0.0000	0.0000
LAWPC2															0.0000	0.0037	0.0008		0.0000	0.0000	0.0000
LAWPC3															0.0000	0.0037	0.0008		0.0000	0.0000	0.0000
LAWPC5															0.0000	0.0037	0.0008		0.0000	0.0000	0.0000
LAWPC6															0.0000	0.0037	0.0008		0.0000	0.0000	0.0000
LAWPC7															0.0000	0.0038	0.0000		0.0000	0.0000	0.0000
LAWPC8															0.0000	0.0038	0.0000		0.0000	0.0000	0.0000
LAWPC9															0.0000	0.0076	0.0008		0.0000	0.0000	0.0000
LAWPC10															0.0000	0.0038	0.0000		0.0000	0.0000	0.0000

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
LAWA25H								0.0283		0.9998	0.0983	0.0239	0.0208	0.0632		0.0380	0.0015	0.0120	0.2369	0.0027	0.0124
LAWA26								0.0278		0.9999	0.1038	0.0012	0.0201	0.0427		0.0382	0.0135	0.0003	0.2419	0.0018	0.0218
LAWA26H								0.0283		0.9998	0.1093	0.0016	0.0203	0.0437		0.0410	0.0143		0.2540	0.0023	0.0111
LAWB11								0.0000		0.9997	0.0584	0.1038	0.1091	0.0877		0.0204	0.0008	0.0314	0.0727	0.0015	0.0227
LAWB12								0.0000		0.9997	0.0600	0.1036	0.0578	0.0908		0.0199	0.0000	0.0005	0.0708	0.0015	0.0220
LAWB13								0.0407		0.9997	0.0598	0.1076	0.0586	0.0907		0.0196	0.0005	0.0777	0.0710	0.0013	0.0225
LAWB14								0.0000		0.9998	0.0578	0.1084	0.1037	0.0847		0.0228	0.0006	0.0790	0.0731	0.0006	0.0229
LAWB15								0.0000		0.9997	0.0565	0.1365	0.1093	0.0839		0.0234	0.0178	0.0354	0.0701	0.0006	0.0242
LAWB16								0.0978		0.9997	0.0619	0.1047	0.0067	0.0895		0.0218	0.0003	0.0308	0.0723	0.0023	0.0227
LAWB17		0.0000	0.0000				0.0000	0.0407		0.9996	0.0621	0.0783	0.0555	0.0809		0.0225	0.0406	0.0320	0.0700	0.0007	0.0233
LAWB18		0.0000	0.0000				0.0000	0.0000		0.9589	0.0610	0.0805	0.0555	0.0810		0.0229	0.0403	0.0330	0.0683	0.0007	0.0239
LAWB19		0.0000	0.0000				0.0000	0.0326		0.9999	0.0921	0.0643	0.0389	0.0932		0.0211	0.0215	0.0203	0.1084	0.0020	0.0218
LAWB20		0.0000	0.0000				0.0000	0.0326		1.0000	0.0819	0.0651	0.0383	0.0914		0.0213	0.0323	0.0210	0.1154	0.0024	0.0231
LAWB21		0.0000	0.0000				0.0000	0.0326		1.0000	0.0872	0.0659	0.0418	0.0623		0.0215	0.0326	0.0203	0.1379	0.0007	0.0248
LAWB22		0.0000	0.0000				0.0000	0.0326		1.0000	0.0856	0.0659	0.0414	0.0671		0.0212	0.0012	0.0204	0.1644	0.0007	0.0243
LAWB23		0.0000	0.0000				0.0000	0.0331		1.0001											
LAWB24		0.0000	0.0000				0.0000	0.0329		1.0000											
LAWB25		0.0000	0.0000				0.0000	0.0328		1.0000											
LAWB26		0.0000	0.0000				0.0000	0.0407		0.9998	0.0771	0.0879	0.0515	0.0696		0.0210	0.0412	0.0211	0.0766	0.0018	0.0217
LAWB27		0.0000	0.0000				0.0000	0.0407		0.9999	0.0741	0.0872	0.0520	0.0752		0.0228	0.0336	0.0223	0.1012	0.0020	0.0223
LAWB28		0.0000	0.0000				0.0000	0.0407		0.9999	0.0687	0.0918	0.0508	0.0688		0.0233	0.0220	0.0215	0.1175	0.0017	0.0210
LAWB29		0.0000	0.0000				0.0000	0.0399		0.9998	0.0846	0.0787	0.0726	0.0730		0.0050	0.0398	0.0287	0.0993	0.0000	0.0018
LAWC1								0.0305		0.9999	0.0941	0.0660	0.0243	0.0997		0.0545			0.1912	0.0021	0.0187
LAWC2								0.0305		0.9999	0.0941	0.0661	0.0237	0.0540		0.0557			0.1934	0.0021	0.0182
LAWC3								0.0305		0.9999	0.0952	0.0675	0.0250	0.0539		0.0533			0.1906	0.0024	0.0185
LAWC4								0.0000		0.9987	0.0920	0.0331	0.1121	0.0653		0.0469			0.1731	0.0018	0.0096
LAWC5								0.0287		0.9999	0.0862	0.0316	0.0759	0.0670		0.0511	0.0006	0.0005	0.1882	0.0024	0.0177
LAWPC1		0.0000	0.0000				0.0000	0.0330		0.9999	0.0938	0.0442	0.0301	0.0717		0.0381	0.0006	0.0206	0.1854	0.0024	0.0138
LAWPC2		0.0000	0.0000				0.0000	0.0330		0.9999	0.0948	0.0439	0.0304	0.0697		0.0372	0.0004	0.0206	0.1861	0.0023	0.0143
LAWPC3		0.0000	0.0000				0.0297	0.0330		0.9999	0.0941	0.0437	0.0295	0.0716		0.0386	0.0003	0.0203	0.1973	0.0021	0.0136
LAWPC5		0.0000	0.0000				0.0198	0.0330		0.9999	0.0951	0.0106	0.0300	0.0749		0.0386	0.0004	0.0199	0.1935	0.0022	0.0141
LAWPC6		0.0000	0.0000				0.0000	0.0330		0.9999	0.0909	0.0205	0.0289	0.0719		0.0374	0.0219	0.0196	0.1943	0.0024	0.0138
LAWPC7		0.0000	0.0000				0.0000	0.0332		0.9997	0.0806	0.0250	0.0409	0.0567		0.0026	0.0340	0.0228	0.1439	0.0015	0.0013
LAWPC8		0.0000	0.0000				0.0000	0.0332		0.9997	0.0872	0.0285	0.0442	0.0640		0.0022	0.0374	0.0257	0.1601	0.0017	0.0019
LAWPC9		0.0000	0.0000				0.0000	0.0328		1.0000	0.0935	0.0446	0.0409	0.0667		0.0375	0.0005	0.0204	0.2007	0.0020	0.0130
LAWPC10		0.0000	0.0000				0.0000	0.0332		0.9997	0.0910	0.0340	0.0511	0.0704		0.0020	0.0447	0.0164	0.1911		0.0014

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
LAWA25H	0.4255	0.0168			0.0003			0.0041						0.0058							
LAWA26	0.4460	0.0231			0.0002			0.0041			0.0040			0.0039							
LAWA26H	0.4439	0.0161			0.0002			0.0040						0.0056							
LAWB11	0.4395	0.0338			0.0002			0.0013			0.0050			0.0032							
LAWB12	0.4504	0.0311			0.0001			0.0012			0.0040			0.0041							
LAWB13	0.4081	0.0289			0.0001			0.0012			0.0030			0.0032							
LAWB14	0.4113	0.0221			0.0001			0.0012			0.0030			0.0024							
LAWB15	0.4013	0.0264			0.0001			0.0013			0.0030			0.0024							
LAWB16	0.4551	0.0234			0.0003			0.0013			0.0040			0.0039							
LAWB17	0.4417	0.0351			0.0001						0.0050			0.0037							
LAWB18	0.4489	0.0294			0.0004			0.0012			0.0040			0.0033							
LAWB19	0.4377	0.0257			0.0001			0.0012			0.0030			0.0059							
LAWB20	0.4273	0.0268			0.0004			0.0012			0.0030			0.0071							
LAWB21	0.4310	0.0291			0.0003			0.0013			0.0030			0.0035							
LAWB22	0.4349	0.0273			0.0002			0.0013			0.0030			0.0037							
LAWB23																					
LAWB24																					
LAWB25																					
LAWB26	0.4514	0.0249			0.0001			0.0013			0.0020			0.0056							
LAWB27	0.4174	0.0296			0.0001			0.0014			0.0000			0.0067							
LAWB28	0.4343	0.0225			0.0001			0.0014			0.0030			0.0052							
LAWB29	0.4511	0.0214			0.0001			0.0000			0.0000			0.0010							
LAWC1	0.3757	0.0251			0.0001			0.0036			0.0050			0.0049							
LAWC2	0.3769	0.0216			0.0001			0.0034			0.0060			0.0044							
LAWC3	0.3875	0.0184			0.0002			0.0034			0.0060			0.0043							
LAWC4	0.4290	0.0198			0.0002			0.0032			0.0060			0.0060							
LAWC5	0.4120	0.0201			0.0002			0.0036			0.0060			0.0052							
LAWPC1	0.4256	0.0249			0.0003			0.0026			0.0000			0.0049							
LAWPC2	0.3986	0.0215			0.0003			0.0026			0.0000			0.0052		0.0312					
LAWPC3	0.4128	0.0252			0.0002			0.0025			0.0020			0.0043		0.0001					
LAWPC5	0.4232	0.0255			0.0004			0.0024			0.0030			0.0051		0.0208					
LAWPC6	0.4276	0.0246			0.0002			0.0024			0.0090			0.0057		0.0001					
LAWPC7	0.5335	0.0228			0.0001			0.0000			0.0000			0.0024							
LAWPC8	0.4868	0.0249			0.0005			0.0005			0.0000			0.0027							
LAWPC9	0.4079	0.0235			0.0003			0.0028			0.0030			0.0040							
LAWPC10	0.4337	0.0269			0.0000			0.0000			0.0000			0.0024							

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
LAWA25H		0.0003							0.0014												
LAWA26									0.0013												
LAWA26H		0.0001							0.0013												
LAWB11									0.0008												
LAWB12									0.0007												
LAWB13									0.0007												
LAWB14									0.0007												
LAWB15									0.0008												
LAWB16									0.0006												
LAWB17									0.0007												
LAWB18									0.0007												
LAWB19									0.0006												
LAWB20									0.0006												
LAWB21									0.0006												
LAWB22									0.0006												
LAWB23																					
LAWB24																					
LAWB25																					
LAWB26									0.0007												
LAWB27									0.0007												
LAWB28									0.0006												
LAWB29									0.0000												
LAWC1		0.0002							0.0014												
LAWC2		0.0497							0.0011												
LAWC3									0.0012												
LAWC4									0.0012												
LAWC5									0.0012												
LAWPC1									0.0008												
LAWPC2									0.0010												
LAWPC3									0.0011												
LAWPC5									0.0010												
LAWPC6									0.0011												
LAWPC7									0.0003												
LAWPC8									0.0004												
LAWPC9									0.0011												
LAWPC10																					

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
LAWA25H					0.0048													0.0301		0.9988
LAWA26					0.0056													0.0294		1.0029
LAWA26H					0.0019													0.0274		0.9981
LAWB11					0.0113													0.0003		1.0039
LAWB12					0.0093													0.0001		0.9279
LAWB13					0.0067													0.0408		1.0020
LAWB14					0.0076													0.0000		1.0020
LAWB15					0.0091													0.0000		1.0021
LAWB16					0.0054													0.0967		1.0037
LAWB17					0.0123													0.0407		1.0052
LAWB18					0.0112													0.0007		0.9669
LAWB19					0.0120													0.0322		1.0020
LAWB20					0.0109													0.0328		1.0023
LAWB21					0.0064													0.0322		1.0024
LAWB22					0.0047													0.0348		1.0027
LAWB23																				
LAWB24																				
LAWB25																				
LAWB26					0.0058													0.0404		1.0017
LAWB27					0.0079													0.0424		0.9989
LAWB28					0.0121													0.0359		1.0022
LAWB29					0.0019													0.0400		0.9990
LAWC1					0.0053	0.0009												0.0315		1.0043
LAWC2					0.0034	0.0008												0.0309		1.0056
LAWC3				0.0448	0.0039	0.0008												0.0276		1.0045
LAWC4					0.0037	0.0009												0.0003		1.0042
LAWC5					0.0059	0.0009												0.0292		1.0055
LAWPC1					0.0057	0.0012												0.0329		0.9996
LAWPC2					0.0046	0.0024												0.0319		0.9990
LAWPC3					0.0061	0.0011												0.0328		0.9993
LAWPC5					0.0051	0.0011												0.0331		1.0000
LAWPC6					0.0034	0.0012												0.0311		1.0080
LAWPC7					0.0045	0.0001												0.0251		0.9981
LAWPC8						0.0004												0.0291		0.9982
LAWPC9					0.0071	0.0012												0.0325		1.0032
LAWPC10																		0.0317		0.9968

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
LAWA25H			<950					
LAWA26								
LAWA26H			<950					
LAWB11			950-1050					
LAWB12			950-1050					
LAWB13			~1050					
LAWB14			950-1050					
LAWB15			~950					
LAWB16			>1050					
LAWB17			950-1050					
LAWB18			<950					
LAWB19			~1050					
LAWB20			~950					
LAWB21			<950					
LAWB22			~950					
LAWB23								
LAWB24								
LAWB25								
LAWB26			~950					
LAWB27			<950					
LAWB28			<950					
LAWB29			<950					
LAWC1			~950					
LAWC2			~950					
LAWC3			>1050					
LAWC4			~1050					
LAWC5			<950					
LAWPC1			<950					
LAWPC2			<950					
LAWPC3			~950					
LAWPC5			~950					
LAWPC6			<950					
LAWPC7			<950					
LAWPC8			<950					
LAWPC9			<950					
LAWPC10			<950					

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
LAWA25H					
LAWA26					
LAWA26H					
LAWB11					
LAWB12					
LAWB13					
LAWB14					
LAWB15					
LAWB16					
LAWB17					
LAWB18					
LAWB19					
LAWB20					
LAWB21					
LAWB22					
LAWB23					
LAWB24					
LAWB25					
LAWB26					
LAWB27					
LAWB28					
LAWB29					
LAWC1					
LAWC2					
LAWC3					
LAWC4					
LAWC5					
LAWPC1					
LAWPC2					
LAWPC3					
LAWPC5					
LAWPC6					
LAWPC7					
LAWPC8					
LAWPC9					
LAWPC10					

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
LAWA25H	clear and uniform						-12.372	20653.8	8.52				950	94.7	1000
LAWA26	shows spatial variations in SO3														
LAWA26H	clear and uniform						-12.171	20540.2	9.62				950	103.7	1000
LAWB11	~5-8 vol% Ca-Mg-Fe silicates, ~2-3 vol% Ca3(PO4), ~2 vol% spinel, ~2 vol% ZrSiO4, ~2 vol% ZrO2						-13.850	23282.5	12.32				950	178.8	1000
LAWB12	~10 vol% Ca-Mg-Fe- silicates, ~4 vol% Ca3(PO4), ~2.5 vol% spinel, ~1.5 vol% ZrSiO4						-9.085	16094.4	9.26				(950)	(160.8)	(1000)
LAWB13	~2.2 vol% Ca3(PO4), ~2.2 vol% spinel						-9.991	16728.9	5.84						(1000)
LAWB14	~22 vol% Ca-Mg-Fe silicates, ~2.6 vol% Ca3(PO4), traces of spinel						-10.744	17686.3	5.39						(1000)
LAWB15	~0.5 vol% Ca-Mg-Fe silicates, ~3.3 vol% Ca3(PO4), traces of spinel						-12.252	19622.7	4.65						1000
LAWB16	~1.9 vol% spinel, ~1.6 vol% ZrSiO4, <0.1 vol% ZrO2						-10.845	19712.5	20.24						(1000)
LAWB17	~1 vol% small spinel, ~1 vol% phosphate and ZrO2 at glass-crucible interface						-11.695	18746.8	4.39						1000
LAWB18	clear and uniform						-9.152	15150.9	4.46						(1000)
LAWB19	~1.6 vol% Ca3(PO4), ~0.9 vol% spinel (Cr,Fe,Ni, and Zn)						-12.175	20758.3	11.16						(1000)
LAWB20	very tiny spinels on the surface						-12.495	20536.6	6.94				950	77.2	1000
LAWB21	clear and uniform						-11.631	18738.0	4.65				950	43.2	1000
LAWB22	very tiny spinels on the surface and traces of phosphate (~0.1 vol%)						-13.388	22412.5	10.61				950	145.4	1000
LAWB23															
LAWB24															
LAWB25															
LAWB26	~1.7 vol% Ca3(PO4), ~0.2 vol% spinel (Cr,Fe,Ni, and Zn)						-12.454	20166.6	5.57				950	59.7	1000
LAWB27	clear and uniform						-12.087	19941.8	6.87				950	70	1000
LAWB28	clear and uniform						-12.646	20417.1	5.48				950	61.9	1000
LAWB29	clear and uniform	2.7268					-12.840	20391.3	4.44				950	48.8	1000
LAWC1	very tiny spinels on the surface						-8.475	13991.7	3.89				(950)	(82.4)	(1000)
LAWC2	very tiny spinels on the surface						-9.568	15446.0	3.62				(950)	(52.8)	(1000)
LAWC3	1.5 vol% SnO2 platelets						-13.427	21571.2	5.65				(950)	(118.4)	(1000)
LAWC4	voids showing traces of sodium sulfate and chromate						-13.433	22026.8	7.74				(950)	(129.1)	1000
LAWC5	clear and uniform						-9.634	16148.3	5.55						(1000)
LAWPC1	clear and uniform						-9.611	16914.4	9.73				(950)	(175.7)	(1000)
LAWPC2	clear and uniform						-12.779	20841.1	6.47				950	75.6	1000
LAWPC3	small spinels						-13.165	21464.9	6.82				950	82.6	1000
LAWPC5	clear and uniform						-13.199	22343.5	12.22						1000
LAWPC6	clear and uniform						-12.177	19812.5	5.73				950	58.5	1000
LAWPC7	clear and uniform						-10.785	19409.1	17.37				950	160.9	1000
LAWPC8	clear and uniform						-11.965	20052.2	8.39				950	88.6	1000
LAWPC9	clear and uniform						-12.895	21297.9	7.94				950	102.5	1000
LAWPC10	clear and uniform	2.7072					-10.554	16685.3	3.23				950	23.7	1000

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
LAWA25H	46.8	1050	24.9	1100	14.1	1150	8.4	1200	5.2	1250	3.4										
LAWA26																					
LAWA26H	52.6	1050	28.3	1100	16.1	1150	9.5	1200	5.9	1250	3.8										
LAWB11	84.8	1050	42.5	1100	22.4	1150	12.3	1200	7.1	1250	4.2										
LAWB12	(55.7)	(1050)	(25.7)	1100	14.3	1150	9	1200	6.2	1250	4.5										
LAWB13	(56)	(1050)	(19)	1100	9.3	1150	5.6	1200	3.8	1250	2.8										
LAWB14	(64.4)	(1050)	(19.4)	1100	8.9	1150	5.1	1200	3.4	1250	2.5										
LAWB15	23.7	1050	13.2	1100	7.7	1150	4.6	1200	2.9	1250	1.9										
LAWB16	(179.3)	(1050)	(70.5)	1100	34.5	1150	19.6	1200	12.3	1250	8.4										
LAWB17	21.3	1050	11.8	1100	6.9	1150	4.3	1200	2.8	1250	1.9										
LAWB18	(29.2)	(1050)	(12.5)	1100	6.8	1150	4.3	1200	3	1250	2.3										
LAWB19	(164.2)	(1050)	(47)	1100	19.9	1150	10.6	1200	6.5	1250	4.5										
LAWB20	37.7	1050	19.9	1100	11.3	1150	6.8	1200	4.3	1250	2.8										
LAWB21	21.7	1050	11.9	1100	7.1	1150	4.5	1200	3	1250	2.1										
LAWB22	67.4	1050	33.9	1100	18.3	1150	10.4	1200	6.3	1250	3.9										
LAWB23																					
LAWB24																					
LAWB25																					
LAWB26	29.3	1050	15.7	1100	9	1150	5.4	1200	3.5	1250	2.3										
LAWB27	35.6	1050	19.4	1100	11.2	1150	6.8	1200	4.3	1250	2.8										
LAWB28	29.4	1050	15.4	1100	8.7	1150	5.3	1200	3.4	1250	2.3										
LAWB29	23.8	1050	12.6	1100	7.2	1150	4.3	1200	2.8	1250	1.8										
LAWC1	(22.8)	(1050)	(10)	1100	5.7	1150	3.8	1200	2.7	1250	2.1										
LAWC2	(19.7)	(1050)	(9.5)	1100	5.5	1150	3.5	1200	2.5	1250	1.8										
LAWC3	(42.1)	1050	18.4	(1100)	(42.1)	1150	5.3	1200	3.3	1250	2.2										
LAWC4	51.8	1050	24.3	1100	12.7	1150	7.3	1200	4.6	1250	3										
LAWC5	(38.8)	(1050)	(16.2)	1100	8.6	1150	5.4	1200	3.7	1250	2.7										
LAWPC1	(61.9)	(1050)	(28.3)	1100	15.4	1150	9.5	1200	6.3	1250	4.6										
LAWPC2	35.9	1050	18.7	1100	10.5	1150	6.3	1200	4	1250	2.6										
LAWPC3	40.1	1050	20.9	1100	11.6	1150	6.7	1200	4.1	1250	2.6										
LAWPC5	82.8	1050	39.1	1100	20.5	1150	11.7	1200	7.2	1250	4.6										
LAWPC6	29.4	1050	15.9	1100	9.2	1150	5.6	1200	3.6	1250	2.4										
LAWPC7	86.3	1050	49.5	1100	28.5	1150	17.3	1200	10.9	1250	7.1										
LAWPC8	43.7	1050	23.4	1100	13.5	1150	8.2	1200	5.2	1250	3.5										
LAWPC9	45.4	1050	22.8	1100	12.6	1150	7.6	1200	4.8	1250	3.3										
LAWPC10	12.7	1050	7.4	1100	4.7	1150	3.1	1200	2.2	1250	1.6										

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
LAWA25H																
LAWA26																
LAWA26H																
LAWB11															0.0847	
LAWB12															0.0917	
LAWB13															0.0406	
LAWB14															0.0567	
LAWB15															0.0805	
LAWB16															0.0147	
LAWB17																
LAWB18															0.0245	
LAWB19																
LAWB20																
LAWB21															0.0147	
LAWB22															0.0406	
LAWB23															0.0175	
LAWB24																
LAWB25																
LAWB26															0.0252	
LAWB27															0.0105	
LAWB28															0.0175	
LAWB29																
LAWC1															0.0217	
LAWC2															0.0189	
LAWC3															0.0196	
LAWC4																
LAWC5																
LAWPC1																
LAWPC2																
LAWPC3																
LAWPC5															0.1106	
LAWPC6															0.0231	
LAWPC7																
LAWPC8																
LAWPC9																
LAWPC10																

TWRS LAW Formulation (Muller and Pegg 1998)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
LAWA25H	0.1078	0.0098	8.78									
LAWA26	0.1274	0.0126	9.38									
LAWA26H	0.1316	0.0126	9.32									
LAWB11	0.0476	0.0196	8.54									
LAWB12	0.0595	0.0189	8.83									
LAWB13	0.0294	0.0147	8.76									
LAWB14	0.0539	0.0175	8.55									
LAWB15	0.0476	0.0147	8.85									
LAWB16	0.0252	0.0063	8.1									
LAWB17	0.0252	0.0084	7.76									
LAWB18	0.0252	0.0084	7.8									
LAWB19	0.014	0.0063	7.77									
LAWB20	0.0217	0.0084	7.74									
LAWB21	0.0217	0.0084	7.85									
LAWB22	0.0224	0.0077	7.75									
LAWB23	0.0224	0.0077	7.84									
LAWB24	0.0217	0.007	7.84									
LAWB25	0.0224	0.0077	7.84									
LAWB26	0.0161	0.0077	7.71									
LAWB27	0.0168	0.0091	7.58									
LAWB28	0.0287	0.0147	7.74									
LAWB29	0.0161	0.0084	7.72			<1.0	0.004	0.009	0.02	0.026		1.85
LAWC1	0.0532	0.0119	8.25									
LAWC2	0.0644	0.0112	8.87									
LAWC3	0.0595	0.0098	8.22									
LAWC4	0.8974	0.1239	8.33									
LAWC5	1.029	0.1344	8.41									
LAWPC1	0.0462	0.0077	8.22									
LAWPC2	0.0518	0.0077	8.2									
LAWPC3	0.056	0.0091	8.21									
LAWPC5	0.0567	0.0077	8.24									
LAWPC6	0.0679	0.0091	8.28									
LAWPC7	0.0336	0.0063	7.99									
LAWPC8	0.0301	0.0084	8.12									
LAWPC9	0.0504	0.0091	8.15									
LAWPC10	0.0651	0.0098	8.11			<0.98	<0.0027	<0.0055	0.02	0.025		2.45

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
Envelope A	0.0970	0.0430	0.0450	0.0740		0.0230	0.0210	0.0210	0.2000			0.4100	0.0310								
Envelope B	0.0810	0.0810	0.0700	0.0800		0.0037	0.0410	0.0300	0.1000			0.4400	0.0300								
Envelope C	0.0990	0.0300	0.0480	0.0640		0.0037	0.0400	0.0300	0.2000			0.4200	0.0300								

ISV Glass (Carter et al. 1988)

ORNL ISV																					
Hanford ISV																					
Hanford ISV (CaO adjusted)																					
Hanford ISV (Na2O adjusted)																					

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D	0.1013	0.0699	0.0404	0.2295		0.0086	0.0300	0.0011	0.1574	0.0010	0.0072	0.3019		0.0008		0.0002					

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20	0.0900	0.1300	0.0060	0.0020		0.0200	0.0010	0.0014	0.2700	0.0020	0.0200	0.4600	0.0000			0.0003					
SRM-21	0.0900	0.1700	0.0060	0.0020		0.0200	0.0010	0.0014	0.2300	0.0020	0.0200	0.4600	0.0000			0.0003					
SRM-22	0.0900	0.2100	0.0060	0.0020		0.0200	0.0010	0.0014	0.1900	0.0020	0.0200	0.4600	0.0000			0.0003					
SRM-12	0.0900	0.1300	0.0050	0.0030		0.0200	0.1100	0.0014	0.1700	0.0020	0.0200	0.4400	0.0010			0.0003					
SRM-26	0.0900	0.1600	0.0060	0.0020		0.0200	0.1100	0.0014	0.1300	0.0020	0.0200	0.4500	0.0010			0.0003					
SRM-18	0.0900	0.1300	0.0060	0.0020		0.0200	0.0400	0.0014	0.2200	0.0020	0.0200	0.4600	0.0000			0.0003					

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW	0.0833	0.0500	0.0132	0.0705		0.0014	0.0186	0.0005	0.1621	0.0145	0.0302	0.3960	0.0454				0.0125		0.0006		0.0175

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01	0.0760	0.0842	0.0288	0.1191		0.0047	0.0009	0.0101	0.0788	0.0087	0.0116	0.3629	0.0582	0.0000		0.0146	0.0000		0.0150		0.0029
HLWD1-02	0.0753	0.0835	0.0285	0.1181		0.0046	0.0009	0.0100	0.1292	0.0086	0.0115	0.3086	0.0576	0.0000		0.0145	0.0089		0.0148		0.0028
HLWD1-03	0.0753	0.1345	0.0285	0.1181		0.0046	0.0009	0.0100	0.0781	0.0086	0.0115	0.3086	0.0576	0.0000		0.0145	0.0089		0.0148		0.0028
HLWD1-04	0.0753	0.0835	0.0796	0.1181		0.0046	0.0009	0.0100	0.0781	0.0086	0.0115	0.3086	0.0576	0.0000		0.0145	0.0089		0.0148		0.0028
HLWD1-05	0.0753	0.0835	0.0285	0.1181		0.0046	0.0315	0.0100	0.0781	0.0086	0.0115	0.3290	0.0576	0.0000		0.0145	0.0089		0.0148		0.0028
HLWD1-07	0.0328	0.0679	0.0000	0.1897		0.0001	0.0291	0.0000	0.0709	0.0009	0.0165	0.3202	0.0000	0.0000		0.0209	0.0128		0.0214		0.0041
HLWD1-08	0.0320	0.0969	0.0000	0.1855		0.0001	0.0291	0.0000	0.0418	0.0121	0.0161	0.3199	0.0000	0.0000		0.0204	0.0125		0.0209		0.0040
HLWD1-09	0.0320	0.0485	0.0000	0.1855		0.0001	0.0291	0.0000	0.0903	0.0121	0.0161	0.3199	0.0000	0.0000		0.0204	0.0125		0.0209		0.0040

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
Envelope A				0.0001																	
Envelope B				0.0010																	
Envelope C				0.0001																	

ISV Glass (Carter et al. 1988)

ORNL ISV																					
Hanford ISV																					
Hanford ISV (CaO adjusted)																					
Hanford ISV (Na2O adjusted)																					

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D				0.0004										0.0041						0.0019	

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20				0.0002										0.0006							
SRM-21				0.0002										0.0006							
SRM-22				0.0002										0.0006							
SRM-12				0.0002										0.0006							
SRM-26				0.0002										0.0006							
SRM-18				0.0002										0.0006							

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW				0.0029				0.0036					0.0027		0.0095		0.0005		0.0560	0.0023	

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01	0.0000	0.0017		0.0029	0.0018	0.0018		0.0081					0.0088	0.0299		0.0022			0.0058	0.0034	
HLWD1-02	0.0000	0.0017		0.0028	0.0018	0.0017		0.0080					0.0087	0.0296		0.0022			0.0057	0.0034	
HLWD1-03	0.0000	0.0017		0.0028	0.0018	0.0017		0.0080					0.0087	0.0296		0.0022			0.0057	0.0034	
HLWD1-04	0.0000	0.0017		0.0028	0.0018	0.0017		0.0080					0.0087	0.0296		0.0022			0.0057	0.0034	
HLWD1-05	0.0000	0.0017		0.0028	0.0018	0.0017		0.0080					0.0087	0.0296		0.0022			0.0057	0.0034	
HLWD1-07	0.0000	0.0024		0.0041	0.0026	0.0025		0.0152					0.0125	0.0426		0.0031			0.0083	0.0049	
HLWD1-08	0.0000	0.0023		0.0040	0.0025	0.0024		0.0152					0.0122	0.0415		0.0030			0.0081	0.0048	
HLWD1-09	0.0000	0.0023		0.0040	0.0025	0.0024		0.0152					0.0122	0.0415		0.0030			0.0081	0.0048	

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
Envelope A																					
Envelope B																					
Envelope C																					

ISV Glass (Carter et al. 1988)

ORNL ISV																					
Hanford ISV																					
Hanford ISV (CaO adjusted)																					
Hanford ISV (Na2O adjusted)																					

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D		0.0000															0.0416			0.0000	0.0019

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20																	0.0001				0.0007
SRM-21																	0.0001				0.0007
SRM-22																	0.0001				0.0007
SRM-12																	0.0001				0.0007
SRM-26																	0.0001				0.0007
SRM-18																	0.0001				0.0007

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW									0.0003							0.0022	0.0027				

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0047	0.0018		0.0000	0.0000	0.0062
HLWD1-02	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0046	0.0018		0.0000	0.0000	0.0062
HLWD1-03	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0046	0.0018		0.0000	0.0000	0.0062
HLWD1-04	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0046	0.0018		0.0000	0.0000	0.0062
HLWD1-05	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0046	0.0018		0.0000	0.0000	0.0062
HLWD1-07	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0067	0.0307		0.0000	0.0000	0.0089
HLWD1-08	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0065	0.0306		0.0000	0.0000	0.0087
HLWD1-09	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0065	0.0306		0.0000	0.0000	0.0087

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
Envelope A								0.0330		0.9981	0.0940	0.0420	0.0440	0.0810		0.0220	0.0210	0.0200	0.2000	0.0014	0.0007
Envelope B								0.0400		0.9977	0.0770	0.0750	0.0650	0.0870		0.0038	0.0400	0.0280	0.1300	0.0016	0.0002
Envelope C								0.0330		0.9978	0.0910	0.0300	0.0460	0.0690		0.0017	0.0390	0.0280	0.2200	0.0017	0.0006

ISV Glass (Carter et al. 1988)

ORNL ISV											0.1360	0.0016	0.1390	0.0378		0.0320	0.0008	0.1010	0.0105	0.0004	
Hanford ISV											0.1220	0.0009	0.0454	0.0657		0.0190		0.0221	0.0313	0.0005	
Hanford ISV (CaO adjusted)											0.1020	0.0008	0.1810	0.0550		0.0150	0.0005	0.0192	0.0301	0.0025	Ha
Hanford ISV (Na2O adjusted)											0.1030		0.0393	0.0559		0.0090	0.0003	0.0183	0.1780	0.0004	Har

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D			0.0000					0.0001		0.9993	0.0980	0.0590	0.0550	0.2165		0.0845	0.0245	0.0022	0.1355	0.0025	0.0054

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20		0.0010								1.0053	0.1000	0.1300	0.0050	0.0030		0.0200	0.0020		0.2400	0.0020	0.0200
SRM-21		0.0010								1.0053	0.1000	0.1600	0.0050	0.0030		0.0200	0.0010		0.2000	0.0020	0.0200
SRM-22		0.0010								1.0053	0.1000	0.2000	0.0050	0.0030		0.0200	0.0010		0.1900	0.0020	0.0200
SRM-12		0.0010								0.9953	0.0900	0.1300	0.0050	0.0030		0.0200	0.1100		0.1700	0.0020	0.0200
SRM-26		0.0010								0.9953	0.1000	0.1500	0.0050	0.0030		0.0200	0.1000		0.1300	0.0020	0.0200
SRM-18		0.0010								0.9943	0.1000	0.1300	0.0060	0.0030		0.0200	0.0390		0.2000	0.0020	0.0200

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW						0.0011				1.0001											

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01	0.0000		0.0446		0.0000	0.0000	0.0000	0.0000		1.0002	0.0621	0.0803	0.0267	0.1016		0.0052	0.0017	0.0100	0.0637	0.0077	0.0330
HLWD1-02	0.0000		0.0442		0.0000	0.0000	0.0000	0.0000		0.9998	0.0677	0.0786	0.0286	0.1048		0.0048	0.0014	0.0102	0.1068	0.0079	0.0097
HLWD1-03	0.0000		0.0442		0.0000	0.0000	0.0000	0.0000		0.9997	0.0673	0.1235	0.0280	0.1036		0.0047	0.0015	0.0100	0.0674	0.0042	0.0100
HLWD1-04	0.0000		0.0442		0.0000	0.0000	0.0000	0.0000		0.9998	0.0704	0.0823	0.0747	0.1038		0.0047	0.0018	0.0109	0.0699	0.0075	0.0125
HLWD1-05	0.0000		0.0442		0.0000	0.0000	0.0000	0.0000		0.9997	0.0628	0.0833	0.0269	0.1030		0.0049	0.0286	0.0104	0.0657	0.0071	0.0136
HLWD1-07			0.0637			0.0000	0.0000	0.0000		0.9955	0.0324	0.0751	0.0052	0.1601		0.0003	0.0293	0.0002	0.0700	0.0009	0.0182
HLWD1-08			0.0621			0.0000	0.0000	0.0000		0.9952	0.0340	0.0958	0.0007	0.1621		0.0005	0.0280	0.0002	0.0417	0.0107	0.0184
HLWD1-09			0.0621			0.0000	0.0000	0.0000		0.9953	0.0336	0.0503	0.0007	0.1672		0.0004	0.0302	0.0002	0.0816	0.0110	0.0185

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
Envelope A	0.4100	0.0310	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000	0.0007			0.0022	0.0017	0.0006		0.0003			
Envelope B	0.4300	0.0300	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000	0.0058			0.0035	0.0016	0.0013		0.0000			
Envelope C	0.4100	0.0330	0.0000	0.0000	0.0001	0.0000		0.0001		0.0000	0.0027			0.0020		0.0008		0.0008			

ISV Glass (Carter et al. 1988)

ORNL ISV	0.4850	0.0003			0.0010										0.0196						
Hanford ISV	0.6160	0.0004			0.0012										0.0218						
nford ISV (CaO adjust	0.5110	0.0002			0.0011									0.0008	0.0195						
nford ISV (Na2O adjus	0.5220	0.0003			0.0011										0.0215						

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D	0.2570		0.0022		0.0004									0.0037							

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20	0.4800	0.0000																			
SRM-21	0.4900	0.0000																			
SRM-22	0.4700	0.0000																			
SRM-12	0.4500	0.0100																			
SRM-26	0.4600	0.0090																			
SRM-18	0.4800	0.0000																			

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW																					

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01	0.3374	0.0310			0.0128							0.0018		0.0022	0.0022						
HLWD1-02	0.3054	0.0478			0.0143	0.0079		0.0136				0.0017		0.0022	0.0016	0.0016					
HLWD1-03	0.2920	0.0294			0.0140	0.0078		0.0132				0.0011		0.0021	0.0016	0.0016					
HLWD1-04	0.3092	0.0451			0.0146	0.0082		0.0135				0.0015		0.0017	0.0018	0.0017					
HLWD1-05	0.3193	0.0486			0.0132	0.0092		0.0147				0.0018		0.0016	0.0016	0.0018					
HLWD1-07	0.3206	0.0003			0.0204	0.0052		0.0215				0.0026		0.0024	0.0024	0.0025					
HLWD1-08	0.3229	0.0002			0.0193	0.0118		0.0222				0.0024		0.0022	0.0023	0.0024					
HLWD1-09	0.3186	0.0001			0.0197	0.0117		0.0217				0.0026		0.0030	0.0024	0.0024					

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
Envelope A		0.0000	0.0002			0.0002		0.0000	0.0001											0.0000	
Envelope B		0.0000	0.0003			0.0001		0.0000	0.0001											0.0000	
Envelope C		0.0000	0.0003			0.0001		0.0000	0.0003											0.0000	

ISV Glass (Carter et al. 1988)

ORNL ISV			0.0013																		
Hanford ISV			0.0014																		
Hanford ISV (CaO adjusted)			0.0012																		
Hanford ISV (Na2O adjusted)			0.0012																		

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D		0.0003	0.0051					0.0005	0.0037			0.0002									

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20																					
SRM-21																					
SRM-22																					
SRM-12																					
SRM-26																					
SRM-18																					

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW																					

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01		0.0082	0.0271					0.0044	0.0043												
HLWD1-02		0.0085	0.0283					0.0067	0.0036												
HLWD1-03		0.0086	0.0282					0.0067	0.0037												
HLWD1-04		0.0088	0.0298		0.0032			0.0072	0.0040												
HLWD1-05		0.0086	0.0276		0.0032			0.0055	0.0044												
HLWD1-07		0.0124	0.0435		0.0045			0.0093	0.0060												
HLWD1-08		0.0120	0.0415		0.0051			0.0100	0.0059												
HLWD1-09		0.0116	0.0413		0.0052			0.0100	0.0059												

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
Envelope A	0.0000				0.0009			0.0000		0.0003			0.0000		0.0008			0.0320		1.0072
Envelope B	0.0000				0.0002			0.0000		0.0000			0.0000		0.0000			0.0370		1.0175
Envelope C	0.0000				0.0043			0.0000		0.0002			0.0000		0.0003			0.0300		1.0119

ISV Glass (Carter et al. 1988)

ORNL ISV						0.0416				0.0062										1.0141
Hanford ISV						0.0372				0.0113					0.0003					0.9965
Hanford ISV (CaO adjusted)						0.0364				0.0094					0.0002					0.9859
Hanford ISV (Na2O adjusted)						0.0373				0.0096					0.0002					0.9974

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D						0.0375			0.0008	0.0019			0.0030					0.0010		1.0001

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20														0.0010					0.0040	1.0070
SRM-21														0.0010					0.0030	1.0050
SRM-22														0.0010					0.0030	1.0150
SRM-12														0.0010					0.0040	1.0150
SRM-26														0.0010					0.0040	1.0040
SRM-18														0.0010					0.0040	1.0050

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW																				

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01						0.0020				0.0059			0.0388							0.8701
HLWD1-02					0.0048	0.0019				0.0058			0.0384							0.9146
HLWD1-03					0.0049	0.0018				0.0062			0.0388							0.8819
HLWD1-04						0.0022				0.0061										0.8971
HLWD1-05						0.0021				0.0062			0.0410							0.9167
HLWD1-07					0.0066	0.0335				0.0086			0.0680							0.9620
HLWD1-08						0.0305				0.0085			0.0607							0.9520
HLWD1-09						0.0305				0.0086			0.0604							0.9494

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
Envelope A						amorphous		
Envelope B						amorphous		
Envelope C						amorphous		

ISV Glass (Carter et al. 1988)

ORNL ISV								
Hanford ISV								
Hanford ISV (CaO adjusted)								
Hanford ISV (Na2O adjusted)								

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D						spinel	NiFe2O4	

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20	1150							
SRM-21	1150							
SRM-22	1150							
SRM-12	1150							
SRM-26	1150							
SRM-18	1150							

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW	1150		1064	spinel				

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01	1150		<1050		clear dark brown glass	2.4 vol% zircon, 0.6 vol% spinel		
HLWD1-02	1150		<1050		clear dark brown glass	0.5 vol% ZrO2 and 1 vol% spinel		
HLWD1-03	1150		1050		clear dark brown glass	1.5 vol% zircon and 1 vol% spinel		
HLWD1-04	1150		<1050		clear dark brown glass	~3 vol% zircon, spinel, and ZrO2		
HLWD1-05	1150		950		clear dark brown glass	~2 vol% ZrO2 and spinel with U incorporated		
HLWD1-07	1150		<1050		glassy brown	Clear in bulk, but on bottom of crucible, about 10 vol% eskolaite/hematite solid solution and 2 vol% spinel		
HLWD1-08	1150		<1050		glassy brown			
HLWD1-09	1150		<1050		glassy brown			

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
Envelope A					
Envelope B					
Envelope C					

ISV Glass (Carter et al. 1988)

ORNL ISV					
Hanford ISV					
Hanford ISV (CaO adjusted)					
Hanford ISV (Na2O adjusted)					

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D					

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20					
SRM-21					
SRM-22					
SRM-12					
SRM-26					
SRM-18					

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW					

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01					
HLWD1-02					
HLWD1-03					
HLWD1-04					
HLWD1-05					
HLWD1-07					
HLWD1-08					
HLWD1-09					

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
Envelope A															
Envelope B															
Envelope C															

ISV Glass (Carter et al. 1988)

ORNL ISV												1324			
Hanford ISV												1665			
Hanford ISV (CaO adjusted)												1325			
Hanford ISV (Na2O adjusted)												1325			

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D															

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20															
SRM-21															
SRM-22															
SRM-12															
SRM-26															
SRM-18															

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW															

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01	Clear bulk. Surface has about 1 vol% spinels. Pt/glass interface has about 1 vol% zircon and ZrO2						-13.130	22542.5	15.05				1000	104.53	1050
HLWD1-02	<0.1 vol% spinel in bulk; <1 vol% spinel plus ZrO2 at interface, both with U incorporated.						-13.724	21354.3	3.61				1000	22.859	1050
HLWD1-03	~1 vol% spinel in bulk; ~5 vol% spinel plus zircon at interface, and 0.1 vol% ZrO2						-13.655	21465.9	4.18				1000	26.30	1050
HLWD1-04	Clear bulk. <1 vol% spinel and 0.4 vol% ZrO2 at interfaces.						-12.821	20206.4	3.97				(1000)	(37.83)	(1050)
HLWD1-05	0.3 vol% ZrO2 and spinels, mainly at air interface.						-10.326	15754.3	2.11				(1000)	(12.556)	(1050)
HLWD1-07	clear glass						-10.298	14661.7	1.01				(1000)	(5.168)	(1050)
HLWD1-08	Two pieces vitreous, third piece has crys., most likely silicates, 300-500 microns wide, extending into bulk by 200 microns, <1 vol% crys.						-10.792	16009.2	1.58				(1000)	(9.894	(1050)
HLWD1-09	<1 vol% surface crys., most likely spinels						-11.784	17160.7	1.32				1000	5.869	1050

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
Envelope A																					
Envelope B																					
Envelope C																					

ISV Glass (Carter et al. 1988)

ORNL ISV																					
Hanford ISV																					
Hanford ISV (CaO adjusted)																					
Hanford ISV (Na2O adjusted)																					

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D																					

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20																					
SRM-21																					
SRM-22																					
SRM-12																					
SRM-26																					
SRM-18																					

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW																					

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01	49.278	1100	25.521	1150	14.281	1200	8.524	1250	5.371	1300	3.545										
HLWD1-02	11.066	1100	5.901	1150	3.404	1200	2.095	1250	1.361	1300	0.925										
HLWD1-03	12.929	1100	6.927	1150	3.986	1200	2.435	1250	1.564	1300	1.049										
HLWD1-04	(14.743	1100	7.007	1150	3.837	1200	2.333	1250	1.536	1300	1.076										
HLWD1-05	(5.922	1100	3.289	1150	2.05	1200	1.39	1250	1.005	1300	0.763										
HLWD1-07	(2.607	1100	1.519	1150	0.981	1200	0.684	1250	0.505	1300	0.39										
HLWD1-08	(4.554	1100	2.49	1150	1.536	1200	1.035	1250	0.745	1300	0.564										
HLWD1-09	3.237	1100	1.944	1150	1.249	1200	0.849	1250	0.603	1300	0.445										

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
Envelope A															0.011	0.021
Envelope B															0.0165	0.0195
Envelope C															0.013	0.0405

ISV Glass (Carter et al. 1988)

ORNL ISV																
Hanford ISV																
Hanford ISV (CaO adjusted)																
Hanford ISV (Na2O adjusted)																

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D					0.33	0.51	0.83									

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20																
SRM-21																
SRM-22																
SRM-12																
SRM-26																
SRM-18																

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW																

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01					0.1267684		0.1333428	0.1016022	9.3							
HLWD1-02					0.3952545		0.3393394	0.1245057	10.3							
HLWD1-03					0.1789486		0.1752703	0.0945924	9.2							
HLWD1-04					0.1746832		0.1913217	0.0676948	9.8							
HLWD1-05					0.3302785	0.305454	0.273477	0.1278724	10.3							
HLWD1-07					0.5258976	0.5288859	0.5120947	0.2431974	10.0							
HLWD1-08					0.3274706	0.3380431	0.2895874	0.1877519	9.3							
HLWD1-09					0.4972554	0.4811752	0.4977629	0.2665308	10.4							

TWRS LAW Formulation 2 (Ferrara et al. 1998)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
Envelope A	0.04	0.0095	10.1			<3	<1	4.8		<4		
Envelope B	0.023	0.004	9.7			<3	<1	<3		<4		
Envelope C	0.07	0.01	10.4			0.28	0.072	<4		0.5		

ISV Glass (Carter et al. 1988)

ORNL ISV												
Hanford ISV												
Hanford ISV (CaO adjusted)												
Hanford ISV (Na2O adjusted)												

TWRS Envelop D HLW Glass (Crawford et al. 1998)

Envelope D						0.34	<0.09	<0.3		<2		

SRS M-Area Mixed Waste Glass (Fu et al. 1997)

SRM-20								0.08	0.14			
SRM-21								0.03	0.10			
SRM-22								0.06	0.18			
SRM-12									0.18			
SRM-26									0.10			
SRM-18								0.11	0.16			

Kinetics of Spinel Crystallization (Reynolds and Hrma 1997)

HLW												

TWRS HLW Glass Formulation (Fu and Pegg 1998)

HLWD1-01												
HLWD1-02												
HLWD1-03												
HLWD1-04												
HLWD1-05												
HLWD1-07												
HLWD1-08						1.18	0.72	<0.006		0.16		
HLWD1-09						1.26	0.83	0.01		0.16		

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
HLWD1-10	0.0301	0.0921	0.0000	0.1756		0.0873	0.0000	0.0000	0.0396	0.0114	0.0152	0.3005	0.0000	0.0000		0.0192	0.0118		0.0196		0.0038
HLWD1-11	0.1177	0.0607	0.0163	0.2626		0.0112	0.0301	0.0025	0.1463	0.0026	0.0107	0.2845	0.0018	0.0000		0.0006	0.0006		0.0001		0.0003
HLWD1-12	0.1332	0.0665	0.0052	0.2185		0.0053	0.0402	0.0014	0.1110	0.0079	0.0002	0.2731	0.0662	0.0000		0.0012	0.0000		0.0090		0.0000
HLWD1-13	0.0382	0.0668	0.0763	0.2289		0.0105	0.0315	0.0229	0.1049	0.0215	0.0000	0.2957	0.0000	0.0000		0.0000	0.0000		0.0000		0.0000
HLWD1-14	0.0378	0.1606	0.0000	0.0756		0.0000	0.0312	0.0000	0.1417	0.0017	0.0000	0.2740	0.1228	0.0000		0.0000	0.0000		0.0000		0.0059
HLWD1-15	0.0661	0.1134	0.0756	0.2362		0.0000	0.0312	0.0000	0.0945	0.0017	0.0000	0.2362	0.1228	0.0000		0.0000	0.0000		0.0000		0.0000
HLWD1-16	0.1606	0.0661	0.0189	0.0567		0.0126	0.0312	0.0000	0.0945	0.0017	0.0000	0.2929	0.1228	0.0047		0.0000	0.0000		0.0000		0.0000
HLWD1-17	0.0378	0.1606	0.0000	0.2362		0.0000	0.0312	0.0000	0.0945	0.0017	0.0000	0.2835	0.0000	0.0000		0.0000	0.0000		0.0000		0.0059
HLWD1-18	0.1604	0.1510	0.0000	0.0472		0.0105	0.0311	0.0229	0.0944	0.0214	0.0000	0.2359	0.1227	0.0000		0.0000	0.0000		0.0000		0.0000
HLWD1-19	0.0378	0.0661	0.0756	0.2079		0.0126	0.0312	0.0000	0.1890	0.0017	0.0000	0.2362	0.0000	0.0047		0.0000	0.0000		0.0000		0.0000
HLWD1-20	0.0378	0.0661	0.0756	0.0472		0.0126	0.0312	0.0000	0.1890	0.0017	0.0000	0.2740	0.1228	0.0047		0.0000	0.0000		0.0000		0.0000
HLWD1-21	0.0997	0.1526	0.0055	0.2212		0.0001	0.0410	0.0022	0.1127	0.0021	0.0078	0.3071	0.0015	0.0035	0.0004	0.0005	0.0005		0.0001		0.0003
HLWD1-23	0.0603	0.1549	0.0132	0.1431		0.0044	0.0403	0.0044	0.1360	0.0044	0.0088	0.3200	0.0009	0.0021	0.0004	0.0044	0.0004		0.0066		0.0014
HLWD1-24	0.0750	0.1117	0.0164	0.1779		0.0055	0.0202	0.0055	0.1691	0.0055	0.0109	0.2654	0.0012	0.0026	0.0005	0.0055	0.0005		0.0082		0.0017
HLWD1-25	0.0692	0.1115	0.0152	0.1642		0.0051	0.0200	0.0051	0.1561	0.0051	0.0101	0.3121	0.0000	0.0024	0.0005	0.0051	0.0005		0.0076		0.0016
HLWD1-26	0.0607	0.1321	0.0100	0.1201		0.0033	0.0375	0.0033	0.1027	0.0033	0.0066	0.4239	0.0139	0.0016	0.0003	0.0033	0.0003		0.0050		0.0010
HLWD1-27	0.0606	0.1107	0.0634	0.1437		0.0044	0.0200	0.0044	0.1366	0.0044	0.0088	0.3324	0.0009	0.0021	0.0004	0.0044	0.0004		0.0066		0.0014
HLWD1-28	0.0948	0.1036	0.0607	0.1557		0.0038	0.0308	0.0010	0.0795	0.0056	0.0002	0.3511	0.0471	0.0000		0.0008	0.0000		0.0064		0.0000
HLWD2-01	0.0846	0.0669	0.0231	0.1587		0.0038	0.0293	0.0081	0.0714	0.0095	0.0093	0.3194	0.0466	0.0000		0.0117	0.0072		0.0120		0.0023
HLWD2-02	0.0174	0.0599	0.0000	0.2414		0.0001	0.0300	0.0000	0.0704	0.0151	0.0147	0.2996	0.0000	0.0000		0.0186	0.0114		0.0190		0.0037
HLWD2-03	0.1606	0.0661	0.0756	0.0472		0.0000	0.0312	0.0000	0.1890	0.0017	0.0000	0.2740	0.0000	0.0000		0.0000	0.0000		0.0000		0.0059
HLWD2-04	0.0850	0.0661	0.0000	0.2362		0.0000	0.0312	0.0000	0.1890	0.0017	0.0305	0.2362	0.0000	0.0000		0.0386	0.0237		0.0395		0.0000

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
HLWD1-10	0.0000	0.0022		0.0038	0.0023	0.0023		0.0152					0.0115	0.0391		0.0029			0.0076	0.0045	
HLWD1-11	0.0000	0.0000		0.0014	0.0000	0.0002		0.0035					0.0001	0.0063		0.0001			0.0003	0.0039	
HLWD1-12	0.0000	0.0000		0.0015	0.0001	0.0008		0.0014					0.0061	0.0068		0.0000			0.0000	0.0009	
HLWD1-13	0.0000	0.0038		0.0065	0.0014	0.0000		0.0000					0.0000	0.0672		0.0000			0.0000	0.0000	
HLWD1-14	0.0000	0.0000		0.0000	0.0014	0.0000		0.0000					0.0179	0.0000		0.0000			0.0118	0.0000	
HLWD1-15	0.0000	0.0000		0.0000	0.0014	0.0000		0.0000					0.0000	0.0000		0.0000			0.0000	0.0000	
HLWD1-16	0.0025	0.0000		0.0000	0.0063	0.0048		0.0280					0.0000	0.0000		0.0059			0.0000	0.0093	
HLWD1-17	0.0000	0.0000		0.0000	0.0014	0.0000		0.0000					0.0179	0.0000		0.0000			0.0118	0.0000	
HLWD1-18	0.0000	0.0038		0.0065	0.0014	0.0000		0.0000					0.0000	0.0672		0.0000			0.0000	0.0000	
HLWD1-19	0.0025	0.0000		0.0065	0.0063	0.0048		0.0280					0.0000	0.0000		0.0059			0.0000	0.0093	
HLWD1-20	0.0025	0.0000		0.0000	0.0063	0.0048		0.0280					0.0000	0.0000		0.0059			0.0000	0.0093	
HLWD1-21	0.0001	0.0000		0.0012	0.0005	0.0002		0.0000					0.0001	0.0048		0.0001			0.0003	0.0038	
HLWD1-23	0.0011	0.0013		0.0031	0.0015	0.0004		0.0009					0.0018	0.0044		0.0000			0.0000	0.0023	
HLWD1-24	0.0014	0.0016		0.0038	0.0018	0.0005		0.0011					0.0022	0.0055		0.0000			0.0000	0.0029	
HLWD1-25	0.0013	0.0015		0.0035	0.0017	0.0005		0.0010					0.0020	0.0051		0.0000			0.0000	0.0026	
HLWD1-26	0.0009	0.0010		0.0023	0.0011	0.0003		0.0007					0.0013	0.0033		0.0000			0.0000	0.0017	
HLWD1-27	0.0011	0.0013		0.0031	0.0015	0.0004		0.0009					0.0018	0.0044		0.0000			0.0000	0.0023	
HLWD1-28	0.0001	0.0000		0.0011	0.0001	0.0006		0.0010					0.0043	0.0049		0.0000			0.0000	0.0006	
HLWD2-01	0.0000	0.0013		0.0046	0.0014	0.0014		0.0082					0.0070	0.0240		0.0018			0.0046	0.0027	
HLWD2-02	0.0000	0.0021		0.0073	0.0023	0.0022		0.0131					0.0112	0.0379		0.0028			0.0074	0.0044	
HLWD2-03	0.0000	0.0000		0.0000	0.0014	0.0000		0.0000					0.0179	0.0000		0.0000			0.0118	0.0000	
HLWD2-04	0.0000	0.0000		0.0000	0.0014	0.0000		0.0000					0.0000	0.0000		0.0000			0.0000	0.0000	

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
HLWD1-10	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0061	0.0305		0.0000	0.0000	0.0082
HLWD1-11	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0005	0.0257		0.0000	0.0000	0.0027
HLWD1-12	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0290		0.0000	0.0000	0.0014
HLWD1-13	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0003		0.0000	0.0182		0.0000	0.0000	0.0000
HLWD1-14	0.0000	0.0026				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0180		0.0000	0.0035	0.0000
HLWD1-15	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0180		0.0000	0.0000	0.0000
HLWD1-16	0.0000	0.0000				0.0000			0.0000		0.0088	0.0057	0.0000	0.0000		0.0127	0.0228		0.0000	0.0000	0.0170
HLWD1-17	0.0000	0.0026				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0180		0.0000	0.0035	0.0000
HLWD1-18	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0003		0.0000	0.0180		0.0000	0.0000	0.0000
HLWD1-19	0.0000	0.0000				0.0000			0.0000		0.0088	0.0049	0.0000	0.0000		0.0127	0.0264		0.0000	0.0000	0.0170
HLWD1-20	0.0000	0.0000				0.0000			0.0000		0.0088	0.0049	0.0000	0.0000		0.0127	0.0228		0.0000	0.0000	0.0170
HLWD1-21	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0001	0.0000		0.0004	0.0206		0.0000	0.0000	0.0023
HLWD1-23	0.0007	0.0000				0.0005			0.0021		0.0013	0.0015	0.0000	0.0000		0.0044	0.0275		0.0013	0.0011	0.0014
HLWD1-24	0.0008	0.0000				0.0006			0.0022		0.0016	0.0016	0.0000	0.0000		0.0055	0.0341		0.0016	0.0013	0.0017
HLWD1-25	0.0008	0.0000				0.0006			0.0024		0.0015	0.0018	0.0000	0.0000		0.0051	0.0315		0.0000	0.0000	0.0000
HLWD1-26	0.0005	0.0000				0.0004			0.0014		0.0010	0.0010	0.0000	0.0000		0.0033	0.0207		0.0010	0.0008	0.0010
HLWD1-27	0.0007	0.0000				0.0005			0.0018		0.0013	0.0013	0.0000	0.0000		0.0044	0.0276		0.0013	0.0011	0.0014
HLWD1-28	0.0000	0.0000				0.0000			0.0000		0.0035	0.0021	0.0000	0.0000		0.0000	0.0240		0.0019	0.0000	0.0010
HLWD2-01	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0047	0.0292		0.0000	0.0000	0.0050
HLWD2-02	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0074	0.0313		0.0000	0.0000	0.0079
HLWD2-03	0.0000	0.0026				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0180		0.0000	0.0035	0.0000
HLWD2-04	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0180		0.0000	0.0000	0.0000

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
HLWD1-10			0.0584			0.0000	0.0000	0.0000		1.0008	0.0309	0.0908	0.0006	0.1501		0.0909	0.0005	0.0001	0.0397	0.0090	0.0166
HLWD1-11			0.0026			0.0000	0.0000	0.0000		0.9959	0.1000	0.0568	0.0149	0.2198		0.0109	0.0279	0.0022	0.1236	0.0024	0.0115
HLWD1-12			0.0087			0.0000	0.0000	0.0000		0.9956											
HLWD1-13			0.0000			0.0020	0.0000	0.0000	0.0006	0.9972	0.0391	0.0615	0.0616	0.2011		0.0099	0.0290	0.0201	0.0799	0.0195	0.0007
HLWD1-14			0.0909			0.0000	0.0000	0.0000		0.9974	0.0389	0.1472	0.0015	0.0669		0.0006	0.0299	0.0006	0.1061	0.0019	0.0010
HLWD1-15			0.0000			0.0000	0.0000	0.0000		0.9971											
HLWD1-16			0.0000			0.0000	0.0000	0.0041		0.9906											
HLWD1-17			0.0909			0.0000	0.0000	0.0000		0.9975	0.0414	0.1650	0.0006	0.1812		0.0004	0.0315	0.0002	0.0819	0.0019	0.0006
HLWD1-18			0.0000			0.0020	0.0000	0.0000	0.0006	0.9973	0.1393	0.1444	0.0013	0.0522		0.0096	0.0296	0.0191	0.0836	0.0197	0.0008
HLWD1-19			0.0000			0.0000	0.0000	0.0041		1.0000	0.0395	0.0607	0.0638	0.1911		0.0118	0.0294	0.0008	0.1482	0.0021	0.0011
HLWD1-20			0.0000			0.0000	0.0000	0.0041		0.9898	0.0395	0.0675	0.0675	0.0466		0.0126	0.0338	0.0006	0.1583	0.0017	0.0013
HLWD1-21			0.0022			0.0006	0.0001	0.0004		0.9966	0.0938	0.1522	0.0066	0.1840		0.0007	0.0388	0.0023	0.1009	0.0019	0.0084
HLWD1-23	0.0046		0.0264			0.0000	0.0000	0.0009		0.9965	0.0519	0.1531	0.0139	0.1354		0.0054	0.0404	0.0048	0.1297	0.0044	0.0100
HLWD1-24	0.0055		0.0328			0.0000	0.0000	0.0011		0.9945	0.0629	0.1133	0.0171	0.1695		0.0063	0.0208	0.0058	0.1574	0.0054	0.0126
HLWD1-25			0.0000			0.0000	0.0000	0.0000		0.9543	0.0561	0.1100	0.0157	0.1479		0.0058	0.0208	0.0053	0.1430	0.0050	0.0114
HLWD1-26	0.0033		0.0199			0.0000	0.0000	0.0007		0.9965											
HLWD1-27	0.0044		0.0265			0.0000	0.0000	0.0009		0.9956	0.0520	0.1177	0.0612	0.1391		0.0050	0.0213	0.0049	0.1260	0.0045	0.0099
HLWD1-28	0.0007		0.0062			0.0000	0.0000	0.0005		0.9937	0.0815	0.1031	0.0547	0.1421		0.0042	0.0298	0.0013	0.0665	0.0052	0.0010
HLWD2-01	0.0000		0.0357			0.0000	0.0000	0.0000		0.9955	0.0785	0.0622	0.0229	0.1416		0.0038	0.0292	0.0082	0.0664	0.0078	0.0111
HLWD2-02	0.0000		0.0567			0.0000	0.0000	0.0000		0.9953	0.0220	0.0578	0.0014	0.2155		0.0007	0.0271	0.0003	0.0605	0.0129	0.0160
HLWD2-03			0.0909			0.0000	0.0000	0.0000		0.9974	0.1565	0.0720	0.0823	0.0515			0.0340		0.1684	0.0019	
HLWD2-04			0.0000			0.0000	0.0000	0.0000		0.9971	0.0749	0.0624	0.0024	0.2076		0.0006	0.0298	0.0002	0.1614	0.0021	0.0303

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
HLWD1-10	0.2976	0.0001			0.0183	0.0111		0.0188				0.0022		0.0029	0.0022	0.0023					
HLWD1-11	0.2995	0.0018			0.0011									0.0011							
HLWD1-12																					
HLWD1-13	0.3274	0.0003			0.0001							0.0034		0.0077	0.0013						
HLWD1-14	0.2968	0.1013			0.0003							0.0006		0.0002	0.0015						
HLWD1-15																					
HLWD1-16																					
HLWD1-17	0.2972	0.0015			0.0002									0.0001	0.0016						
HLWD1-18	0.2509	0.1002			0.0001							0.0040		0.0068	0.0014						
HLWD1-19	0.2749	0.0004			0.0001							0.0001		0.0014							
HLWD1-20	0.2994	0.0735	0.0026		0.0004			0.0003						0.0001		0.0048					
HLWD1-21	0.3204	0.0016	0.0032		0.0007	0.0007		0.0001		0.0012				0.0011	0.0001	0.0004					
HLWD1-23	0.3375	0.0015	0.0021		0.0051	0.0008		0.0066		0.0021		0.0016		0.0029	0.0014	0.0006					
HLWD1-24	0.2802	0.0014	0.0025		0.0064	0.0008		0.0082		0.0026		0.0020		0.0039	0.0017	0.0007					
HLWD1-25	0.3171		0.0020	0.0000	0.0061	0.0009		0.0076		0.0024		0.0018		0.0035	0.0016	0.0006					
HLWD1-26																					
HLWD1-27	0.3504	0.0012	0.0021		0.0054	0.0008		0.0069				0.0016		0.0029		0.0007					
HLWD1-28	0.3438	0.0383	0.0002		0.0011	0.0003		0.0062						0.0008	0.0001	0.0007					
HLWD2-01	0.3172	0.0421			0.0111	0.0075		0.0117				0.0015		0.0026	0.0014	0.0014					
HLWD2-02	0.2954	0.0007			0.0166	0.0140		0.0219				0.0026		0.0047	0.0020	0.0025					
HLWD2-03	0.3296									0.0064					0.0015						
HLWD2-04	0.2606	0.0002			0.0336	0.0220		0.0114						0.0016	0.0013						

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
HLWD1-10		0.0113	0.0376		0.0049			0.0096	0.0052												
HLWD1-11		0.0005	0.0070					0.0007													
HLWD1-12																					
HLWD1-13			0.0588					0.0002				0.0002									
HLWD1-14		0.0174	0.0011					0.0117				0.0010									
HLWD1-15																					
HLWD1-16																					
HLWD1-17			0.0003																		
HLWD1-18			0.0639																		
HLWD1-19			0.0002																		
HLWD1-20			0.0002		0.0070				0.0099												
HLWD1-21		0.0001	0.0050		0.0002			0.0004													
HLWD1-23		0.0018	0.0051					0.0002			0.0008					0.0002			0.0002	0.0013	
HLWD1-24		0.0023	0.0063					0.0002			0.0010					0.0003			0.0001	0.0016	
HLWD1-25		0.0022	0.0058					0.0002			0.0004					0.0003			0.0002	0.0015	
HLWD1-26																					
HLWD1-27		0.0023	0.0053					0.0005			0.0007					0.0006			0.0006		
HLWD1-28		0.0041	0.0051					0.0002	0.0014												
HLWD2-01		0.0067	0.0235		0.0019			0.0049	0.0036												
HLWD2-02		0.0110	0.0346		0.0029			0.0069	0.0077												
HLWD2-03		0.0195						0.0128				0.0028									
HLWD2-04			0.0002																		

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
HLWD1-10					0.0065	0.0298				0.0080			0.0606							0.9582
HLWD1-11					0.0020	0.0267				0.0028			0.0045							0.9177
HLWD1-12																				
HLWD1-13			0.0006			0.0193				0.0005			0.0010							0.9432
HLWD1-14			0.0026			0.0188			0.0041	0.0006			0.0818							0.9344
HLWD1-15																				
HLWD1-16																				
HLWD1-17						0.0181				0.0002			0.0754							0.8993
HLWD1-18			0.0010			0.0167				0.0004			0.0008							0.9458
HLWD1-19			0.0002		0.0096	0.0210				0.0163			0.0010					0.0041		0.8778
HLWD1-20					0.0130	0.0195				0.0163			0.0009					0.0042		0.8815
HLWD1-21			0.0002		0.0020	0.0196			0.0003	0.0023			0.0031		0.0002					0.9525
HLWD1-23			0.0010		0.0089	0.0250		0.0014	0.0007	0.0017	0.0017		0.0273		0.0002					0.9887
HLWD1-24			0.0012		0.0092	0.0315		0.0018	0.0010	0.0020	0.0017		0.0322		0.0002					0.9741
HLWD1-25			0.0011		0.0084	0.0350														0.9197
HLWD1-26																				
HLWD1-27						0.0258			0.0011	0.0016			0.0257							0.9778
HLWD1-28	0.0012					0.0226		0.0018		0.0013	0.0005		0.0067					0.0006		0.9264
HLWD2-01					0.0051	0.0311			0.0014	0.0049			0.0360							0.9473
HLWD2-02					0.0065	0.0270				0.0077			0.0552							0.9341
HLWD2-03						0.0196			0.0038				0.0375							1.0001
HLWD2-04						0.0176				0.0006			0.0005							0.9213

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
HLWD1-10	1150		<1050		glassy brown			
HLWD1-11	1150		>1050		glassy brown	2-5 vol% spinel; <1 vol% hematite; <1 vol% silicate & zircon		
HLWD1-12	1150		>1050		opaque brown	spinels and hematite		
HLWD1-13	1150		>1050		opaque brown			
HLWD1-14	1150		>1050		clear on top and bottom but crystallized bulk			
HLWD1-15	1150		>1050		heavily crystallized			
HLWD1-16	1150		>1050		heavily crystallized			
HLWD1-17	1150		<1050		clear top and bottom with middle section crystallized			
HLWD1-18	1150		>1050		brown glass			
HLWD1-19	1150		>1050		brown and yellow scum on top of brown glass			
HLWD1-20	1150		1050		opaque green w/ white spots on top			
HLWD1-21	1150		<1050		opaque brown glass w/ brown spots on bottom	0.1-0.2 vol% Ag, 0.1um diameter		
HLWD1-23	1150		1050		glassy brown but crucible is heterogeneous	glass on bottom of crucible has spinels. Pd along sides of crucible.		
HLWD1-24	1150		1050		glassy brown but crucible is heterogeneous	glass on bottom of crucible has spinels. Pd along sides of crucible.		
HLWD1-25	1150		<1050		glassy brown but crucible is heterogeneous			
HLWD1-26	1150		<1050		brown glass with opaque brown & yellow streaks & heterogeneous crucible	Yellow coloration due to Ag particles Brown band has Ru crystal clusters.		
HLWD1-27	1150		<1050		glassy brown but crucible is heterogeneous			
HLWD1-28	1150		<1050		glassy brown			
HLWD2-01	1150		<1050		opaque dark brown glass	0.5 vol% ZrO2, 3.6 vol% spinel, both with U incorp., trace hematite		
HLWD2-02	1150		<1050		glassy brown			
HLWD2-03	1150		<1050		clear light brown			yes
HLWD2-04	1150		<1050		glassy brown			

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
HLWD1-10					
HLWD1-11					
HLWD1-12					
HLWD1-13					
HLWD1-14					
HLWD1-15					
HLWD1-16					
HLWD1-17					
HLWD1-18					
HLWD1-19					
HLWD1-20					
HLWD1-21					
HLWD1-23					
HLWD1-24					
HLWD1-25					
HLWD1-26					
HLWD1-27					
HLWD1-28					
HLWD2-01					
HLWD2-02					
HLWD2-03					
HLWD2-04					

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
HLWD1-10	surface crystallized, <1 vol% bulk crys., most likely spinels						-12.419	19557.4	3.76				1000	20.641	1050
HLWD1-11	1mm wide band of crystals at Pt/glass interface. 23 vol% crystals in this band. Mostly Fe3O4 w/Mg, Al, Si, Cr, Mn, & Ni. Rest of glass has <1 vol% crystals.						-10.616	16471.7	2.61				(1000)	(14.681	(1050)
HLWD1-12	About 5% ZrO2 and spinel														
HLWD1-13	About 3% hematite or spinel and 5-10% silicate						-13.159	18650.4	0.95				1000	4.445	1050
HLWD1-14	About 2 vol% ZrO2						-12.716	18386.0	1.23				1000	5.865	1050
HLWD1-15	About 25% spinels and silicates														
HLWD1-16	6 vol% ZrO2, <1 vol% Zr-Sb-Ca-Ti-Fe crystals & one patch of Fe2O3 crystals														
HLWD1-17	<1 vol% crystals						-10.424	14507.4	0.80				1000	2.75	1050
HLWD1-18	10 vol% crys. From top to center and on bottom. Clear in middle section. Lots of bubbles in upper area.						-11.147	18683.3	7.26				(1000)	~100	(1050)
HLWD1-19	<1 vol% spinels and 0.5 vol% Ag						-10.396	13242.8	0.34				1000	1.027	1050
HLWD1-20	1 vol% crys.														
HLWD1-21	<1 vol% crystals, mainly spinels on bottom of crucible and some drops high in Ag (may occur during cooling)						-9.917	14458.8	1.28				1000	4.367	1050
HLWD1-23	Clear except for 0.1-1um Ag ~1 vol% Ag						-10.046	13685.2	0.65				1000	2.106	1050
HLWD1-24	Ag particles and Fe-Ni enriched crystals, 1 vol%.														
HLWD1-25	<1 vol% crystals														
HLWD1-26	Several Ru clusters varying in size from 50x100 um to 5x5um. Much less than 1 vol% crystals.														
HLWD1-27	clear glass						-10.788	15581.2	1.18				1000	4.539	1050
HLWD1-28	Fe-Ni spinels with Cr, Mn, Al, and Mg incorporation along the glass/crucible interface. About 0.2 vol% total crystals.														
HLWD2-01	0.02 vol% spinel at interfaces. 0.2 vol% ZrO2 at interfaces extending down to bulk.												(1100)	(11.679	(1050)
HLWD2-02	clear except for one 3x5um Sn particle						-14.645	21451.7	1.54				1050	4.94	1100
HLWD2-03	clear glass						-10.328	16674.7	4.01				1000	17.138	1050
HLWD2-04	Clear for bulk. Crystals (probably spinels) on bottom and center of meniscus. <1 vol% total crystals						-9.648	13594.6	0.91				1000	2.881	1050

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
HLWD1-10	10.475	1100	5.857	1150	3.538	1200	2.277	1250	1.543	1300	1.092										
HLWD1-11	(7.294	1100	4.115	1150	2.554	1200	1.706	1250	1.207	1300	0.894										
HLWD1-12																					
HLWD1-13	2.555	1100	1.529	1150	0.949	1200	0.608	1250	0.401	1300	0.272										
HLWD1-14	3.236	1100	1.907	1150	1.189	1200	0.776	1250	0.528	1300	0.372										
HLWD1-15																					
HLWD1-16																					
HLWD1-17	1.708	1100	1.122	1150	0.772	1200	0.553	1250	0.409	1300	0.312										
HLWD1-18	~40	(1100)	~20	(1150)	~10	1200	4.70	1250	3.00	1300	2.10										
HLWD1-19	0.677	1100	0.466	1150	0.331	1200	0.243	1250	0.183	1300	0.141										
HLWD1-20																					
HLWD1-21	2.736	1100	1.805	1150	1.244	1200	0.89	1250	0.658	1300	0.499										
HLWD1-23	1.338	1100	0.899	1150	0.632	1200	0.462	1250	0.348	1300	0.27										
HLWD1-24																					
HLWD1-25																					
HLWD1-26																					
HLWD1-27	2.66	1100	1.677	1150	1.123	1200	0.789	1250	0.577	1300	0.437										
HLWD1-28																					
HLWD2-01	(4.941	(1200)	(3.71	(1250)	(3.214																
HLWD2-02	2.615	1150	1.496	1200	0.913	1250	0.587														
HLWD2-03	9.612	1100	5.855	1150	3.81	1200	2.617	1250	1.878	1300	1.398										
HLWD2-04	1.866	1100	1.266	1150	0.892	1200	0.65	1250	0.488	1300	0.375										

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
HLWD1-10					0.3677863		0.3710316	0.1574067	9.3							
HLWD1-11					0.8012563	0.67	0.6334435	0.3083801	11.3							
HLWD1-12																
HLWD1-13					0.1942531	0.250445	0.2630401	0.1599618	10.5							
HLWD1-14					1.33	0.98	0.84	0.14	10.1							
HLWD1-15																
HLWD1-16																
HLWD1-17					1.2209873	1.0093427	0.7923769	0.2182348	10.7							
HLWD1-18					0.6478138	0.5360557	0.4770007	0.1760258	9.6							
HLWD1-19					1.47	1.4	1.89	0.49	11.8							
HLWD1-20					0.6120691	0.5646938	0.7392427	0.2287683	11.6							
HLWD1-21					0.6081054	0.5126693	0.4320195	0.1979808	10.1							
HLWD1-23					2.4933787	2.0059108	1.6943758	0.379732	10.82							
HLWD1-24																
HLWD1-25					1.9608046	1.5578925	1.5236959	0.3735782	10.3							
HLWD1-26																
HLWD1-27					1.05	0.98	1.12	0.28	11.1							
HLWD1-28																
HLWD2-01					0.23	0.2527201	0.2131451	0.1114544	10.0							
HLWD2-02					0.47	0.4391158	0.4323454	0.2861254	10.0							
HLWD2-03					0.2265118	0.3415069	0.5263493	0.1849666	11.2							
HLWD2-04					3.57	2.87	3.01	0.63	11.9							

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
HLWD1-10						1.55	1.14	0.01		0.21		
HLWD1-11												
HLWD1-12												
HLWD1-13												
HLWD1-14												
HLWD1-15												
HLWD1-16												
HLWD1-17												
HLWD1-18												
HLWD1-19												
HLWD1-20												
HLWD1-21												
HLWD1-23												
HLWD1-24												
HLWD1-25												
HLWD1-26												
HLWD1-27												
HLWD1-28												
HLWD2-01												
HLWD2-02												
HLWD2-03												
HLWD2-04												

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
HLWD2-05	0.0378	0.0661	0.0756	0.0850		0.0104	0.0312	0.0227	0.1890	0.0213	0.0000	0.2362	0.1228	0.0000		0.0000	0.0000		0.0000		0.0000
HLWD2-06	0.0917	0.1199	0.0564	0.1703		0.0022	0.0299	0.0022	0.1136	0.0116	0.0043	0.3380	0.0005	0.0010	0.0002	0.0022	0.0002		0.0033		0.0007
HLWD2-07	0.0446	0.1488	0.0593	0.1059		0.0033	0.0297	0.0033	0.1007	0.0376	0.0065	0.3648	0.0007	0.0016	0.0003	0.0033	0.0003		0.0049		0.0010
HLWD3-01	0.0832	0.0707	0.0204	0.0970		0.0210	0.0006	0.0070	0.1947	0.0060	0.0188	0.3018	0.0403	0.0000		0.0101	0.0000		0.0103		0.0026
HLWD3-02	0.0466	0.0714	0.0004	0.1175		0.0153	0.0000	0.0000	0.1584	0.0075	0.0195	0.4004	0.0001	0.0000		0.0129	0.0000		0.0132		0.0031
HLWD3-03	0.1622	0.0763	0.0763	0.1049		0.0000	0.0315	0.0000	0.0954	0.0017	0.0308	0.2957	0.0000	0.0000		0.0390	0.0239		0.0399		0.0000
HLWD3-04	0.1606	0.1606	0.0756	0.0850		0.0126	0.0312	0.0000	0.0945	0.0017	0.0000	0.2362	0.0000	0.0047		0.0000	0.0000		0.0000		0.0000
HLWD3-05	0.1606	0.0661	0.0000	0.0472		0.0000	0.0312	0.0000	0.1890	0.0017	0.0284	0.2362	0.1228	0.0000		0.0358	0.0220		0.0367		0.0000
HLWD3-06	0.0378	0.1606	0.0756	0.0472		0.0000	0.0312	0.0000	0.0945	0.0017	0.0305	0.2929	0.1039	0.0000		0.0386	0.0237		0.0395		0.0000
HLWD3-07	0.1606	0.1134	0.0000	0.1890		0.0000	0.0312	0.0000	0.1890	0.0017	0.0000	0.2929	0.0000	0.0000		0.0000	0.0000		0.0000		0.0000
HLWD3-08	0.1708	0.0887	0.0147	0.1058		0.0094	0.0000	0.0032	0.2203	0.0034	0.0084	0.2863	0.0016	0.0015	0.0003	0.0032	0.0003		0.0047		0.0009
EnvDSR1	0.0900	0.0686	0.0558	0.2255		0.0010	0.0294	0.0011	0.1555	0.0010	0.0069	0.3143	0.0000	0.0003		0.0002	0.0000		0.0000		0.0000

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35	0.0693	0.0634	0.1259	0.0300		0.0024	0.0425		0.1405	0.0003	0.0005	0.4000	0.0506								
Frit-2-78-35	0.0693	0.1234	0.1259	0.0300		0.0024	0.0600		0.0830	0.0003	0.0005	0.3800	0.0506								
Frit-3-78-35	0.0693	0.1234	0.1259	0.0600		0.0024	0.0300		0.0630	0.0003	0.0005	0.4000	0.0506								
Frit-4-78-35	0.0693	0.1234	0.1259	0.0025		0.0024	0.0600		0.0604	0.0003	0.0005	0.4000	0.0506								
Frit-5-78-35	0.0693	0.0534	0.1259	0.0298		0.0024	0.0600		0.1132	0.0003	0.0005	0.4200	0.0506								
Frit-6-78-35	0.0693	0.0613	0.1259	0.0610		0.0024	0.0325		0.1317	0.0003	0.0005	0.3900	0.0506								
Frit-5-78-30	0.0594	0.0555	0.1079	0.0315		0.0021	0.0646		0.1186	0.0002	0.0005	0.4524	0.0433								
Frit-5-78-37	0.0733	0.0526	0.1331	0.0291		0.0026	0.0581		0.1110	0.0003	0.0006	0.4070	0.0535								
Frit-5-78-40	0.0792	0.0514	0.1439	0.0280		0.0028	0.0554		0.1077	0.0003	0.0006	0.3877	0.0578								
Frit-5-78a-35	0.0693	0.0534	0.1260	0.0298		0.0024	0.0600		0.1132	0.0003	0.0005	0.4200	0.0506								
Frit-5-78b-35	0.0859	0.0509	0.1132	0.0300		0.0014	0.0600		0.1137	0.0003	0.0117	0.4228	0.0471								
Frit-5-78c-35	0.0881	0.0522	0.1160	0.0307		0.0015	0.0615		0.1165	0.0003	0.0120	0.4333	0.0482								
DZr-3a	0.0933	0.0631	0.1229	0.0308		0.0015	0.0605		0.1095	0.0003	0.0127	0.3859	0.0511								
DZr-3c	0.0958	0.0648	0.1262	0.0316		0.0016	0.0621		0.1125	0.0003	0.0131	0.3963	0.0525								
DZr-4a	0.0933	0.0445	0.1229	0.0463		0.0015	0.0558		0.1226	0.0003	0.0127	0.3806	0.0511								
DZr-4c	0.0958	0.0457	0.1262	0.0475		0.0016	0.0573		0.1259	0.0003	0.0131	0.3909	0.0525								
DZr-5a	0.0933	0.0445	0.1229	0.0277		0.0015	0.0744		0.1033	0.0003	0.0127	0.3999	0.0511								
DZr-5c	0.0958	0.0457	0.1262	0.0284		0.0016	0.0764		0.1061	0.0003	0.0131	0.4106	0.0525								
DZr-6a	0.0933	0.0569	0.1229	0.0525		0.0015	0.0558		0.1219	0.0003	0.0127	0.3627	0.0511								

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
HLWD2-05	0.0000	0.0037		0.0065	0.0014	0.0000		0.0000					0.0000	0.0666		0.0000			0.0000	0.0000	
HLWD2-06	0.0006	0.0007		0.0056	0.0007	0.0002		0.0004					0.0009	0.0022		0.0000			0.0000	0.0011	
HLWD2-07	0.0008	0.0010		0.0128	0.0011	0.0003		0.0007					0.0013	0.0033		0.0000			0.0000	0.0017	
HLWD3-01	0.0000	0.0013		0.0020	0.0013	0.0012		0.0071					0.0061	0.0210		0.0015			0.0040	0.0024	
HLWD3-02	0.0000	0.0015		0.0025	0.0016	0.0015		0.0091					0.0077	0.0265		0.0019			0.0051	0.0030	
HLWD3-03	0.0000	0.0000		0.0000	0.0014	0.0000		0.0000					0.0000	0.0000		0.0000			0.0000	0.0000	
HLWD3-04	0.0025	0.0000		0.0000	0.0063	0.0048		0.0280					0.0000	0.0000		0.0059			0.0000	0.0093	
HLWD3-05	0.0000	0.0000		0.0000	0.0014	0.0000		0.0000					0.0000	0.0000		0.0000			0.0000	0.0000	
HLWD3-06	0.0000	0.0000		0.0000	0.0014	0.0000		0.0000					0.0000	0.0000		0.0000			0.0000	0.0000	
HLWD3-07	0.0000	0.0000		0.0000	0.0014	0.0000		0.0000					0.0000	0.0000		0.0000			0.0000	0.0000	
HLWD3-08	0.0008	0.0009		0.0077	0.0010	0.0003		0.0006					0.0013	0.0066		0.0000			0.0000	0.0019	
EnvDSR1	0.0000	0.0000		0.0004	0.0010	0.0000		0.0000					0.0000	0.0039		0.0000			0.0000	0.0018	

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35	0.0003			0.0014				0.0599							0.0005					0.0001	
Frit-2-78-35	0.0003			0.0014				0.0599							0.0005					0.0001	
Frit-3-78-35	0.0003			0.0014				0.0599							0.0005					0.0001	
Frit-4-78-35	0.0003			0.0014				0.0599							0.0005					0.0001	
Frit-5-78-35	0.0003			0.0014				0.0599							0.0005					0.0001	
Frit-6-78-35	0.0003			0.0014				0.0599							0.0005					0.0001	
Frit-5-78-30	0.0002			0.0012				0.0513							0.0005					0.0001	
Frit-5-78-37	0.0003			0.0015				0.0633							0.0006					0.0001	
Frit-5-78-40	0.0003			0.0016				0.0684							0.0006					0.0001	
Frit-5-78a-35	0.0003			0.0014				0.0599							0.0005					0.0001	
Frit-5-78b-35	0.0003			0.0013				0.0470							0.0013					0.0002	
Frit-5-78c-35	0.0003			0.0014				0.0235							0.0013					0.0002	
DZr-3a	0.0003			0.0014				0.0510							0.0014					0.0002	
DZr-3c	0.0003			0.0015				0.0255							0.0014					0.0002	
DZr-4a	0.0003			0.0014				0.0510							0.0014					0.0002	
DZr-4c	0.0003			0.0015				0.0255							0.0014					0.0002	
DZr-5a	0.0003			0.0014				0.0510							0.0014					0.0002	
DZr-5c	0.0003			0.0015				0.0255							0.0014					0.0002	
DZr-6a	0.0003			0.0014				0.0510							0.0014					0.0002	

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
HLWD2-05	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0003		0.0000	0.0180		0.0000	0.0000	0.0000
HLWD2-06	0.0003	0.0000				0.0003			0.0009		0.0007	0.0008	0.0000	0.0000		0.0057	0.0135		0.0007	0.0005	0.0007
HLWD2-07	0.0005	0.0000				0.0004			0.0015		0.0010	0.0011	0.0000	0.0000		0.0094	0.0203		0.0010	0.0008	0.0010
HLWD3-01	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0039	0.0249		0.0000	0.0000	0.0043
HLWD3-02	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0047	0.0195		0.0000	0.0015	0.0055
HLWD3-03	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0182		0.0000	0.0000	0.0000
HLWD3-04	0.0000	0.0000				0.0000			0.0000		0.0088	0.0057	0.0000	0.0000		0.0127	0.0228		0.0000	0.0000	0.0170
HLWD3-05	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0180		0.0000	0.0000	0.0000
HLWD3-06	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0180		0.0000	0.0000	0.0000
HLWD3-07	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0180		0.0000	0.0000	0.0000
HLWD3-08	0.0005	0.0000				0.0003			0.0013		0.0009	0.0009	0.0000	0.0000		0.0032	0.0227		0.0009	0.0008	0.0010
EnvDSR1	0.0000	0.0000				0.0000			0.0000		0.0000	0.0000	0.0000	0.0000		0.0000	0.0412		0.0000	0.0000	0.0019

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35																0.0124					
Frit-2-78-35																0.0124					
Frit-3-78-35																0.0124					
Frit-4-78-35																0.0124					0.0300
Frit-5-78-35																0.0124					
Frit-6-78-35																0.0124					
Frit-5-78-30																0.0106					
Frit-5-78-37																0.0131					
Frit-5-78-40																0.0142					
Frit-5-78a-35																0.0124					
Frit-5-78b-35																0.0105	0.0024				
Frit-5-78c-35																0.0107	0.0025				
DZr-3a																0.0114	0.0026				
DZr-3c																0.0117	0.0027				
DZr-4a																0.0114	0.0026				
DZr-4c																0.0117	0.0027				
DZr-5a																0.0114	0.0026				
DZr-5c																0.0117	0.0027				
DZr-6a																0.0114	0.0026				

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
HLWD2-05			0.0000			0.0020	0.0000	0.0000		0.9966	0.0416	0.0631	0.0631	0.0729		0.0105	0.0297	0.0194	0.1409	0.0181	0.0005
HLWD2-06	0.0022		0.0130			0.0000	0.0000	0.0004		1.0003	0.0770	0.1214	0.0496	0.1499		0.0024	0.0289	0.0024	0.0937	0.0101	0.0051
HLWD2-07	0.0034		0.0196			0.0000	0.0000	0.0007		1.0003	0.0384	0.1452	0.0540	0.0903		0.0039	0.0295	0.0035	0.0835	0.0283	0.0079
HLWD3-01			0.0308			0.0000	0.0000	0.0000		0.9963	0.0736	0.0672	0.0193	0.0864		0.0175	0.0013	0.0074	0.1648	0.0055	0.0202
HLWD3-02			0.0393			0.0000	0.0000	0.0000		0.9972	0.0481	0.0737	0.0004	0.1212		0.0158			0.1349	0.0078	0.0201
HLWD3-03			0.0000			0.0000	0.0000	0.0000		0.9972	0.1407	0.0763	0.0666	0.0917		0.0010	0.0325	0.0006	0.0810	0.0016	0.0279
HLWD3-04	0.0040		0.0000			0.0000	0.0000	0.0041		0.9946	0.1490	0.1661	0.0720	0.0795		0.0125	0.0348		0.0810	0.0018	
HLWD3-05			0.0000			0.0000	0.0000	0.0000		0.9971											
HLWD3-06			0.0000			0.0000	0.0000	0.0000		0.9971	0.0326	0.1466	0.0666	0.0510		0.0005	0.0291	0.0006	0.0822	0.0029	0.0299
HLWD3-07			0.0000			0.0000	0.0000	0.0000		0.9972	0.1327	0.1152	0.0008	0.1756		0.0005	0.0312	0.0002	0.1617	0.0016	0.0005
HLWD3-08	0.0032		0.0189			0.0000	0.0000	0.0008		1.0000	0.1647	0.0898	0.0155	0.0959		0.0090	0.0005	0.0041	0.2010	0.0032	0.0092
EnvDSR1			0.0000			0.0000	0.0000	0.0001		0.9999	0.0757	0.0687	0.0529	0.2046		0.0021	0.0298	0.0026	0.1278	0.0028	0.0043

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35										1.0000											
Frit-2-78-35										1.0000											
Frit-3-78-35										1.0000											
Frit-4-78-35										0.9999											
Frit-5-78-35										1.0000											
Frit-6-78-35										1.0001											
Frit-5-78-30										1.0000											
Frit-5-78-37										1.0000											
Frit-5-78-40										1.0000											
Frit-5-78a-35										1.0000											
Frit-5-78b-35										1.0000											
Frit-5-78c-35										1.0000											
DZr-3a										0.9999											
DZr-3c										1.0001											
DZr-4a										0.9999											
DZr-4c										1.0001											
DZr-5a										0.9999											
DZr-5c										1.0000											
DZr-6a										0.9999											

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
HLWD2-05	0.2832	0.0832			0.0001							0.0038		0.0061							
HLWD2-06	0.3300	0.0006	0.0012	0.0031	0.0025	0.0006		0.0033				0.0007		0.0041	0.0009	0.0004					
HLWD2-07	0.3593	0.0010	0.0015	0.0000	0.0039	0.0008		0.0047				0.0010		0.0049	0.0012	0.0005					
HLWD3-01	0.3078	0.0323			0.0099	0.0007		0.0099				0.0015		0.0017	0.0011	0.0017					
HLWD3-02	0.4130	0.0001			0.0133			0.0136		0.0032		0.0015		0.0026	0.0016	0.0016		0.0094			
HLWD3-03	0.3010	0.0006			0.0348	0.0237		0.0372				0.0001		0.0001	0.0000						
HLWD3-04	0.2662		0.0035		0.0002						0.0027				0.0066	0.0051					
HLWD3-05																					
HLWD3-06	0.3038	0.0868			0.0341	0.0219		0.0378						0.0024	0.0013						
HLWD3-07	0.3040	0.0004			0.0002									0.0001	0.0014						
HLWD3-08	0.2894	0.0016	0.0014		0.0034	0.0006		0.0048				0.0011		0.0058	0.0009	0.0004					
EnvDSR1	0.3139	0.0048			0.0008									0.0027							

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35																					
Frit-2-78-35																					
Frit-3-78-35																					
Frit-4-78-35																					
Frit-5-78-35																					
Frit-6-78-35																					
Frit-5-78-30																					
Frit-5-78-37																					
Frit-5-78-40																					
Frit-5-78a-35																					
Frit-5-78b-35																					
Frit-5-78c-35																					
DZr-3a																					
DZr-3c																					
DZr-4a																					
DZr-4c																					
DZr-5a																					
DZr-5c																					
DZr-6a																					

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
HLWD2-05									0.0005												
HLWD2-06		0.0009	0.0024						0.0019		0.0010					0.0003			0.0004	0.0008	
HLWD2-07		0.0011	0.0034					0.0002	0.0024												
HLWD3-01		0.0060	0.0204					0.0041	0.0032												
HLWD3-02		0.0080	0.0273		0.0020			0.0053	0.0031												
HLWD3-03			0.0004						0.0002												
HLWD3-04					0.0059				0.0100												0.0084
HLWD3-05																					
HLWD3-06		0.0001	0.0006						0.0004			0.0002									
HLWD3-07			0.0001																		
HLWD3-08		0.0013	0.0064		0.0001			0.0001			0.0002					0.0006			0.0005		
EnvDSR1			0.0076																		

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35																					
Frit-2-78-35																					
Frit-3-78-35																					
Frit-4-78-35																					
Frit-5-78-35																					
Frit-6-78-35																					
Frit-5-78-30																					
Frit-5-78-37																					
Frit-5-78-40																					
Frit-5-78a-35																					
Frit-5-78b-35																					
Frit-5-78c-35																					
DZr-3a																					
DZr-3c																					
DZr-4a																					
DZr-4c																					
DZr-5a																					
DZr-5c																					
DZr-6a																					

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
HLWD2-05					0.0005	0.0166												0.0001		0.8539
HLWD2-06					0.0058	0.0129			0.0006	0.0008	0.0013		0.0124					0.0005		0.9299
HLWD2-07	0.0006				0.0061	0.0196		0.0009	0.0008	0.0013	0.0015		0.0185					0.0007		0.9204
HLWD3-01					0.0035	0.0264				0.0043			0.0300							0.9277
HLWD3-02					0.0048	0.0201			0.0015	0.0057			0.0405							1.0002
HLWD3-03					0.0001	0.0181				0.0003			0.0005					0.0001		0.9371
HLWD3-04	0.0060				0.0097	0.0240				0.0168	0.0008		0.0008					0.0042		0.9676
HLWD3-05																				
HLWD3-06			0.0005		0.0013	0.0168			0.0003	0.0004			0.0010							0.9517
HLWD3-07			0.0001		0.0018	0.0175				0.0002			0.0005							0.9463
HLWD3-08					0.0041	0.0227			0.0009	0.0011			0.0187							0.9590
EnvDSR1						0.0342				0.0019								0.0004		0.9376

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35																				
Frit-2-78-35																				
Frit-3-78-35																				
Frit-4-78-35																				
Frit-5-78-35																				
Frit-6-78-35																				
Frit-5-78-30																				
Frit-5-78-37																				
Frit-5-78-40																				
Frit-5-78a-35																				
Frit-5-78b-35																				
Frit-5-78c-35																				
DZr-3a																				
DZr-3c																				
DZr-4a																				
DZr-4c																				
DZr-5a																				
DZr-5c																				
DZr-6a																				

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
HLWD2-05	1150		>1050		brown glass w/ blue metallic coating			no
HLWD2-06	1150		>1050		clear brown glass			
HLWD2-07	1150		<1050		glassy brown			
HLWD3-01	1150		<950		glassy brown			
HLWD3-02	1150		<950		glassy brown			
HLWD3-03	1150		<1050		clear brown glass			
HLWD3-04	1150		<1050		opaque brown w/ white spots on top			
HLWD3-05	1150		>1050		opaque yellowish green glass w/ white spots	white spots are zirconia crystals about 300X500 microns. ~5 vol% ZrO2		
HLWD3-06	1150		<1050		clear light brown			
HLWD3-07	1150		<1050		glassy brown			
HLWD3-08	1150		<1050		glassy brown			
EnvDSR1	1150		<1050		glassy brown			

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35					Homogeneous			yes
Frit-2-78-35					Homogeneous			yes
Frit-3-78-35					Some crystals			no
Frit-4-78-35					Some crystals			no
Frit-5-78-35			< 1050		Homogeneous			yes
Frit-6-78-35					Some crystals			no
Frit-5-78-30					Homogeneous			yes
Frit-5-78-37					Homogeneous			yes
Frit-5-78-40					Homogeneous			yes
Frit-5-78a-35			870	CaF2	Homogeneous			yes
Frit-5-78b-35			868	CaF2	Homogeneous			yes
Frit-5-78c-35			879	Sodalite group	Homogeneous			yes
DZr-3a					Homogeneous			yes
DZr-3c					Homogeneous			yes
DZr-4a					Homogeneous			yes
DZr-4c					Homogeneous			yes
DZr-5a					Homogeneous			yes
DZr-5c					Homogeneous			yes
DZr-6a					Homogeneous			yes

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
HLWD2-05					
HLWD2-06					
HLWD2-07					
HLWD3-01					
HLWD3-02					
HLWD3-03					
HLWD3-04					
HLWD3-05					
HLWD3-06					
HLWD3-07					
HLWD3-08					
EnvDSR1					

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35					
Frit-2-78-35					
Frit-3-78-35					
Frit-4-78-35					
Frit-5-78-35					
Frit-6-78-35					
Frit-5-78-30					
Frit-5-78-37					
Frit-5-78-40					
Frit-5-78a-35					
Frit-5-78b-35					
Frit-5-78c-35					
DZr-3a			~5 vol% crystallinity		
DZr-3c			~2% crystallinity		
DZr-4a			10-20% crystallinity		
DZr-4c			10-20% crystallinity		
DZr-5a			5-10% crystallinity		
DZr-5c			5-10% crystallinity		
DZr-6a			surface fully crystallized, lots of crystallinity in bulk		

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
HLWD2-05	10-20 vol% crystals. May be spinels. Metallic coating on top.						-11.556	17553.7	2.18				(1000)	(13.71	(1050)
HLWD2-06	some spinel crystals on bottom. Overall, 1-5 vol% crystals						-10.732	16124.9	1.82				1000	7.178	1050
HLWD2-07	Cr-Fe-Ni spinels at glass/crucible interface. Some Ru, Al, and Mg incorporation into these spinels. About 0.3 vol% crystals.								1.00						
HLWD3-01	clear except for one 8x10um phase of Fe-Cr-Ni-Si						-11.835	18215.9	2.63				1000	12.544	1050
HLWD3-02	clear glass						-9.612	16069.4	5.37				(1000)	(28.15	(1050)
HLWD3-03	<1 vol% crys. total, mainly in the glass-crucible interface. Most likely some Fe2O3 in glass						-11.354	17846.2	3.28				1000	14.80	1050
HLWD3-04	clear glass						-10.428	14798.5	0.97				1000	3.467	1050
HLWD3-05	50 vol% crys. In bottom layer. 5 vol% in rest of glass														
HLWD3-06	clear glass						-12.427	17625.0	0.96				1000	4.319	1050
HLWD3-07	<1 vol% crystals in glass, most likely spinels Most crystals settled to bottom.						-9.153	13968.5	1.94				1000	6.282	1050
HLWD3-08	Two types of crystals on bottom, most likely spinel and silicate, <1 vol%.						-11.596	19441.1	7.89				1000	43.264	1050
EnvDSR1	<1 vol% spinel-like crystals at the glass/crucible interface.						-11.653	17137.7	1.48				1000	6.413	1050

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35															
Frit-2-78-35															
Frit-3-78-35															
Frit-4-78-35															
Frit-5-78-35															
Frit-6-78-35															
Frit-5-78-30															
Frit-5-78-37															
Frit-5-78-40															
Frit-5-78a-35															
Frit-5-78b-35															
Frit-5-78c-35															
DZr-3a															
DZr-3c															
DZr-4a															
DZr-4c															
DZr-5a															
DZr-5c															
DZr-6a															

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
HLWD2-05	(6.513	1100	3.541	1150	2.13	1200	1.385	1250	0.958	1300	0.696										
HLWD2-06	4.266	1100	2.685	1150	1.773	1200	1.22	1250	0.87	1300	0.639										
HLWD2-07																					
HLWD3-01	6.78	1100	4.001	1150	2.533	1200	1.698	1250	1.193												
HLWD3-02	(14.472	1100	8.352	1150	5.264	1200	3.552	1250	2.531	1300	1.884										
HLWD3-03	8.426	1100	5.075	1150	3.208	1200	2.114	1250	1.445	1300	1.019										
HLWD3-04	2.117	1100	1.374	1150	0.939	1200	0.669	1250	0.494	1300	0.376										
HLWD3-05																					
HLWD3-06	2.43	1100	1.46	1150	0.927	1200	0.617	1250	0.428	1300	0.307										
HLWD3-07	4.065	1100	2.74	1150	1.914	1200	1.379	1250	1.021	1300	0.774										
HLWD3-08	21.802	1100	12.179	1150	7.381	1200	4.776	1250	3.26	1300	2.325										
EnvDSR1	3.641	1100	2.214	1150	1.424	1200	0.96	1250	0.674	1300	0.49										

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35																					
Frit-2-78-35																					
Frit-3-78-35																					
Frit-4-78-35																					
Frit-5-78-35																					
Frit-6-78-35																					
Frit-5-78-30																					
Frit-5-78-37																					
Frit-5-78-40																					
Frit-5-78a-35																					
Frit-5-78b-35																					
Frit-5-78c-35																					
DZr-3a																					
DZr-3c																					
DZr-4a																					
DZr-4c																					
DZr-5a																					
DZr-5c																					
DZr-6a																					

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
HLWD2-05					5.81	4.20	4.69	0.56	12.2							
HLWD2-06					0.21	0.21	0.28	0.14	10.2							
HLWD2-07																
HLWD3-01					0.77	0.70	0.91	0.21	11.3							
HLWD3-02					0.42		0.49	0.21	10.2							
HLWD3-03					0.1090876	0.147602	0.1497036	0.0663794	10.3							
HLWD3-04					0.2792833	0.2976974	0.2817181	0.0714168	9.4							
HLWD3-05																
HLWD3-06					0.561173	0.5122604	0.5351218	0.1444362	9.9							
HLWD3-07					0.69	0.4650013	0.5819798	0.2535211	10.9							
HLWD3-08					4.66		2.493098	0.222863	11.5							
EnvDSR1					0.63	0.70	0.84	0.28	11.3							

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35																
Frit-2-78-35																
Frit-3-78-35																
Frit-4-78-35																
Frit-5-78-35					0.098	0.168	0.033	0.034								
Frit-6-78-35																
Frit-5-78-30					0.180	0.280	0.162	0.087								
Frit-5-78-37					0.098	0.155	0.015	0.027								
Frit-5-78-40					0.078	0.146	0.015	0.021								
Frit-5-78a-35																
Frit-5-78b-35																
Frit-5-78c-35																
DZr-3a																
DZr-3c																
DZr-4a																
DZr-4c																
DZr-5a																
DZr-5c																
DZr-6a																

TWRS HLW Glass Formulation (Fu and Pegg 1998)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
HLWD2-05												
HLWD2-06												
HLWD2-07												
HLWD3-01												
HLWD3-02												
HLWD3-03						5.43	5.24	<0.006		0.04		
HLWD3-04						0.76	0.04	0.02		0.76		
HLWD3-05												
HLWD3-06						8.45	9.22	<0.006		0.07		
HLWD3-07												
HLWD3-08						2.19	2.62	2.32		1.02		
EnvDSR1						0.08	<0.003	<0.006		0.12		

INEEL DZr Process Demonstration (Musick et al. 2000)

Frit-1-78-35												
Frit-2-78-35												
Frit-3-78-35												
Frit-4-78-35												
Frit-5-78-35												
Frit-6-78-35												
Frit-5-78-30												
Frit-5-78-37												
Frit-5-78-40												
Frit-5-78a-35												
Frit-5-78b-35												
Frit-5-78c-35												
DZr-3a												
DZr-3c												
DZr-4a												
DZr-4c												
DZr-5a												
DZr-5c												
DZr-6a												

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
DZr-6c	0.0958	0.0584	0.1262	0.0539		0.0016	0.0573		0.1252	0.0003	0.0131	0.3724	0.0525								
DZr-7a	0.0933	0.0631	0.1229	0.0029		0.0015	0.0605		0.1095	0.0003	0.0127	0.3859	0.0511								
DZr-7c	0.0958	0.0648	0.1262	0.0030		0.0016	0.0621		0.1125	0.0003	0.0131	0.3963	0.0525								
DZr-8a	0.0933	0.0569	0.1229	0.0215		0.0015	0.0558		0.1219	0.0003	0.0127	0.3627	0.0511								
DZr-8c	0.0958	0.0584	0.1262	0.0221		0.0016	0.0573		0.1252	0.0003	0.0131	0.3724	0.0525								
DZr-9-78-38	0.0933	0.0724	0.1229	0.0029		0.0015	0.0620		0.1071	0.0003	0.0127	0.3707	0.0610								
DZr-9-78-40	0.0982	0.0707	0.1294	0.0031		0.0016	0.0600		0.1050	0.0003	0.0134	0.3590	0.0634								
DZr-10-78-38	0.0933	0.0724	0.1229	0.0277		0.0015	0.0620		0.1071	0.0003	0.0127	0.3707	0.0610								
DZr-10-78-40	0.0982	0.0707	0.1294	0.0271		0.0016	0.0600		0.1050	0.0003	0.0134	0.3590	0.0634								
GLA 78-21																					
GLA 78-22																					
GLA 78-23																					
GLA 78-9-11																					
GLA 78-9-15																					
GLA 78-9-18																					
GLA 78-10-14																					
GLA 78-10-15																					
GLA 78-10-16																					

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F	0.0772	0.1096	0.0000	0.0243		0.0015	0.0365	0.0012	0.0684	0.0003	0.0002	0.6235	0.0538								
P2-0Ca-1F	0.0694	0.0986	0.0000	0.0219		0.0013	0.0329	0.0011	0.1556	0.0003	0.0001	0.5612	0.0485								
P2-0Ca-2F	0.0691	0.0981	0.0000	0.0218		0.0013	0.0327	0.0011	0.1548	0.0003	0.0001	0.5581	0.0481								
P2-0Ca-3F	0.0688	0.0976	0.0000	0.0216		0.0013	0.0326	0.0011	0.1540	0.0003	0.0001	0.5552	0.0479								
P2-0Ca-4F	0.0684	0.0971	0.0000	0.0215		0.0013	0.0324	0.0011	0.1533	0.0003	0.0001	0.5526	0.0478								
P2-0Ca-5F	0.0679	0.0964	0.0000	0.0214		0.0013	0.0322	0.0011	0.1521	0.0003	0.0001	0.5485	0.0473								
P2-3Ca-0F	0.0749	0.1063	0.0300	0.0236		0.0014	0.0354	0.0012	0.0664	0.0003	0.0001	0.6048	0.0522								
P2-3Ca-1F	0.0676	0.0959	0.0270	0.0213		0.0013	0.0320	0.0011	0.1514	0.0003	0.0001	0.5458	0.0472								
P2-3Ca-2F	0.0672	0.0954	0.0269	0.0212		0.0013	0.0318	0.0011	0.1505	0.0003	0.0001	0.5428	0.0468								
P2-3Ca-3F	0.0667	0.0948	0.0268	0.0211		0.0013	0.0316	0.0011	0.1495	0.0003	0.0001	0.5392	0.0465								
P2-3Ca-4F	0.0664	0.0943	0.0266	0.0210		0.0013	0.0314	0.0011	0.1487	0.0003	0.0001	0.5363	0.0463								
P2-3Ca-5F	0.0660	0.0937	0.0264	0.0209		0.0013	0.0312	0.0010	0.1478	0.0003	0.0001	0.5330	0.0460								
P2-9Ca-0F	0.0645	0.0916	0.0943	0.0203		0.0012	0.0305	0.0010	0.1273	0.0002	0.0001	0.5211	0.0450								
P2-9Ca-1F	0.0630	0.0894	0.0920	0.0199		0.0012	0.0298	0.0010	0.1411	0.0002	0.0001	0.5087	0.0439								

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
DZr-6c	0.0003			0.0015				0.0255							0.0014					0.0002	
DZr-7a	0.0003			0.0014				0.0510					0.0279		0.0014					0.0002	
DZr-7c	0.0003			0.0015				0.0255					0.0287		0.0014					0.0002	
DZr-8a	0.0003			0.0014				0.0510					0.0310		0.0014					0.0002	
DZr-8c	0.0003			0.0015				0.0255					0.0318		0.0014					0.0002	
DZr-9-78-38	0.0003			0.0014				0.0510					0.0248		0.0014					0.0002	
DZr-9-78-40	0.0003			0.0015				0.0537					0.0240		0.0014					0.0002	
DZr-10-78-38	0.0003			0.0014				0.0510							0.0014					0.0002	
DZr-10-78-40	0.0003			0.0015				0.0537							0.0014					0.0002	
GLA 78-21																					
GLA 78-22																					
GLA 78-23																					
GLA 78-9-11																					
GLA 78-9-15																					
GLA 78-9-18																					
GLA 78-10-14																					
GLA 78-10-15																					
GLA 78-10-16																					

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F	0.0003			0.0010				0.0000											0.0001		
P2-0Ca-1F	0.0003			0.0009				0.0060											0.0001		
P2-0Ca-2F	0.0003			0.0009				0.0114											0.0001		
P2-0Ca-3F	0.0003			0.0009				0.0164											0.0001		
P2-0Ca-4F	0.0003			0.0009				0.0209											0.0001		
P2-0Ca-5F	0.0003			0.0009				0.0283											0.0001		
P2-3Ca-0F	0.0003			0.0010				0.0000											0.0001		
P2-3Ca-1F	0.0002			0.0009				0.0061											0.0001		
P2-3Ca-2F	0.0002			0.0009				0.0116											0.0001		
P2-3Ca-3F	0.0002			0.0009				0.0180											0.0001		
P2-3Ca-4F	0.0002			0.0009				0.0231											0.0001		
P2-3Ca-5F	0.0002			0.0009				0.0294											0.0001		
P2-9Ca-0F	0.0002			0.0009				0.0000											0.0001		
P2-9Ca-1F	0.0002			0.0008				0.0070											0.0001		

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
DZr-6c																0.0117	0.0027				
DZr-7a																0.0114	0.0026				
DZr-7c																0.0117	0.0027				
DZr-8a																0.0114	0.0026				
DZr-8c																0.0117	0.0027				
DZr-9-78-38																0.0114	0.0026				
DZr-9-78-40																0.0120	0.0027				
DZr-10-78-38																0.0114	0.0026				
DZr-10-78-40																0.0120	0.0027				
GLA 78-21																					
GLA 78-22																					
GLA 78-23																					
GLA 78-9-11																					
GLA 78-9-15																					
GLA 78-9-18																					
GLA 78-10-14																					
GLA 78-10-15																					
GLA 78-10-16																					

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F															0.0007	0.0003	0.0010				
P2-0Ca-1F															0.0006	0.0002	0.0009				
P2-0Ca-2F															0.0006	0.0002	0.0009				
P2-0Ca-3F															0.0006	0.0002	0.0009				
P2-0Ca-4F															0.0006	0.0002	0.0009				
P2-0Ca-5F															0.0006	0.0002	0.0009				
P2-3Ca-0F															0.0007	0.0003	0.0010				
P2-3Ca-1F															0.0006	0.0002	0.0009				
P2-3Ca-2F															0.0006	0.0002	0.0009				
P2-3Ca-3F															0.0006	0.0002	0.0009				
P2-3Ca-4F															0.0006	0.0002	0.0009				
P2-3Ca-5F															0.0006	0.0002	0.0008				
P2-9Ca-0F															0.0006	0.0002	0.0008				
P2-9Ca-1F															0.0006	0.0002	0.0008				

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
DZr-6c										1.0000											
DZr-7a										0.9999											
DZr-7c										1.0002											
DZr-8a										0.9999											
DZr-8c										1.0000											
DZr-9-78-38										1.0000											
DZr-9-78-40										1.0000											
DZr-10-78-38										1.0000											
DZr-10-78-40										1.0000											
GLA 78-21											0.0599	0.0539	0.1199	0.0233		0.0003	0.0633		0.1205	0.0002	0.0295
GLA 78-22											0.0444	0.0570	0.1236	0.0235		0.0003	0.0643		0.1267	0.0002	0.0273
GLA 78-23											0.0440	0.0559	0.1220	0.0237		0.0003	0.0627		0.1207	0.0001	0.0329
GLA 78-9-11											0.0824	0.0720	0.1149	0.0075		0.0011	0.0601		0.1122	0.0002	0.0312
GLA 78-9-15											0.0772	0.0991	0.1114	0.0033		0.0009	0.0569		0.1057	0.0003	0.0290
GLA 78-9-18											0.0661	0.0737	0.1269	0.0032		0.0000	0.0588		0.1077	0.0003	0.0315
GLA 78-10-14											0.1034	0.0808	0.0695	0.0170		0.0032	0.0597		0.1176	0.0001	0.0382
GLA 78-10-15											0.0931	0.0918	0.0688	0.0175		0.0029	0.0550		0.1208	0.0002	0.0362
GLA 78-10-16											0.0873	0.0849	0.0671	0.0174		0.0030	0.0600		0.1229	0.0002	0.0394

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F										1.0000											
P2-0Ca-1F										1.0000											
P2-0Ca-2F										1.0000											
P2-0Ca-3F										1.0000											
P2-0Ca-4F										1.0000											
P2-0Ca-5F										1.0000											
P2-3Ca-0F										1.0000											
P2-3Ca-1F										1.0000											
P2-3Ca-2F										1.0000											
P2-3Ca-3F										1.0000											
P2-3Ca-4F										1.0000											
P2-3Ca-5F										1.0000											
P2-9Ca-0F										1.0000											
P2-9Ca-1F										1.0000											

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
DZr-6c																					
DZr-7a																					
DZr-7c																					
DZr-8a																					
DZr-8c																					
DZr-9-78-38																					
DZr-9-78-40																					
DZr-10-78-38																					
DZr-10-78-40																					
GLA 78-21	0.4075	0.0587									0.0003			0.0012				0.0545			
GLA 78-22	0.4043	0.0632									0.0003			0.0015				0.0567			
GLA 78-23	0.4064	0.0597									0.0003			0.0014				0.0630			
GLA 78-9-11	0.3698	0.0565												0.0010				0.0600			
GLA 78-9-15	0.3627	0.0547												0.0010				0.0649			
GLA 78-9-18	0.3679	0.0570												0.0012				0.0724			
GLA 78-10-14	0.4047	0.0677									0.0003			0.0013				0.0292			
GLA 78-10-15	0.4110	0.0696									0.0004			0.0014				0.0248			
GLA 78-10-16	0.4119	0.0708									0.0003			0.0014				0.0265			

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F																					
P2-0Ca-1F																					
P2-0Ca-2F																					
P2-0Ca-3F																					
P2-0Ca-4F																					
P2-0Ca-5F																					
P2-3Ca-0F																					
P2-3Ca-1F																					
P2-3Ca-2F																					
P2-3Ca-3F																					
P2-3Ca-4F																					
P2-3Ca-5F																					
P2-9Ca-0F																					
P2-9Ca-1F																					

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
DZr-6c																					
DZr-7a																					
DZr-7c																					
DZr-8a																					
DZr-8c																					
DZr-9-78-38																					
DZr-9-78-40																					
DZr-10-78-38																					
DZr-10-78-40																					
GLA 78-21		0.0002		0.0007					0.0001												
GLA 78-22		0.0001		0.0005					0.0000												
GLA 78-23		0.0002		0.0005					0.0001												
GLA 78-9-11		0.0246		0.0009					0.0000												
GLA 78-9-15		0.0277		0.0007					0.0000												
GLA 78-9-18		0.0282		0.0004					0.0001												
GLA 78-10-14		0.0035		0.0010					0.0000												
GLA 78-10-15		0.0032		0.0009					0.0000												
GLA 78-10-16		0.0032		0.0010					0.0000												

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F																					
P2-0Ca-1F																					
P2-0Ca-2F																					
P2-0Ca-3F																					
P2-0Ca-4F																					
P2-0Ca-5F																					
P2-3Ca-0F																					
P2-3Ca-1F																					
P2-3Ca-2F																					
P2-3Ca-3F																					
P2-3Ca-4F																					
P2-3Ca-5F																					
P2-9Ca-0F																					
P2-9Ca-1F																					

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
DZr-6c																				
DZr-7a																				
DZr-7c																				
DZr-8a																				
DZr-8c																				
DZr-9-78-38																				
DZr-9-78-40																				
DZr-10-78-38																				
DZr-10-78-40																				
GLA 78-21					0.0037	0.0022														0.9999
GLA 78-22					0.0025	0.0032														0.9996
GLA 78-23					0.0025	0.0031														0.9995
GLA 78-9-11					0.0055															0.9999
GLA 78-9-15					0.0045															1.0000
GLA 78-9-18					0.0045															0.9999
GLA 78-10-14					0.0027															0.9999
GLA 78-10-15					0.0022															0.9998
GLA 78-10-16					0.0026															0.9999

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F																				
P2-0Ca-1F																				
P2-0Ca-2F																				
P2-0Ca-3F																				
P2-0Ca-4F																				
P2-0Ca-5F																				
P2-3Ca-0F																				
P2-3Ca-1F																				
P2-3Ca-2F																				
P2-3Ca-3F																				
P2-3Ca-4F																				
P2-3Ca-5F																				
P2-9Ca-0F																				
P2-9Ca-1F																				

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
DZr-6c					Homogeneous			yes
DZr-7a					Homogeneous			yes
DZr-7c					Homogeneous			yes
DZr-8a					Homogeneous			yes
DZr-8c					Homogeneous			yes
DZr-9-78-38			< 950		Homogeneous			yes
DZr-9-78-40					Homogeneous			yes
DZr-10-78-38			< 950		Homogeneous			yes
DZr-10-78-40					Homogeneous			yes
GLA 78-21					small (~1 mm) black particles	iron and nickel sulfides	<0.5% crystallinity	no
GLA 78-22						iron and nickel sulfides	<0.5% crystallinity	no
GLA 78-23					small (~1 mm) black particles and larger cuspidine crystals		<1 vol% cuspidine	no
GLA 78-9-11					multiple phases and a transparent green glass with streaks of white material throughout	a cluster of undissolved batch material along with dispersed particles (Zr and Cr2O3 rich) in a glass matrix	~1.3 vol% cuspidine and ~3.1 vol% CaF2	no
GLA 78-9-15					multiple phases and a transparent green glass with streaks of white material throughout	a cluster of undissolved batch material along with dispersed particles (Zr and Cr2O3 rich) in a glass matrix	~8.2 vol% cuspidine and ~1.6 vol% CaF2	no
GLA 78-9-18					multiple phases and a transparent green glass with streaks of white material throughout		~0.5 vol% crystallinity	no
GLA 78-10-14			~950					
GLA 78-10-15			~950					
GLA 78-10-16			~950					

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F								
P2-0Ca-1F								
P2-0Ca-2F								
P2-0Ca-3F								
P2-0Ca-4F								
P2-0Ca-5F								
P2-3Ca-0F								
P2-3Ca-1F								
P2-3Ca-2F								
P2-3Ca-3F								
P2-3Ca-4F								
P2-3Ca-5F								
P2-9Ca-0F								
P2-9Ca-1F								

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
DZr-6c			homogenous on top, crystallization on bottom, ~20% overall crystallization		
DZr-7a			~30% overall crystallization		
DZr-7c			some mottling, likely crystallization		
DZr-8a			fully crystallized, like a rock		
DZr-8c			homogenous on top, crystallization on bottom, ~30% overall crystallization		
DZr-9-78-38			~1 vol% (bulk) crystallinity		
DZr-9-78-40			20-40 vol% crystallinity		
DZr-10-78-38			<5 vol% (surface) crystallinity		
DZr-10-78-40			>50 vol% crystallinity		
GLA 78-21			~1-2 vol% dendritic crystals on all surfaces and spinel		
GLA 78-22			~5-10 vol% dendritic crystals on all surfaces and spinel		
GLA 78-23			~2 vol% dendritic crystals on all surfaces and spinel		
GLA 78-9-11			~1-2 vol% dendritic crystals with distorted edges		
GLA 78-9-15			~1-2 vol% dendritic crystals with distorted edges		
GLA 78-9-18			~25-50% dendritic crystals with distorted edges		
GLA 78-10-14			~1 vol% hematite and spinel		
GLA 78-10-15			~1 vol% hematite and spinel		
GLA 78-10-16			~1 vol% hematite and spinel		

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F					
P2-0Ca-1F					
P2-0Ca-2F					
P2-0Ca-3F					
P2-0Ca-4F					
P2-0Ca-5F					
P2-3Ca-0F					
P2-3Ca-1F					
P2-3Ca-2F					
P2-3Ca-3F					
P2-3Ca-4F					
P2-3Ca-5F					
P2-9Ca-0F					
P2-9Ca-1F					

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
DZr-6c															
DZr-7a															
DZr-7c															
DZr-8a															
DZr-8c															
DZr-9-78-38															
DZr-9-78-40															
DZr-10-78-38															
DZr-10-78-40															
GLA 78-21															
GLA 78-22															
GLA 78-23															
GLA 78-9-11															
GLA 78-9-15															
GLA 78-9-18															
GLA 78-10-14															
GLA 78-10-15															
GLA 78-10-16															

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F									14.90						
P2-0Ca-1F									11.30						
P2-0Ca-2F															
P2-0Ca-3F															
P2-0Ca-4F															
P2-0Ca-5F															
P2-3Ca-0F									11.10						
P2-3Ca-1F									9.70						
P2-3Ca-2F															
P2-3Ca-3F															
P2-3Ca-4F															
P2-3Ca-5F															
P2-9Ca-0F									5.99						
P2-9Ca-1F									5.10						

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
DZr-6c																					
DZr-7a																					
DZr-7c																					
DZr-8a																					
DZr-8c																					
DZr-9-78-38																					
DZr-9-78-40																					
DZr-10-78-38																					
DZr-10-78-40																					
GLA 78-21																					
GLA 78-22																					
GLA 78-23																					
GLA 78-9-11																					
GLA 78-9-15																					
GLA 78-9-18																					
GLA 78-10-14																					
GLA 78-10-15																					
GLA 78-10-16																					

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F																					
P2-0Ca-1F																					
P2-0Ca-2F																					
P2-0Ca-3F																					
P2-0Ca-4F																					
P2-0Ca-5F																					
P2-3Ca-0F																					
P2-3Ca-1F																					
P2-3Ca-2F																					
P2-3Ca-3F																					
P2-3Ca-4F																					
P2-3Ca-5F																					
P2-9Ca-0F																					
P2-9Ca-1F																					

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
DZr-6c																
DZr-7a																
DZr-7c																
DZr-8a																
DZr-8c																
DZr-9-78-38					0.199		0.418	0.065								
DZr-9-78-40					0.19		0.32	0.061								
DZr-10-78-38					0.208		0.339	0.065								
DZr-10-78-40					0.169		0.295	0.058								
GLA 78-21					0.228	0.348	0.395	0.091	11.20							
GLA 78-22					0.180	0.304	0.330	0.077	11.15							
GLA 78-23					0.169	0.293	0.336	0.089	11.11							
GLA 78-9-11					0.188	0.281	0.302	0.076	10.93							
GLA 78-9-15					0.173	0.304	0.349	0.100	10.79							
GLA 78-9-18					0.222	0.284	0.338	0.079	10.90							
GLA 78-10-14					0.260	0.369	0.326	0.113	10.86							
GLA 78-10-15					0.231	0.403	0.326	0.112	10.93							
GLA 78-10-16					0.230	0.310	0.250	0.113	10.92							

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F					0.15	0.345	(0.02)	0.135	9.17							
P2-0Ca-1F					0.22	0.205	0.27	0.13	10.12							
P2-0Ca-2F					0.245	0.205	0.28	0.125	10.08							
P2-0Ca-3F					0.255	0.2	0.28	0.12	10.04							
P2-0Ca-4F					0.285	0.215	0.3	0.115	9.95							
P2-0Ca-5F					0.29	0.22	0.305	0.115	9.83							
P2-3Ca-0F					0.11	0.275	(0.03)	0.08	9.42							
P2-3Ca-1F					0.22	0.22	0.29	0.11	10.4							
P2-3Ca-2F					0.23	0.2	0.285	0.115	10.3							
P2-3Ca-3F					0.225	0.195	0.27	0.11	10.08							
P2-3Ca-4F					0.24	0.195	0.27	0.11	10.1							
P2-3Ca-5F					0.27	0.2	0.28	0.11	10.07							
P2-9Ca-0F					0.105	0.21	0.12	0.05	10.01							
P2-9Ca-1F					0.225	0.325	0.38	0.105	10.9							

INEEL DZr Process Demonstration (Musick et al. 2000)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
DZr-6c												
DZr-7a												
DZr-7c												
DZr-8a												
DZr-8c												
DZr-9-78-38												
DZr-9-78-40												
DZr-10-78-38												
DZr-10-78-40												
GLA 78-21												
GLA 78-22												
GLA 78-23												
GLA 78-9-11												
GLA 78-9-15												
GLA 78-9-18												
GLA 78-10-14												
GLA 78-10-15												
GLA 78-10-16												

INEEL CVS 2a (Peeler et al. 1999)

P2-0Ca-0F												
P2-0Ca-1F												
P2-0Ca-2F												
P2-0Ca-3F												
P2-0Ca-4F												
P2-0Ca-5F												
P2-3Ca-0F												
P2-3Ca-1F												
P2-3Ca-2F												
P2-3Ca-3F												
P2-3Ca-4F												
P2-3Ca-5F												
P2-9Ca-0F												
P2-9Ca-1F												

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
P2-9Ca-2F	0.0624	0.0886	0.0913	0.0197		0.0012	0.0295	0.0010	0.1398	0.0002	0.0001	0.5043	0.0435								
P2-9Ca-3F	0.0620	0.0880	0.0906	0.0195		0.0012	0.0294	0.0010	0.1388	0.0002	0.0001	0.5007	0.0432								
P2-9Ca-4F	0.0616	0.0875	0.0901	0.0195		0.0012	0.0292	0.0010	0.1380	0.0002	0.0001	0.4977	0.0430								
P2-9Ca-5F	0.0616	0.0875	0.0900	0.0194		0.0012	0.0291	0.0010	0.1380	0.0002	0.0001	0.4975	0.0430								

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe	0.0177	0.0684	0.0113	0.1454			0.0476	0.0074	0.1154	0.0183		0.4991	0.0091								
SRL 165 TDS	0.0418	0.0692	0.0153	0.1202			0.0479	0.0081	0.1049	0.0000		0.5509	0.0122								
SRL 165 HiAl	0.0928	0.0739	0.0114	0.0635			0.0514	0.0080	0.1176	0.0068		0.5429	0.0101								

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01	0.1071	0.1062	0.0097	0.1169		0.0043	0.0195	0.0097	0.1305	0.0043	0.0085	0.3213	0.0604	0.0019	0.0005	0.0043	0.0004		0.0063		0.0049
HLW98-02	0.1106	0.1096	0.0101	0.1207		0.0044	0.0201	0.0101	0.1347	0.0044	0.0087	0.3318	0.0302	0.0020	0.0005	0.0045	0.0004		0.0065		0.0051
HLW98-03	0.1179	0.1000	0.0142	0.0943		0.0024	0.0300	0.0094	0.1179	0.0024	0.0094	0.3943	0.0377	0.0009	0.0005	0.0024	0.0005		0.0024		0.0024
HLW98-04	0.1179	0.1300	0.0142	0.0943		0.0024	0.0000	0.0094	0.1179	0.0024	0.0094	0.3943	0.0377	0.0009	0.0005	0.0024	0.0005		0.0024		0.0024
HLW98-05	0.1146	0.1300	0.0137	0.1217		0.0023		0.0092	0.1146	0.0023	0.0092	0.4117		0.0009	0.0005	0.0023	0.0005		0.0046		0.0023
HLW98-06	0.0851	0.1000	0.0043	0.1276		0.0043	0.0300	0.0085	0.1106	0.0043	0.0064	0.4276	0.0213	0.0009	0.0009	0.0043	0.0004		0.0034		0.0013
HLW98-07	0.0882	0.1000	0.0044	0.1323		0.0044	0.0100	0.0088	0.1146	0.0044	0.0066	0.4323	0.0220	0.0009	0.0009	0.0044	0.0004		0.0035		0.0013
HLW98-08	0.0743	0.1200	0.0153	0.1226		0.0044	0.0300	0.0087	0.0918	0.0044	0.0066	0.4093	0.0219	0.0009	0.0009	0.0044	0.0004		0.0035		0.0013
HLW98-09	0.0797	0.1200	0.0040	0.1196		0.0040	0.0300	0.0080	0.0837	0.0040	0.0060	0.4496	0.0199	0.0008	0.0008	0.0040	0.0004		0.0032		0.0012
HLW98-10	0.0701	0.1200	0.0144	0.1157		0.0041	0.0300	0.0084	0.0867	0.0041	0.0062	0.4332	0.0206	0.0008	0.0008	0.0041	0.0004		0.0033		0.0012
HLW98-11	0.0729	0.1200	0.0150	0.1202		0.0043	0.0300	0.0086	0.0901	0.0043	0.0064	0.4173	0.0215	0.0009	0.0009	0.0043	0.0004		0.0034		0.0013
HLW98-12	0.0749	0.1500	0.0027	0.1267		0.0030	0.0700	0.0009	0.0293	0.0046	0.0059	0.4099	0.0388	0.0008	0.0006	0.0006			0.0053		0.0012
HLW98-13	0.0666	0.1500	0.0024	0.1126		0.0026	0.0300	0.0008	0.1060	0.0041	0.0053	0.4088	0.0344	0.0007	0.0005	0.0005			0.0047		0.0011
HLW98-14	0.0870	0.1200	0.0190	0.0876		0.0019	0.0300	0.0114	0.1404	0.0016	0.0065	0.4169	0.0031	0.0011		0.0059	0.0006		0.0004		
HLW98-15	0.0870	0.1500	0.0190	0.0876		0.0019	0.0000	0.0114	0.1404	0.0016	0.0065	0.4169	0.0031	0.0011		0.0059	0.0006		0.0004		
HLW98-16	0.0720	0.1200	0.0148	0.1187		0.0043	0.0171	0.0085	0.0890	0.0043	0.0064	0.4356	0.0212		0.0009	0.0043	0.0004		0.0034		0.0013
HLW98-17	0.0703	0.1200	0.0145	0.1154		0.0042	0.0300	0.0083	0.0867	0.0042	0.0062	0.4323	0.0207		0.0009	0.0042	0.0004		0.0033		0.0013
HLW98-18	0.0772	0.0500	0.0028	0.1296		0.0031	0.0700	0.0009	0.0302	0.0048	0.0061	0.5102	0.0400		0.0006	0.0006			0.0054		0.0012
HLW98-19	0.0915	0.1200	0.0200	0.0921		0.0020	0.0000	0.0120	0.1477	0.0017	0.0068	0.4256	0.0033	0.0012		0.0062	0.0006		0.0004		

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
P2-9Ca-2F	0.0002			0.0008				0.0157											0.0001		
P2-9Ca-3F	0.0002			0.0008				0.0225											0.0001		
P2-9Ca-4F	0.0002			0.0008				0.0282											0.0001		
P2-9Ca-5F	0.0002			0.0008				0.0286											0.0001		

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe														0.0602							
SRL 165 TDS														0.0295							
SRL 165 HiAl														0.0217							

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01	0.0011	0.0013		0.0029	0.0014	0.0010		0.0010					0.0017	0.0097						0.0022	
HLW98-02	0.0011	0.0013		0.0030	0.0014	0.0010		0.0010					0.0017	0.0101						0.0023	
HLW98-03	0.0024	0.0009		0.0014	0.0024	0.0000		0.0005					0.0047	0.0047					0.0047	0.0024	
HLW98-04	0.0024	0.0009		0.0014	0.0024			0.0005					0.0047	0.0047					0.0047	0.0024	
HLW98-05	0.0023	0.0009		0.0014	0.0023			0.0005					0.0046	0.0046					0.0046	0.0023	
HLW98-06	0.0009			0.0017	0.0017	0.0009		0.0009					0.0009	0.0043						0.0043	
HLW98-07	0.0009			0.0018	0.0018	0.0009		0.0009					0.0009	0.0044						0.0044	
HLW98-08	0.0009			0.0017	0.0063	0.0009		0.0009					0.0009	0.0044					0.0044	0.0026	
HLW98-09	0.0008			0.0016	0.0032	0.0008		0.0008					0.0008	0.0040					0.0040	0.0024	
HLW98-10	0.0008			0.0017	0.0059	0.0008		0.0008					0.0008	0.0041					0.0041	0.0025	
HLW98-11	0.0009			0.0017	0.0062	0.0009		0.0009					0.0009	0.0043					0.0043	0.0026	
HLW98-12	0.0001			0.0009	0.0048	0.0004		0.0005					0.0037	0.0039						0.0005	
HLW98-13	0.0001			0.0008	0.0042	0.0004		0.0005					0.0032	0.0035						0.0004	
HLW98-14	0.0007			0.0018	0.0078								0.0004	0.0042						0.0027	
HLW98-15	0.0007			0.0018	0.0078								0.0004	0.0042						0.0027	
HLW98-16	0.0009			0.0017	0.0061	0.0009		0.0009					0.0009	0.0043					0.0043	0.0026	
HLW98-17	0.0009			0.0017	0.0060	0.0009		0.0009					0.0009	0.0042					0.0042	0.0025	
HLW98-18	0.0001			0.0010	0.0044	0.0004		0.0006					0.0038	0.0040						0.0005	
HLW98-19	0.0007			0.0019	0.0082								0.0004	0.0044						0.0028	

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
P2-9Ca-2F															0.0006	0.0002	0.0008				
P2-9Ca-3F															0.0006	0.0002	0.0008				
P2-9Ca-4F															0.0006	0.0002	0.0008				
P2-9Ca-5F															0.0006	0.0002	0.0008				

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe																					
SRL 165 TDS																					
SRL 165 HiAl																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01											0.0019	0.0019				0.0043	0.0263		0.0013		0.0013
HLW98-02											0.0020	0.0020				0.0044	0.0271		0.0013		0.0013
HLW98-03											0.0005	0.0005				0.0024	0.0118		0.0005		0.0005
HLW98-04											0.0005	0.0005				0.0024	0.0118		0.0005		0.0005
HLW98-05											0.0005	0.0005				0.0023	0.0115		0.0005		0.0005
HLW98-06											0.0043	0.0026				0.0021	0.0085		0.0013		0.0013
HLW98-07											0.0044	0.0026				0.0022	0.0088		0.0013		0.0013
HLW98-08											0.0022	0.0026				0.0022	0.0229		0.0014		0.0013
HLW98-09											0.0020	0.0024				0.0020	0.0104		0.0012		0.0012
HLW98-10											0.0021	0.0025				0.0021	0.0216		0.0012		0.0012
HLW98-11											0.0021	0.0026				0.0021	0.0225		0.0013		0.0013
HLW98-12											0.0030	0.0021				0.0038	0.0175		0.0020		0.0009
HLW98-13											0.0027	0.0019				0.0033	0.0156		0.0018		0.0008
HLW98-14																0.0013	0.0275				
HLW98-15																0.0013	0.0275				
HLW98-16											0.0021	0.0025				0.0021	0.0222		0.0013		0.0013
HLW98-17											0.0021	0.0025				0.0021	0.0217		0.0013		0.0013
HLW98-18											0.0031	0.0022				0.0039	0.0143		0.0021		0.0009
HLW98-19																0.0014	0.0290				

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
P2-9Ca-2F										1.0000											
P2-9Ca-3F										1.0000											
P2-9Ca-4F										1.0000											
P2-9Ca-5F										1.0000											

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe										0.9999											
SRL 165 TDS										1.0000											
SRL 165 HiAl										1.0001											

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01	0.0044							0.0195		0.9999											
HLW98-02	0.0045							0.0201		1.0000											
HLW98-03	0.0005				0.0005			0.0200		1.0003	0.1085	0.1025	0.0183	0.0897		0.0032	0.0289	0.0089	0.1124	0.0022	0.0108
HLW98-04	0.0005				0.0005			0.0200		1.0003	0.1070	0.1269	0.0151	0.0878		0.0032	0.0003	0.0084	0.1052	0.0020	0.0105
HLW98-05	0.0005				0.0005	0.0000		0.0200		1.0007	0.1048	0.1309	0.0148	0.1108		0.0030	0.0004	0.0082	0.1061	0.0019	0.0105
HLW98-06	0.0021				0.0009	0.0009		0.0200		1.0008	0.0819	0.0988	0.0051	0.1171		0.0052	0.0286	0.0081	0.0953	0.0040	0.0073
HLW98-07	0.0022				0.0009	0.0009		0.0200		1.0000	0.0844	0.1003	0.0056	0.1248		0.0050	0.0111	0.0084	0.1081	0.0041	0.0077
HLW98-08	0.0022				0.0009	0.0009		0.0200		1.0003	0.0723	0.1264	0.0163	0.1168		0.0057	0.0302	0.0083	0.0810	0.0041	0.0075
HLW98-09	0.0020				0.0008	0.0008		0.0200		1.0001	0.0839	0.1220	0.0058	0.1143		0.0053	0.0268	0.0084	0.0762	0.0038	0.0070
HLW98-10	0.0021				0.0008	0.0008		0.0200		1.0000	0.0715	0.1049	0.0135	0.1110		0.0039	0.0243	0.0073	0.0682	0.0051	0.0081
HLW98-11	0.0021				0.0009	0.0009		0.0200		1.0003	0.0665	0.1258	0.0170	0.1061		0.0050	0.0308	0.0090	0.0848	0.0042	0.0069
HLW98-12	0.0060			0.0050				0.0200		1.0003	0.0749	0.1466	0.0037	0.1194		0.0042	0.0615	0.0012	0.0290	0.0046	0.0095
HLW98-13	0.0053			0.0044				0.0200		1.0000											
HLW98-14								0.0200		0.9998	0.0835	0.1260	0.0196	0.0853		0.0031	0.0280	0.0118	0.1274	0.0018	0.0104
HLW98-15								0.0200		0.9998	0.0800	0.1579	0.0199	0.0850		0.0029	0.0007	0.0115	0.1237	0.0016	0.0088
HLW98-16	0.0021			0.0000	0.0009	0.0009		0.0200		1.0002	0.0749	0.1141	0.0151	0.1072		0.0034	0.0164	0.0106	0.0986	0.0042	0.0055
HLW98-17	0.0021				0.0009	0.0009		0.0200		1.0000	0.0660	0.1238	0.0134	0.1065		0.0031	0.0294	0.0092	0.0893	0.0038	0.0049
HLW98-18	0.0062							0.0200		1.0002											
HLW98-19								0.0200		0.9999	0.0835	0.1200	0.0200	0.0821		0.0027	0.0006	0.0111	0.1205	0.0016	0.0079

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
P2-9Ca-2F																					
P2-9Ca-3F																					
P2-9Ca-4F																					
P2-9Ca-5F																					

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe																					
SRL 165 TDS																					
SRL 165 HiAl																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01																					
HLW98-02																					
HLW98-03	0.3883	0.0324	0.0010	0.0003	0.0028	0.0006		0.0024				0.0011		0.0012		0.0001					
HLW98-04	0.3764	0.0193	0.0009	0.0004	0.0026	0.0007		0.0023				0.0010		0.0011							
HLW98-05	0.4102	0.0002	0.0009	0.0005	0.0025	0.0006		0.0045				0.0010		0.0009		0.0001					
HLW98-06	0.4224	0.0186	0.0033	0.0008	0.0048	0.0006		0.0033				0.0001		0.0015		0.0009					
HLW98-07	0.4253	0.0184	0.0033		0.0049			0.0035				0.0002		0.0015							
HLW98-08	0.4085	0.0205	0.0007	0.0007	0.0051	0.0005		0.0034				0.0001		0.0015		0.0008					
HLW98-09	0.4336	0.0199	0.0008	0.0005	0.0085	0.0004		0.0029				0.0002		0.0015		0.0007					
HLW98-10	0.3799	0.0162	0.0018	0.0004	0.0405	0.0005		0.0028				0.0001		0.0012		0.0011					
HLW98-11	0.4215	0.0207	0.0006	0.0005	0.0030	0.0006		0.0033				0.0001		0.0015		0.0010					
HLW98-12	0.4074	0.0359	0.0007	0.0006	0.0010	0.0003		0.0050				0.0002		0.0008		0.0003					
HLW98-13																					
HLW98-14	0.4214	0.0044	0.0010		0.0071	0.0010		0.0005				0.0002		0.0016		0.0001					
HLW98-15	0.4107	0.0041	0.0010	0.0001	0.0068	0.0008		0.0004				0.0002		0.0014							
HLW98-16	0.4265	0.0121	0.0001	0.0007	0.0047	0.0008		0.0032				0.0002		0.0014		0.0009					
HLW98-17	0.4226	0.0109		0.0007	0.0042	0.0006		0.0030				0.0002		0.0013		0.0008					
HLW98-18																					
HLW98-19	0.3933	0.0032	0.0011		0.0070	0.0007		0.0004				0.0002		0.0016							

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
P2-9Ca-2F																					
P2-9Ca-3F																					
P2-9Ca-4F																					
P2-9Ca-5F																					

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe																					
SRL 165 TDS																					
SRL 165 HiAl																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01																					
HLW98-02																					
HLW98-03			0.0047						0.0026												0.0007
HLW98-04			0.0045						0.0024												0.0008
HLW98-05			0.0045						0.0025												0.0008
HLW98-06			0.0047						0.0050												0.0038
HLW98-07			0.0049						0.0053												
HLW98-08			0.0047						0.0028												0.0021
HLW98-09			0.0046						0.0026												0.0013
HLW98-10			0.0479						0.0026												0.0013
HLW98-11			0.0028						0.0029												0.0013
HLW98-12			0.0042						0.0007												0.0031
HLW98-13																					
HLW98-14			0.0049						0.0029												0.0004
HLW98-15			0.0048						0.0030												0.0030
HLW98-16			0.0051						0.0028												0.0022
HLW98-17			0.0044						0.0025												0.0021
HLW98-18																					
HLW98-19			0.0049						0.0030												0.0002

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
P2-9Ca-2F																				
P2-9Ca-3F																				
P2-9Ca-4F																				
P2-9Ca-5F																				

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe																				
SRL 165 TDS																				
SRL 165 HiAl																				

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01																				
HLW98-02																				
HLW98-03	0.0003					0.0113		0.0006		0.0008	0.0007		0.0005		0.0007	0.0018		0.0200		0.9603
HLW98-04	0.0002					0.0115		0.0006		0.0008	0.0006		0.0005		0.0007	0.0017		0.0191		0.9145
HLW98-05	0.0001					0.0155		0.0006		0.0007	0.0004			0.0005	0.0006	0.0017		0.0196		0.9603
HLW98-06	0.0012					0.0091		0.0011		0.0018	0.0012			0.0002	0.0009	0.0010		0.0195		0.9572
HLW98-07						0.0095				0.0017				0.0003				0.0197		0.9580
HLW98-08	0.0014					0.0224		0.0011		0.0020	0.0013			0.0006	0.0010	0.0016		0.0207		0.9721
HLW98-09	0.0007					0.0115		0.0007		0.0021	0.0006			0.0005	0.0001	0.0015		0.0194		0.9681
HLW98-10	0.0001					0.0432		0.0011		0.0017	0.0004			0.0007	0.0009	0.0007		0.0172		0.9801
HLW98-11	0.0009					0.0204		0.0012		0.0018	0.0005			0.0005	0.0010	0.0006		0.0204		0.9632
HLW98-12	0.0010					0.0153		0.0017		0.0018	0.0045			0.0010	0.0001	0.0014		0.0178		0.9594
HLW98-13																				
HLW98-14	0.0005					0.0261		0.0006		0.0006	0.0001		0.0010		0.0002	0.0021		0.0178		0.9914
HLW98-15	0.0004					0.0258		0.0001		0.0005	0.0001		0.0010		0.0002	0.0020		0.0177		0.9761
HLW98-16	0.0011					0.0182		0.0010		0.0024	0.0004			0.0009	0.0009	0.0027		0.0177		0.9560
HLW98-17	0.0014					0.0165		0.0010		0.0020	0.0008				0.0008	0.0024		0.0197		0.9473
HLW98-18																				
HLW98-19						0.0257		0.0002		0.0003	0.0001		0.0007		0.0001	0.0002		0.0190		0.9119

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
P2-9Ca-2F								
P2-9Ca-3F								
P2-9Ca-4F								
P2-9Ca-5F								

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe								
SRL 165 TDS								
SRL 165 HiAl								

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01	1150		> 1050°C		Homogeneous glass with a few undissolved inclusions			
HLW98-02	1150		> 1050°C		Homogeneous glass			
HLW98-03	1150		< 1050°C		Homogeneous glass with some undissolved solids at bottom of crucible			
HLW98-04	1150		> 1050°C		Dark brown homogeneous glass			
HLW98-05	1150		> 1050°C		Homogeneous brown glass			
HLW98-06	1150		< 1050°C		Mostly homogeneous glass with some multicolor swirls			
HLW98-07	1150		> 1050°C		Dark brown glass with light brown swirls			
HLW98-08	1150		< 1050°C		Inhomogeneous glass with brown swirls. Undissolved secondary phase			
HLW98-09	1150		< 1050°C		Dull looking brown glass			
HLW98-10	1150	About 950°C			Homogeneous dark brown glass			
HLW98-11	1150	About 950°C			Homogeneous dark brown glass			
HLW98-12	1150		< 950°C		Inhomogeneous glass shows iridescent swirls			
HLW98-13	1150				Inhomogeneous glass with greenish brown crystallization			
HLW98-14	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-15	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-16	1150		< 95°C		Homogeneous dark brown glass			
HLW98-17	1150		< 950 °C		Homogeneous brown glass			
HLW98-18	1150		> 950°C		Homogeneous brown glass			
HLW98-19	1150		< 950 °C		Homogeneous dark brown glass			

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
P2-9Ca-2F					
P2-9Ca-3F					
P2-9Ca-4F					
P2-9Ca-5F					

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe					
SRL 165 TDS					
SRL 165 HiAl					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01					After 20 hours at 1050°C, 2-4 vol% of magnetic spinel and 5-15 vol% of white crystals in clusters
HLW98-02					After 20 hours at 1050 °C, about 1 vol% of magnetic spinel
HLW98-03					After 20 hours, < 0.1 vol% of spinel
HLW98-04					After 20 hours, 1 vol% of spinel and 1 vol% of yellowish green crystals at bottom
HLW98-05					After 20 hours, 2-3 vol% of spinel, accumulation of 10-20 mm clusters at bottom
HLW98-06					After 20 hours, < 0.1 vol% of spinel
HLW98-07					After 20 hours, 1-3 vol% of uniformly distributed spinel
HLW98-08					After 20 hours, trace amount of spinel at crucible/glass interface
HLW98-09					After 20 hours, < 1 vol% spinel distributed throughout the glass
HLW98-10					After 28 hours at 950°C, 0.5-1 vol% of magnetic spinel (1-100 mm diameter)
HLW98-11					After 28 hours at 950°C, about 1 vol% of magnetic spinel (1-10 mm diameter)
HLW98-12					After 63 hours, 0.1-0.5 vol% of spinel, which is high in Fe, low in Al, Cr, Mn, Ni, Zn with no Mg
HLW98-13					
HLW98-14					After 63 hours, no crystallization observed
HLW98-15					After 63 hours, clear glass shows no crystallization
HLW98-16					After 28 hours at 950°C, 0.1-0.5 vol% of spinel
HLW98-17					After 28 hours, 0.1 vol% of magnetic spinel
HLW98-18					After 110 hours, about 1.2 vol% of zircon and 2.8 vol% of spinel. (high in Fe, low in Al, Ni, Cr, Mn and Zn)
HLW98-19					After 110 hours, clear glass shows no secondary phases

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
P2-9Ca-2F															
P2-9Ca-3F															
P2-9Ca-4F															
P2-9Ca-5F															

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe		2.801											1100	4.6	
SRL 165 TDS		2.662											1100	7.7	
SRL 165 HiAl		2.622											1100	6.7	

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01															
HLW98-02															
HLW98-03							-12.081	20002.5	7.21				1000	37.953	1050
HLW98-04															
HLW98-05															
HLW98-06							-11.363	18962.8	7.12				1000	34.228	1050
HLW98-07							-13.517	23522.8	20.36				1000	142.84	1050
HLW98-08							-11.691	18832.3	4.68				1000	22.38	1050
HLW98-09															
HLW98-10															
HLW98-11															
HLW98-12							-11.723	18293.2	3.10				1000	14.45	1050
HLW98-13															
HLW98-14							-10.742	16937.1	3.19				1000	13.128	1050
HLW98-15							-12.045	20178.3	8.46				1000	46.06	1050
HLW98-16															
HLW98-17															
HLW98-18															
HLW98-19															

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
P2-9Ca-2F																					
P2-9Ca-3F																					
P2-9Ca-4F																					
P2-9Ca-5F																					

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe																					
SRL 165 TDS																					
SRL 165 HiAl																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01																					
HLW98-02																					
HLW98-03	20.793	1100	11.967	1150	7.194	1200	4.495														
HLW98-04																					
HLW98-05																					
HLW98-06	19.493	1100	11.566	1150	7.119	1200	4.529														
HLW98-07	71.05	1100	37.18	1150	20.37	1200	11.62														
HLW98-08	12.686	1100	7.539	1150	4.671	1200	3.003														
HLW98-09																					
HLW98-10																					
HLW98-11																					
HLW98-12	8.072	1100	4.839	1150	3.075	1200	2.053														
HLW98-13																					
HLW98-14	7.782	1100	4.86	1150	3.175	1200	2.156														
HLW98-15	24.311	1100	13.833	1150	8.38	1200	5.352														
HLW98-16																					
HLW98-17																					
HLW98-18																					
HLW98-19																					

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
P2-9Ca-2F					0.26	0.29	0.36	0.105	10.81							
P2-9Ca-3F					0.285	0.325	0.405	0.12	10.83							
P2-9Ca-4F					0.3	0.32	0.39	0.115	10.8							
P2-9Ca-5F					0.28	0.29	0.37	0.1	10.71							

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe																
SRL 165 TDS																
SRL 165 HiAl																

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01																
HLW98-02					0.33	0.335	0.37	0.115	9.85							
HLW98-03																
HLW98-04					0.215		0.235	0.085	9.22							
HLW98-05																
HLW98-06																
HLW98-07																
HLW98-08																
HLW98-09																
HLW98-10																
HLW98-11																
HLW98-12					0.28	0.31	0.15	0.135	9.51							
HLW98-13																
HLW98-14																
HLW98-15																
HLW98-16																
HLW98-17																
HLW98-18																
HLW98-19																

INEEL CVS 2a (Peeler et al. 1999)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
P2-9Ca-2F												
P2-9Ca-3F												
P2-9Ca-4F												
P2-9Ca-5F												

SRL 165 Glasses (Pye 1985)

SRL 165 HiFe												
SRL 165 TDS												
SRL 165 HiAl												

RPP-WTP HLW Formulation (Kot and Pegg 2001)

HLW98-01				0.071	0.05	0.285	0.318	0.025	0.136	0.121	0.0532	0.894
HLW98-02				0.098	0.07	0.317	0.365	0.023	0.17	0.137	0.0532	1.02
HLW98-03				0.015	0.05	0.091	0.064	0.014	0.052	0.089	0.0532	0.488
HLW98-04				0.013	0.05	0.097	0.067	0.019	0.05	0.087	0.0532	0.505
HLW98-05				0.015	0.05	0.082	0.116	0.012	0.04	0.09	0.0532	0.45
HLW98-06				0.014	0.05	0.112	0.072	0.01	0.07	0.08	0.0532	0.44
HLW98-07				0.017	0.05	0.098	0.06	<0.006	0.04	0.08	0.0532	0.35
HLW98-08				0.03	0.05	0.13	0.08	0.01	0.08	0.07	0.0532	0.46
HLW98-09				0.02	0.05	0.22	0.07	<0.01	0.06	0.06	0.0532	0.42
HLW98-10												
HLW98-11												
HLW98-12				0.02	0.05	0.03	0.11	0.01	0.06	<0.03	0.0532	0.401
HLW98-13				0.033	0.012	0.053	0.179	0.01	0.111	0.261	0.038	0.77
HLW98-14				0.037	0.075	0.303	0.05	0.02	0.05	0.11	0.0532	0.79
HLW98-15				0.029	0.08	0.224	0.03	0.01	0.03	0.1	0.0532	0.54
HLW98-16												
HLW98-17												
HLW98-18				0.002	0.017	0.026	0.076	0.011	0.031	<0.03	0.0532	0.007
HLW98-19				0.023	0.05	0.228	0.01	0.01	0.015	0.08	0.0532	0.529

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
HLW98-20	0.0891	0.1200	0.0195	0.0978		0.0020	0.0150	0.0117	0.1438	0.0016	0.0066	0.4360	0.0032	0.0000		0.0061	0.0006		0.0004		
HLW98-21	0.0677	0.0700	0.0024	0.1136		0.0027	0.0600	0.0008	0.0664	0.0042	0.0053	0.5089	0.0350		0.0005	0.0005			0.0048		0.0011
HLW98-22	0.0535	0.1200	0.0117	0.1462		0.0012	0.0300	0.0070	0.0863	0.0010	0.0040	0.4026	0.0019			0.0036	0.0004		0.0002		
HLW98-23	0.0485	0.1200	0.0106	0.1324		0.0011	0.0300	0.0064	0.0782	0.0009	0.0036	0.4429	0.0017			0.0033	0.0003		0.0002		
HLW98-24	0.0677	0.1100	0.0024	0.1136		0.0027	0.0600	0.0008	0.0664	0.0042	0.0053	0.4689	0.0350		0.0005	0.0005			0.0048		0.0011
HLW98-25	0.0664	0.1000	0.0024	0.1114		0.0026	0.0600	0.0008	0.0659	0.0041	0.0052	0.4688	0.0343	0.0007	0.0005	0.0005			0.0047		0.0011
HLW98-26	0.0781	0.0700	0.0026	0.1305		0.0018	0.0650	0.0007	0.0611	0.0057	0.0013	0.4626	0.0279		0.0004	0.0004			0.0039		0.0009
HLW98-27B	0.0781	0.0400	0.0026	0.1305		0.0018	0.0450	0.0007	0.1435	0.0057	0.0013	0.4302	0.0279		0.0004	0.0004			0.0039		0.0009
HLW98-28	0.0781	0.0200	0.0026	0.1305		0.0018	0.0400	0.0007	0.1435	0.0057	0.0013	0.4552	0.0279	0.0000	0.0004	0.0004			0.0039		0.0009
HLW98-29	0.0781	0.1289	0.0026	0.1305		0.0018	0.0400	0.0007	0.0796	0.0057	0.0013	0.4102	0.0279	0.0000	0.0004	0.0004			0.0039		0.0009
HLW98-30	0.0781	0.1000	0.0026	0.1097		0.0018	0.0600	0.0007	0.0661	0.0057	0.0013	0.4534	0.0279	0.0000	0.0004	0.0004			0.0039		0.0009
HLW98-31	0.0740	0.1000	0.0025	0.1039		0.0017	0.0600	0.0006	0.0659	0.0054	0.0013	0.4553	0.0356	0.0000	0.0004	0.0004			0.0037		0.0008
HLW98-32A	0.1368	0.0900	0.0024	0.1110		0.0005	0.0700	0.0007	0.0358	0.0067	0.0005	0.4550	0.0146	0.0000	0.0004	0.0003			0.0078		0.0004
HLW98-33	0.1003	0.0700	0.0067	0.1092		0.0003	0.0300	0.0020	0.0879	0.0014	0.0014	0.3773	0.0011	0.0022	0.0000	0.0006			0.0004		0.0003
HLW98-34	0.1078	0.0700	0.0071	0.1173		0.0003	0.0400	0.0022	0.0936	0.0015	0.0015	0.4089	0.0012	0.0024	0.0000	0.0007			0.0004		0.0003
HLW98-35	0.1034	0.0700	0.0176	0.1206		0.0006	0.0500	0.0008	0.0971	0.0073	0.0006	0.4354	0.0158	0.0000	0.0004	0.0003			0.0085		0.0005
HLW98-36	0.0939	0.0900	0.0281	0.0382		0.0008	0.0500	0.0003	0.1263	0.0024	0.0021	0.4350	0.0784	0.0000	0.0000	0.0000			0.0006		0.0000
HLW98-37	0.0443	0.0505	0.0045	0.0561		0.0000	0.0450	0.0005	0.1528	0.0020	0.0007	0.4177	0.1156	0.0000	0.0000	0.0000			0.0009		0.0000
HLW98-38	0.0336	0.0500	0.0064	0.0663		0.0010	0.0450	0.0008	0.1143	0.0033	0.0047	0.3823	0.0684	0.0009	0.0000	0.0003			0.0009		0.0012
HLW98-39	0.0370	0.0300	0.0070	0.0730		0.0011	0.0400	0.0009	0.1223	0.0036	0.0051	0.3696	0.0753	0.0010	0.0000	0.0003			0.0009		0.0013
HLW98-40	0.0823	0.0600	0.0026	0.1189		0.0006	0.0450	0.0008	0.1419	0.0072	0.0006	0.4353	0.0156	0.0004	0.0004	0.0003			0.0084		0.0005

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
HLW98-20	0.0007			0.0018	0.0038								0.0004	0.0043						0.0027	
HLW98-21	0.0001			0.0009	0.0039	0.0004		0.0005					0.0033	0.0035						0.0004	
HLW98-22	0.0004			0.0011	0.0023								0.0003	0.0026						0.0016	
HLW98-23	0.0004			0.0010	0.0021								0.0002	0.0023						0.0015	
HLW98-24	0.0001			0.0009	0.0039	0.0004		0.0005					0.0033	0.0035						0.0004	
HLW98-25	0.0001			0.0008	0.0038	0.0004		0.0005					0.0032	0.0192						0.0004	
HLW98-26	0.0001			0.0005	0.0008	0.0003		0.0004					0.0034	0.0271						0.0016	
HLW98-27B	0.0001			0.0005	0.0008	0.0003		0.0004					0.0034	0.0271						0.0016	
HLW98-28	0.0001	0.0000		0.0005	0.0008	0.0003		0.0004			0.0000		0.0034	0.0271	0.0000				0.0000	0.0016	
HLW98-29	0.0001	0.0000		0.0005	0.0008	0.0003		0.0004			0.0000		0.0034	0.0271	0.0000				0.0000	0.0016	
HLW98-30	0.0001	0.0000		0.0005	0.0008	0.0003		0.0004			0.0000		0.0034	0.0271	0.0000				0.0000	0.0016	
HLW98-31	0.0001	0.0000		0.0004	0.0008	0.0003		0.0004			0.0000		0.0032	0.0000	0.0303				0.0000	0.0015	
HLW98-32A	0.0001	0.0000		0.0008	0.0009	0.0002		0.0001			0.0000		0.0031	0.0141	0.0000				0.0000	0.0007	
HLW98-33	0.0003	0.0000		0.0015	0.0009	0.0000		0.0003			0.0000		0.0010	0.0000	0.0664				0.0000	0.0020	
HLW98-34	0.0002	0.0000		0.0016	0.0010	0.0000		0.0002			0.0000		0.0011	0.0000	0.0444				0.0000	0.0022	
HLW98-35	0.0002	0.0000		0.0008	0.0010	0.0002		0.0002			0.0000		0.0034	0.0153	0.0000				0.0000	0.0008	
HLW98-36	0.0001	0.0005		0.0014	0.0000	0.0000		0.0001			0.0000		0.0000	0.0000	0.0059				0.0000	0.0005	
HLW98-37	0.0000	0.0007		0.0011	0.0011	0.0000		0.0000			0.0000		0.0001	0.0000	0.0244				0.0000	0.0008	
HLW98-38	0.0000	0.0000		0.0019	0.0000	0.0004		0.0000			0.0000		0.0003	0.0000	0.0364				0.0007	0.0022	
HLW98-39	0.0000	0.0000		0.0021	0.0000	0.0004		0.0000			0.0000		0.0003	0.0000	0.0401				0.0009	0.0024	
HLW98-40	0.0000	0.0000		0.0008	0.0010	0.0002		0.0002			0.0000		0.0033	0.0151	0.0000				0.0000	0.0007	

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
HLW98-20																0.0014	0.0116				
HLW98-21											0.0027	0.0019				0.0034	0.0125		0.0018		0.0008
HLW98-22																0.0008	0.1013				
HLW98-23																0.0007	0.0917				
HLW98-24											0.0027	0.0019				0.0034	0.0125		0.0018		0.0008
HLW98-25											0.0027	0.0019				0.0033	0.0117		0.0018		0.0008
HLW98-26											0.0022	0.0015				0.0026	0.0245		0.0015		0.0007
HLW98-27B											0.0022	0.0015				0.0026	0.0245		0.0015		0.0007
HLW98-28	0.0000						0.0000		0.0000		0.0022	0.0015			0.0000	0.0026	0.0245		0.0015	0.0000	0.0007
HLW98-29	0.0000						0.0000		0.0000		0.0022	0.0015			0.0000	0.0026	0.0245		0.0015	0.0000	0.0007
HLW98-30	0.0000						0.0000		0.0000		0.0022	0.0015			0.0000	0.0026	0.0245		0.0015	0.0000	0.0007
HLW98-31	0.0000						0.0000		0.0000		0.0021	0.0015			0.0000	0.0025	0.0232		0.0014	0.0000	0.0006
HLW98-32A	0.0000						0.0000		0.0000		0.0034	0.0006			0.0000	0.0002	0.0226		0.0002	0.0000	0.0000
HLW98-33	0.0000						0.0000		0.0000		0.0000	0.0000			0.0000	0.0003	0.1156		0.0000	0.0000	0.0004
HLW98-34	0.0000						0.0000		0.0000		0.0000	0.0000			0.0000	0.0002	0.0735		0.0000	0.0000	0.0004
HLW98-35	0.0000						0.0000		0.0000		0.0037	0.0007			0.0000	0.0003	0.0245		0.0002	0.0000	0.0000
HLW98-36	0.0000						0.0000		0.0000		0.0000	0.0000			0.0000	0.0001	0.0000		0.0000	0.0000	0.0000
HLW98-37	0.0000						0.0000		0.0000		0.0000	0.0000			0.0000	0.0000	0.0296		0.0000	0.0000	0.0000
HLW98-38	0.0000						0.0005		0.0002		0.0000	0.0000			0.0010	0.0000	0.0480		0.0000	0.0579	0.0002
HLW98-39	0.0002						0.0005		0.0003		0.0000	0.0000			0.0011	0.0000	0.0529		0.0000	0.0637	0.0003
HLW98-40	0.0000						0.0000		0.0000		0.0037	0.0006			0.0000	0.0003	0.0242		0.0002	0.0000	0.0000

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
HLW98-20								0.0200		1.0001	0.0844	0.1245	0.0203	0.0922		0.0027	0.0167	0.0112	0.1188	0.0022	0.0077
HLW98-21								0.0200		1.0000	0.0623	0.0728	0.0033	0.1058		0.0032	0.0609	0.0010	0.0622	0.0047	0.0073
HLW98-22								0.0200		1.0000	0.0559	0.1176	0.0129	0.1274		0.0019	0.0301	0.0067	0.0775	0.0010	0.0048
HLW98-23								0.0200		1.0000	0.0481	0.1158	0.0117	0.1189		0.0016	0.0289	0.0059	0.0699	0.0008	0.0041
HLW98-24								0.0200		1.0000	0.0668	0.1133	0.0032	0.1056		0.0036	0.0552	0.0010	0.0642	0.0041	0.0061
HLW98-25								0.0200		1.0000											
HLW98-26								0.0200		1.0001											
HLW98-27B								0.0200		1.0001	0.0784	0.0388	0.0040	0.1238		0.0035	0.0403	0.0011	0.1267	0.0054	0.0019
HLW98-28			0.0000					0.0200		1.0001											
HLW98-29			0.0000					0.0200		1.0001											
HLW98-30			0.0000					0.0200		1.0001											
HLW98-31			0.0000					0.0200		0.9998	0.0740	0.0950	0.0029	0.0964		0.0024	0.0520	0.0009	0.0568	0.0048	0.0023
HLW98-32A			0.0000					0.0200		0.9999	0.1170	0.0900	0.0029	0.1014		0.0011	0.0634	0.0010	0.0342	0.0063	0.0022
HLW98-33			0.0000					0.0200		1.0000											
HLW98-34			0.0000					0.0200		1.0000	0.1040	0.0678	0.0086	0.1101		0.0018	0.0362	0.0029	0.0880	0.0014	0.0023
HLW98-35			0.0000					0.0200		1.0002	0.0947	0.0671	0.0163	0.1095		0.0023	0.0425	0.0016	0.0852	0.0067	0.0017
HLW98-36			0.0249					0.0200		1.0000	0.0844	0.0868	0.0279	0.0376		0.0018	0.0462	0.0005	0.1217	0.0026	0.0036
HLW98-37			0.0316					0.0200		1.0000	0.0453	0.0519	0.0053	0.0537		0.0010	0.0404	0.0007	0.1373	0.0023	0.0016
HLW98-38			0.0511					0.0200		1.0002	0.0340	0.0529	0.0075	0.0656		0.0017	0.0410	0.0010	0.1033	0.0036	0.0063
HLW98-39			0.0562					0.0100		0.9998	0.0401	0.0323	0.0087	0.0711		0.0019	0.0368	0.0013	0.1116	0.0039	0.0065
HLW98-40			0.0090					0.0200		1.0001	0.0767	0.0603	0.0035	0.1123		0.0014	0.0397	0.0010	0.1274	0.0070	0.0020

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
HLW98-20	0.4113	0.0032	0.0000		0.0067	0.0008		0.0004				0.0003		0.0028		0.0001					
HLW98-21	0.4804	0.0307	0.0001	0.0006	0.0009	0.0003		0.0047				0.0003		0.0017		0.0004					
HLW98-22	0.3734	0.0018		0.0002	0.0055	0.0005		0.0003				0.0002		0.0010							
HLW98-23	0.4169	0.0017			0.0049	0.0006		0.0002				0.0001		0.0009		0.0001					
HLW98-24	0.4516	0.0307	0.0001	0.0007	0.0009	0.0002		0.0045				0.0001		0.0007		0.0004					
HLW98-25																					
HLW98-26																					
HLW98-27B	0.4232	0.0241	0.0001	0.0003	0.0015	0.0003		0.0041				0.0002		0.0004		0.0006					
HLW98-28																					
HLW98-29																					
HLW98-30																					
HLW98-31	0.4434	0.0312	0.0001	0.0007	0.0008	0.0001		0.0034				0.0002		0.0003		0.0004					
HLW98-32A	0.4353	0.0139	0.0001	0.0005	0.0008	0.0000		0.0075				0.0002		0.0007		0.0004					
HLW98-33																					
HLW98-34	0.4019	0.0019	0.0023	0.0002	0.0020	0.0001		0.0004				0.0002		0.0014		0.0002					
HLW98-35	0.4119	0.0132	0.0001	0.0003	0.0010	0.0001		0.0078				0.0002		0.0008		0.0005					
HLW98-36	0.4324	0.0710	0.0000	0.0000	0.0002	0.0000		0.0007				0.0013		0.0016		0.0000					
HLW98-37	0.4299	0.1058	0.0003	0.0000	0.0006	0.0000		0.0009				0.0013		0.0011		0.0000					
HLW98-38	0.3700	0.0681	0.0011	0.0000	0.0012	0.0000		0.0009				0.0006		0.0019		0.0005					
HLW98-39	0.3695	0.0692	0.0012	0.0000	0.0014	0.0002		0.0010				0.0007		0.0020		0.0006					
HLW98-40	0.4235	0.0142	0.0005	0.0000	0.0009	0.0000		0.0073				0.0001		0.0009		0.0000					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
HLW98-20			0.0049						0.0030												0.0003
HLW98-21			0.0043						0.0007												0.0030
HLW98-22			0.0029						0.0020											0.0003	
HLW98-23			0.0027						0.0019											0.0004	
HLW98-24			0.0038						0.0007												0.0029
HLW98-25																					
HLW98-26																					
HLW98-27B			0.0263						0.0018												0.0023
HLW98-28																					
HLW98-29																					
HLW98-30																					
HLW98-31			0.0000	0.0363					0.0019		0.0000										0.0026
HLW98-32A			0.0144	0.0000					0.0009		0.0000										0.0036
HLW98-33																					
HLW98-34			0.0000	0.0415					0.0028		0.0000										0.0004
HLW98-35			0.0146	0.0000					0.0012		0.0000										0.0041
HLW98-36			0.0000	0.0060					0.0011		0.0000										
HLW98-37			0.0000	0.0246					0.0013		0.0002						0.0001				0.0007
HLW98-38			0.0000	0.0353					0.0030		0.0004						0.0003		0.0002		0.0008
HLW98-39			0.0000	0.0367					0.0036		0.0005						0.0003		0.0002		0.0008
HLW98-40			0.0160	0.0000					0.0013		0.0000								0.0001		0.0039

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
HLW98-20						0.0118				0.0002	0.0001		0.0006		0.0001	0.0006		0.0193		0.9472
HLW98-21	0.0006					0.0121		0.0019		0.0012	0.0003			0.0005	0.0001	0.0008		0.0193		0.9484
HLW98-22						0.0817		0.0001		0.0006	0.0002		0.0014		0.0001	0.0003		0.0191		0.9274
HLW98-23						0.0740				0.0004	0.0001		0.0012		0.0001	0.0003		0.0193		0.9315
HLW98-24	0.0007					0.0116		0.0017		0.0014	0.0004			0.0004	0.0005	0.0002		0.0197		0.9570
HLW98-25																				
HLW98-26																				
HLW98-27B	0.0005					0.0212		0.0013		0.0014	0.0003			0.0004	0.0001	0.0002		0.0195		0.9540
HLW98-28																				
HLW98-29																				
HLW98-30																				
HLW98-31	0.0006					0.0219		0.0015		0.0013	0.0005		0.0006		0.0001	0.0004		0.0208		0.9566
HLW98-32A	0.0000					0.0226		0.0004		0.0003	0.0002		0.0005		0.0001	0.0002		0.0194		0.9415
HLW98-33																				
HLW98-34						0.0669		0.0001		0.0007	0.0004		0.0009		0.0001			0.0207		0.9682
HLW98-35	0.0005					0.0209		0.0004		0.0012	0.0002		0.0008		0.0001			0.0204		0.9279
HLW98-36						0.0001				0.0005	0.0005		0.0219					0.0185		0.9689
HLW98-37						0.0277		0.0001		0.0005			0.0255					0.0201		0.9802
HLW98-38				0.0018		0.0422		0.0004		0.0006	0.0010		0.0473		0.0003	0.0006		0.0192		0.9146
HLW98-39				0.0019		0.0462		0.0006		0.0007	0.0010		0.0508		0.0003			0.0103		0.9139
HLW98-40	0.0000					0.0222		0.0004		0.0003			0.0095					0.0191		0.9515

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
HLW98-20	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-21	1150		< 950°C		Homogeneous glass with some undissolved solids			
HLW98-22	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-23	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-24	1150		< 950 °C		Dark brown homogeneous glass			
HLW98-25	1150		< 950 °C		Inhomogeneous glass shows multicolor swirls			
HLW98-26	1150		> 950 °C		Homogeneous dark brown glass			
HLW98-27B	1150		> 950 °C		Homogeneous dark brown glas			
HLW98-28	1150		> 950 °C		Homogeneous glass			
HLW98-29	1150		> 950 °C		Homogeneous dark brown glass			
HLW98-30	1150		< 950 °C		Homogeneous amber tinted glass			
HLW98-31	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-32A	1150		> 950°C		Homogeneous dark brown glass			
HLW98-33	1150		> 950 °C		Mostly homogeneous with small amount of undissolved solids			
HLW98-34	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-35	1150		³ 950°C		Homogeneous dark brown glass			
HLW98-36	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-37	1150		> 950 °C		Homogeneous dark brown glass			
HLW98-38	1150		> 950 °C		Homogeneous dark brown glass with metallic appearance			
HLW98-39	1150		> 950 °C		Homogeneous dark brown glass with bluish metallic appearance			
HLW98-40	1150				Inhomogeneous glass with multicolor swirls			

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
HLW98-20					After 110 hours, clear glass shows no secondary phases
HLW98-21					After 74 hours, 0.05-0.2 vol% of highly magnetic spinel (high in Fe, low in Al, Ni, Cr, Mn and Zn, no Mg)
HLW98-22					After 65 hours, < 0.01 vol% of spinel found at the bottom
HLW98-23					After 65 hours, clear glass shows no crystallization
HLW98-24					After 110 hours, 0.1 vol% of spinel, (high in Fe, low in Al, Cr, Mn, Ni and Zn; no Mg). Spinel cluster along air/glass/crucible interface
HLW98-25					After 72 hours, < 0.1 vol% of magnetic spinel (high in Fe, low in Al, Cr, Mg, Ni and Zn)
HLW98-26					After 66 hours, about 2.0 vol% of spinel. (high in Fe, low in Al, Cr, Mn, Ni and Zn, no Mg)
HLW98-27B					After 60 hours, 1.0-2.5 vol% of spinel (high in Fe, low in Al, Cr, Mn Ni and Sb, no Mg)
HLW98-28					After 16 hours, about 1.0 vol% of spinel
HLW98-29					After 94 hours, about 2 vol% of magnetic spinel, mostly at the bottom, sides, and air-glass interface
HLW98-30					After 21 hours, 0.14 vol% of spinel. (high in Fe, low in Al, Cr, Mg, Mn, Ni and Zn), mostly at the bottom sides and air-glass surface
HLW98-31					After 70 hours, 0.2-0.5 vol% of magnetic spinel, mostly at the sides and bottom
HLW98-32A					After 68 hours, 3-7 vol% of magnetic spinel (high in Fe, low in Al, Cr, Mn, Ni and Zn)
HLW98-33					After 48 hours, 2-5 vol% of magnetic spinel (high in Fe, Mn and low in Al, Ni and Zn)
HLW98-34					After 48 hours, 0.75 vol% of magnetic spinel (high in Fe, medium in Mn, and low in Al, Cr, Ni and Zn)
HLW98-35					After 72 hours, about 1 vol% of magnetic spinel
HLW98-36					After 72 hours, no secondary phases were observed
HLW98-37					After 72 hours, 3-7 vol% of white crystals plus traces of dark magnetic spinel
HLW98-38					After 72 hours, 0.1-0.2 vo% of spinel (Cr, Fe, Mn Ni, Zn) and 1-2 vol% of white ThO2 crystals
HLW98-39					After 72 hours, 1-2 vol% of magnetic spinel (Cr, Mn, Fe, Ni, Zn) and 25-50 vol% of white crystal high in Th and Zr with some Si
HLW98-40					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
HLW98-20															
HLW98-21							-11.278	19350.5	10.18				1000	51.088	1050
HLW98-22															
HLW98-23							-10.746	17369.6	4.31				1000	18.481	1050
HLW98-24							-10.833	17819.0	5.41				1000	24.045	1050
HLW98-25															
HLW98-26															
HLW98-27B															
HLW98-28															
HLW98-29															
HLW98-30															
HLW98-31		2.75					-11.094	17871.5	4.33				1000	19.199	1050
HLW98-32A															
HLW98-33															
HLW98-34		2.83					-11.803	18764.9	3.99				1000	19.235	1050
HLW98-35															
HLW98-36															
HLW98-37															
HLW98-38															
HLW98-39															
HLW98-40															

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
HLW98-20																					
HLW98-21	28.278	1100	16.537	1150	10.144	1200	6.486														
HLW98-22																					
HLW98-23	10.717	1100	6.602	1150	4.28	1200	2.898														
HLW98-24	13.813	1100	8.412	1150	5.383	1200	3.594														
HLW98-25																					
HLW98-26																					
HLW98-27B																					
HLW98-28																					
HLW98-29																					
HLW98-30																					
HLW98-31	11.114	1100	6.771	1150	4.312	1200	2.854														
HLW98-32A																					
HLW98-33																					
HLW98-34	10.676	1100	6.326	1150	3.961	1200	2.599														
HLW98-35																					
HLW98-36																					
HLW98-37																					
HLW98-38																					
HLW98-39																					
HLW98-40																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
HLW98-20					0.295	0.225	0.25	0.145	9.52							
HLW98-21					0.28	0.29	0.135	0.165	9.81							
HLW98-22					0.215	0.23	0.215	0.1	9.67							
HLW98-23					0.22	0.235	0.205	0.11	9.51							
HLW98-24																
HLW98-25																
HLW98-26																
HLW98-27B					0.355	0.34	0.42	0.215	10.85							
HLW98-28																
HLW98-29																
HLW98-30																
HLW98-31					0.365	0.26	0.19	0.16	9.84							
HLW98-32A					0.235	0.215	0.075	0.155	9.54							
HLW98-33																
HLW98-34					0.235	0.235	0.205	0.115	9.75							
HLW98-35																
HLW98-36																
HLW98-37																
HLW98-38																
HLW98-39																
HLW98-40																

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
HLW98-20				<0.004	0.05	0.208	0.009	0.008	0.032	0.09	0.0532	0.531
HLW98-21				<0.003	0.05	0.022	0.058	<0.006	0.04	0.036	0.0532	0.246
HLW98-22				<0.003	0.05	0.2	0.008	0.01	0.04	0.065	0.0532	0.59
HLW98-23				<0.003	0.05	0.16	0.004	<0.006	0.01	0.057	0.0532	0.51
HLW98-24				<0.003	0.05	0.027	0.071	<0.006	0.046	<0.03	0.0532	0.29
HLW98-25				0.014	0.05	0.039	0.091	0.009	0.06	<0.03	0.0532	0.343
HLW98-26				0.01	0.05	0.02	0.06	<0.006	0.06	0.04	0.0532	0.34
HLW98-27B				<.0031	0.05	0.04	0.09	0.03	0.11	0.06	0.0532	0.45
HLW98-28				<.0031	0.05	0.03	0.08	0.02	0.09	0.07	0.0532	0.37
HLW98-29				<.0031	0.05	0.03	0.08	0.01	0.1	0.04	0.0532	0.41
HLW98-30				0.01	0.06	0.16	0.15	0.01	0.15	0.03	0.0532	0.41
HLW98-31				<0.0031	0.05	0.03	0.07	0.02	0.09	0.03	0.09	0.33
HLW98-32A				<0.0031	0.061	0.097	0.172	<0.0055	0.088	0.026	0.0532	0.337
HLW98-33				0.07	0.05	0.118	0.014	0.007	0.034	0.203	0.0532	0.607
HLW98-34				0.064	0.05	0.193	0.079	0.012	0.107	0.081	0.0532	0.547
HLW98-35												
HLW98-36												
HLW98-37												
HLW98-38												
HLW98-39												
HLW98-40												

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
HLW98-41	0.0343	0.0300	0.0065	0.0677		0.0010	0.0500	0.0008	0.1404	0.0033	0.0048	0.3628	0.0698	0.0009	0.0000	0.0003			0.0009		0.0012
HLW98-42	0.0797	0.0850	0.0025	0.1152		0.0006	0.0700	0.0007	0.0889	0.0069	0.0006	0.4477	0.0151	0.0004	0.0004	0.0003			0.0081		0.0005
HLW98-43	0.0325	0.0500	0.0062	0.0641		0.0010	0.0600	0.0008	0.1275	0.0032	0.0045	0.3666	0.0661	0.0009	0.0000	0.0003			0.0008		0.0011
HLW98-44	0.0325	0.0700	0.0062	0.0641		0.0010	0.0600	0.0008	0.1025	0.0032	0.0045	0.3716	0.0661	0.0009	0.0000	0.0003	0.0000		0.0008		0.0011
HLW98-45	0.0314	0.0700	0.0060	0.0620		0.0010	0.0600	0.0007	0.1033	0.0031	0.0044	0.3834	0.0639	0.0009	0.0000	0.0003	0.0000		0.0008		0.0011
HLW98-46	0.0300	0.0750	0.0057	0.0591		0.0009	0.0700	0.0007	0.0984	0.0029	0.0042	0.3899	0.0610	0.0008	0.0000	0.0002	0.0000		0.0008		0.0011
HLW98-47	0.0287	0.0750	0.0055	0.0567		0.0009	0.0700	0.0007	0.1014	0.0028	0.0040	0.4016	0.0584	0.0008	0.0000	0.0002	0.0000		0.0007		0.0010
HLW98-48	0.0449	0.0900	0.0047	0.0492		0.0008	0.0500	0.0006	0.1103	0.0024	0.0035	0.4216	0.0507	0.0007	0.0000	0.0002	0.0000		0.0006		0.0009
HLW98-49	0.0588	0.0700	0.0045	0.0470		0.0007	0.0400	0.0006	0.1385	0.0023	0.0033	0.4208	0.0485	0.0007	0.0000	0.0002	0.0000		0.0006		0.0008
HLW98-50	0.0250	0.1100	0.0043	0.0458		0.0002	0.0400	0.0006	0.1359	0.0026	0.0035	0.4544	0.0546	0.0007	0.0000	0.0002	0.0000		0.0007		0.0008
HLW98-51R	0.0238	0.0900	0.0045	0.0470		0.0007	0.0500	0.0006	0.0860	0.0023	0.0033	0.4783	0.0485	0.0007	0.0000	0.0002	0.0000		0.0006		0.0008
HLW98-52	0.0797	0.0700	0.0025	0.1152		0.0006	0.0600	0.0007	0.0989	0.0069	0.0006	0.4626	0.0151	0.0004	0.0004	0.0003			0.0081		0.0005
HLW98-53A	0.0811	0.0725	0.0025	0.1172		0.0006	0.0600	0.0007	0.0992	0.0071	0.0006	0.4638	0.0154	0.0004	0.0004	0.0003			0.0083		0.0005
HLW98-54	0.0797	0.1000	0.0025	0.1152		0.0006	0.0600	0.0007	0.0564	0.0069	0.0006	0.4752	0.0151	0.0004	0.0004	0.0003			0.0081		0.0005
HLW98-55	0.0797	0.0700	0.0025	0.1152		0.0006	0.0700	0.0007	0.0914	0.0069	0.0006	0.4886	0.0151	0.0004	0.0004	0.0003			0.0081		0.0005
HLW98-56	0.0756	0.0700	0.0058	0.1179		0.0000	0.0700	0.0012	0.0954	0.0077	0.0024	0.4972	0.0165	0.0002	0.0000	0.0004	0.0000		0.0137		0.0007
HLW98-57	0.0744	0.0400	0.0062	0.1195		0.0003	0.0500	0.0012	0.1302	0.0075	0.0025	0.4713	0.0162	0.0002	0.0000	0.0004	0.0000		0.0133		0.0008
HLW98-58	0.0763	0.0400	0.0061	0.1208		0.0003	0.0500	0.0012	0.1376	0.0078	0.0025	0.4787	0.0166	0.0002	0.0000	0.0004	0.0000		0.0137		0.0008
HLW98-59	0.0800	0.0400	0.0025	0.1156		0.0006	0.0500	0.0007	0.1315	0.0070	0.0006	0.4775	0.0152	0.0004	0.0004	0.0003			0.0082		0.0005
HLW98-60	0.0760	0.0400	0.0059	0.1194		0.0003	0.0500	0.0012	0.1325	0.0077	0.0024	0.4765	0.0166	0.0002	0.0000	0.0004	0.0000		0.0137		0.0007
HLW98-61	0.0770	0.0400	0.0049	0.1224		0.0003	0.0500	0.0012	0.1391	0.0076	0.0046	0.4708	0.0147	0.0002	0.0000	0.0004	0.0000		0.0139		0.0006
HLW98-62	0.0967	0.1200	0.0231	0.0393		0.0008	0.0500	0.0003	0.0964	0.0025	0.0022	0.4255	0.0808	0.0000	0.0000	0.0000			0.0006		0.0000
HLW98-63	0.1185	0.0627	0.0079	0.1290		0.0003	0.0358	0.0024	0.1010	0.0017	0.0017	0.3783	0.0013	0.0026	0.0000	0.0007			0.0005		0.0003
HLW98-64	0.0814	0.0956	0.0027	0.1143		0.0019	0.0574	0.0007	0.0639	0.0059	0.0014	0.4354	0.0392	0.0000	0.0004	0.0005			0.0041		0.0009

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
HLW98-41	0.0000	0.0000		0.0020	0.0000	0.0004		0.0000			0.0000		0.0003	0.0000	0.0372				0.0008	0.0022	
HLW98-42	0.0000	0.0000		0.0008	0.0009	0.0002		0.0002			0.0000		0.0032	0.0146	0.0000				0.0000	0.0007	
HLW98-43	0.0000	0.0000		0.0019	0.0000	0.0004		0.0000			0.0000		0.0003	0.0000	0.0352				0.0008	0.0021	
HLW98-44	0.0000	0.0000		0.0019	0.0000	0.0004		0.0000					0.0003		0.0352	0.0000			0.0008	0.0021	
HLW98-45	0.0000	0.0000		0.0018	0.0000	0.0003		0.0000					0.0003		0.0340	0.0000			0.0008	0.0020	
HLW98-46	0.0000	0.0000		0.0017	0.0000	0.0003		0.0000					0.0002		0.0325	0.0000			0.0007	0.0019	
HLW98-47	0.0000	0.0000		0.0017	0.0000	0.0003		0.0000					0.0002		0.0311	0.0000			0.0007	0.0019	
HLW98-48	0.0000	0.0000		0.0014	0.0000	0.0003		0.0000					0.0002		0.0270	0.0000			0.0006	0.0016	
HLW98-49	0.0000	0.0000		0.0014	0.0000	0.0003		0.0000					0.0002		0.0258	0.0000			0.0006	0.0016	
HLW98-50	0.0000	0.0000		0.0010	0.0000	0.0002		0.0000					0.0001		0.0091	0.0000			0.0004	0.0011	
HLW98-51R	0.0000	0.0000		0.0014	0.0000	0.0003		0.0000					0.0002		0.0258	0.0000			0.0006	0.0016	
HLW98-52	0.0000	0.0000		0.0008	0.0009	0.0002		0.0002			0.0000		0.0032	0.0000	0.0146				0.0000	0.0007	
HLW98-53A	0.0000	0.0000		0.0008	0.0010	0.0002		0.0002			0.0000		0.0033	0.0000	0.0149				0.0000	0.0007	
HLW98-54	0.0000	0.0000		0.0008	0.0009	0.0002		0.0002			0.0000		0.0032	0.0000	0.0146				0.0000	0.0007	
HLW98-55	0.0000	0.0000		0.0008	0.0009	0.0002		0.0002			0.0000		0.0032	0.0000	0.0146				0.0000	0.0007	
HLW98-56	0.0005	0.0000		0.0009	0.0000	0.0000		0.0001					0.0031		0.0026	0.0000			0.0001	0.0000	
HLW98-57	0.0005	0.0001		0.0012	0.0000	0.0000		0.0001					0.0031		0.0162	0.0000			0.0003	0.0005	
HLW98-58	0.0005	0.0001		0.0011	0.0000	0.0000		0.0001					0.0031		0.0097	0.0000			0.0002	0.0003	
HLW98-59	0.0002	0.0000		0.0008	0.0009	0.0002		0.0002			0.0000		0.0033	0.0000	0.0147				0.0000	0.0007	
HLW98-60	0.0005	0.0001		0.0010	0.0000	0.0000		0.0001					0.0031		0.0061	0.0000			0.0002	0.0001	
HLW98-61	0.0003	0.0001		0.0011	0.0000	0.0003		0.0001					0.0030		0.0103	0.0000			0.0022	0.0011	
HLW98-62	0.0002	0.0005		0.0014	0.0007	0.0000		0.0002			0.0001		0.0000	0.0000	0.0171				0.0000	0.0005	
HLW98-63	0.0003	0.0000		0.0018	0.0011	0.0000		0.0003			0.0000		0.0012	0.0000	0.0488				0.0000	0.0024	
HLW98-64	0.0001	0.0000		0.0005	0.0009	0.0003		0.0004			0.0000		0.0036	0.0333	0.0000				0.0000	0.0017	

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
HLW98-41	0.0002						0.0005		0.0002		0.0000	0.0000			0.0010	0.0000	0.0490		0.0000	0.0591	0.0002
HLW98-42	0.0000						0.0000		0.0000		0.0036	0.0006			0.0000	0.0003	0.0234		0.0002	0.0000	0.0000
HLW98-43	0.0002						0.0004		0.0002		0.0000	0.0000			0.0009	0.0000	0.0464		0.0000	0.0560	0.0002
HLW98-44	0.0002				0.0000		0.0004		0.0002		0.0000	0.0000			0.0009	0.0000	0.0464	0.0000	0.0000	0.0560	0.0002
HLW98-45	0.0002				0.0000		0.0004		0.0002		0.0000	0.0000			0.0009	0.0000	0.0449	0.0000	0.0000	0.0541	0.0002
HLW98-46	0.0001				0.0000		0.0004		0.0002		0.0000	0.0000			0.0009	0.0000	0.0428	0.0000	0.0000	0.0516	0.0002
HLW98-47	0.0001				0.0000		0.0004		0.0002		0.0000	0.0000			0.0008	0.0000	0.0410	0.0000	0.0000	0.0494	0.0002
HLW98-48	0.0001				0.0000		0.0003		0.0002		0.0000	0.0000			0.0007	0.0000	0.0356	0.0000	0.0000	0.0429	0.0002
HLW98-49	0.0001				0.0000		0.0003		0.0002		0.0000	0.0000			0.0007	0.0000	0.0340	0.0000	0.0000	0.0410	0.0002
HLW98-50	0.0000				0.0000		0.0004		0.0002		0.0000	0.0000			0.0008	0.0000	0.0001	0.0000	0.0000	0.0463	0.0002
HLW98-51R	0.0001				0.0000		0.0003		0.0002		0.0000	0.0000			0.0007	0.0000	0.0340	0.0000	0.0000	0.0410	0.0002
HLW98-52	0.0000						0.0000		0.0000		0.0036	0.0006			0.0000	0.0003	0.0234		0.0002	0.0000	0.0000
HLW98-53A	0.0000						0.0000		0.0000		0.0036	0.0006			0.0000	0.0003	0.0238		0.0002	0.0000	0.0000
HLW98-54	0.0000						0.0000		0.0000		0.0036	0.0006			0.0000	0.0003	0.0234		0.0002	0.0000	0.0000
HLW98-55	0.0000						0.0000		0.0000		0.0036	0.0006			0.0000	0.0003	0.0234		0.0002	0.0000	0.0000
HLW98-56	0.0000				0.0000		0.0000		0.0000		0.0000	0.0000			0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0001
HLW98-57	0.0001				0.0000		0.0000		0.0000		0.0000	0.0000			0.0000	0.0003	0.0262	0.0000	0.0000	0.0001	0.0001
HLW98-58	0.0000				0.0000		0.0000		0.0000		0.0000	0.0000			0.0000	0.0003	0.0136	0.0000	0.0000	0.0001	0.0001
HLW98-59	0.0000						0.0000		0.0000		0.0036	0.0006			0.0000	0.0003	0.0235		0.0002	0.0000	0.0000
HLW98-60	0.0000				0.0000		0.0000		0.0000		0.0000	0.0000			0.0000	0.0002	0.0068	0.0000	0.0000	0.0000	0.0001
HLW98-61	0.0001				0.0000		0.0000		0.0000		0.0000	0.0000			0.0016	0.0002	0.0150	0.0000	0.0000	0.0001	0.0001
HLW98-62	0.0000						0.0000		0.0000		0.0000	0.0000			0.0000	0.0002	0.0208		0.0000	0.0000	0.0000
HLW98-63	0.0000						0.0000		0.0000		0.0000	0.0000			0.0000	0.0003	0.0808		0.0000	0.0000	0.0004
HLW98-64	0.0000						0.0000		0.0000		0.0023	0.0016			0.0000	0.0027	0.0255		0.0016	0.0000	0.0007

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
HLW98-41			0.0521					0.0200		0.9999	0.0485	0.0359	0.0120	0.0672		0.0034	0.0428	0.0027	0.1249	0.0039	0.0072
HLW98-42			0.0087					0.0200		1.0000											
HLW98-43			0.0494					0.0200		1.0000	0.0322	0.0598	0.0066	0.0610		0.0013	0.0539	0.0010	0.1035	0.0033	0.0055
HLW98-44	0.0000		0.0494		0.0000	0.0000	0.0000	0.0200		1.0000	0.0303	0.0705	0.0071	0.0599		0.0014	0.0538	0.0010	0.0878	0.0033	0.0058
HLW98-45	0.0000		0.0477		0.0000	0.0000	0.0000	0.0200		1.0001	0.0313	0.0716	0.0070	0.0600		0.0015	0.0556	0.0010	0.0926	0.0032	0.0059
HLW98-46	0.0000		0.0455		0.0000	0.0000	0.0000	0.0200		0.9997	0.0315	0.0730	0.0067	0.0568		0.0015	0.0646	0.0010	0.0898	0.0031	0.0057
HLW98-47	0.0000		0.0436		0.0000	0.0000	0.0000	0.0200		1.0000	0.0280	0.0749	0.0070	0.0532		0.0015	0.0619	0.0010	0.0893	0.0031	0.0052
HLW98-48	0.0000		0.0379		0.0000	0.0000	0.0000	0.0200		1.0001	0.0423	0.0903	0.0056	0.0470		0.0013	0.0440	0.0007	0.0864	0.0027	0.0050
HLW98-49	0.0000		0.0362		0.0000	0.0000	0.0000	0.0200		0.9999	0.0562	0.0717	0.0052	0.0457		0.0014	0.0359	0.0007	0.1213	0.0025	0.0049
HLW98-50	0.0000		0.0408		0.0000	0.0000	0.0000	0.0200		1.0000	0.0275	0.1117	0.0051	0.0444		0.0008	0.0370	0.0009	0.1255	0.0028	0.0055
HLW98-51R	0.0000		0.0362		0.0000	0.0000	0.0000	0.0200		0.9999	0.0282	0.0952	0.0055	0.0473		0.0013	0.0479	0.0008	0.0732	0.0026	0.0048
HLW98-52			0.0087					0.0200		0.9999											
HLW98-53A			0.0000					0.0200		1.0002	0.0756	0.0716	0.0036	0.1173		0.0010	0.0558	0.0010	0.0857	0.0088	0.0012
HLW98-54			0.0087					0.0200		1.0000	0.0577	0.1014	0.0030	0.1161		0.0010	0.0534	0.0008	0.0522	0.0068	0.0017
HLW98-55			0.0000					0.0002		0.9999											
HLW98-56	0.0000		0.0172		0.0000	0.0000	0.0001	0.0004		1.0000	0.0723	0.0745	0.0069	0.1128		0.0003	0.0672	0.0015	0.0811	0.0072	0.0014
HLW98-57	0.0000		0.0168		0.0000	0.0000	0.0001	0.0005		1.0002											
HLW98-58	0.0000		0.0173		0.0000	0.0000	0.0001	0.0005		1.0001	0.0697	0.0397	0.0075	0.1086		0.0009	0.0436	0.0017	0.1179	0.0076	0.0040
HLW98-59			0.0000					0.0200		1.0002	0.0766	0.0427	0.0033	0.1055		0.0009	0.0459	0.0010	0.1159	0.0067	0.0022
HLW98-60	0.0000		0.0173		0.0000	0.0000	0.0001	0.0204		0.9996	0.0694	0.0402	0.0075	0.1088		0.0008	0.0433	0.0015	0.1143	0.0081	0.0037
HLW98-61	0.0000		0.0162		0.0000	0.0000	0.0001	0.0004		1.0000	0.0665	0.0396	0.0084	0.0904		0.0019	0.0383	0.0018	0.1015	0.0061	0.0067
HLW98-62			0.0000					0.0201		1.0000	0.0903	0.1180	0.0231	0.0436		0.0012	0.0483	0.0007	0.0905	0.0034	0.0047
HLW98-63			0.0000					0.0179		1.0000	0.1122	0.0651	0.0095	0.1129		0.0010	0.0330	0.0028	0.0937	0.0015	0.0030
HLW98-64			0.0000					0.0191		1.0000											

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
HLW98-41	0.3526	0.0565	0.0002	0.0000	0.0015	0.0005		0.0011				0.0007		0.0022		0.0010					
HLW98-42																					
HLW98-43	0.3383	0.0560	0.0011	0.0003	0.0008	0.0003		0.0014				0.0004		0.0017		0.0005					
HLW98-44	0.3534	0.0575	0.0012	0.0006	0.0011	0.0004		0.0010				0.0005		0.0017		0.0005					
HLW98-45	0.3786	0.0593	0.0011	0.0000	0.0012	0.0002		0.0008				0.0005		0.0017		0.0004					
HLW98-46	0.3759	0.0566	0.0010	0.0000	0.0011	0.0000		0.0007				0.0005		0.0016		0.0004					
HLW98-47	0.3905	0.0526	0.0100		0.0013			0.0007				0.0006		0.0018							
HLW98-48	0.3755	0.0428	0.0010		0.0056			0.0006				0.0006		0.0014							
HLW98-49	0.4234	0.0456	0.0009		0.0006			0.0006				0.0006		0.0015							
HLW98-50	0.4480	0.0515	0.0008	0.0000	0.0003	0.0005		0.0008				0.0005		0.0010		0.0003					
HLW98-51R	0.4484	0.0478	0.0009		0.0006			0.0006				0.0005		0.0013							
HLW98-52																					
HLW98-53A	0.4367	0.0146	0.0006	0.0003	0.0009	0.0001		0.0079				0.0002		0.0038		0.0003					
HLW98-54	0.4739	0.0139	0.0005	0.0000	0.0009	0.0000		0.0073				0.0003		0.0009		0.0000					
HLW98-55																					
HLW98-56	0.4889	0.0168	0.0004		0.0006			0.0131				0.0003		0.0008							
HLW98-57																					
HLW98-58	0.4574	0.0161	0.0002		0.0009			0.0124				0.0004		0.0011							
HLW98-59	0.4564	0.0149	0.0004	0.0000	0.0009	0.0000		0.0076				0.0002		0.0007		0.0002					
HLW98-60	0.4603	0.0160	0.0003		0.0008			0.0125				0.0003		0.0010							
HLW98-61	0.4961	0.0132	0.0003	0.0002	0.0008	0.0006		0.0110				0.0004		0.0010		0.0007					
HLW98-62	0.4224	0.0876	0.0001	0.0002	0.0005	0.0006		0.0006				0.0008		0.0027		0.0001					
HLW98-63	0.3702	0.0018	0.0028	0.0000	0.0024	0.0000		0.0005				0.0002		0.0016		0.0001					
HLW98-64																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
HLW98-41			0.0000	0.0319					0.0045		0.0003						0.0003		0.0001		0.0016
HLW98-42																					
HLW98-43			0.0000	0.0326					0.0028		0.0002						0.0003		0.0001		0.0005
HLW98-44				0.0413					0.0029		0.0002						0.0003		0.0001		0.0005
HLW98-45				0.0334					0.0030		0.0004						0.0004		0.0001		0.0008
HLW98-46				0.0317					0.0028		0.0004						0.0004		0.0001		0.0009
HLW98-47				0.0290					0.0027		0.0003						0.0002		0.0002		0.0004
HLW98-48				0.0268					0.0020		0.0002						0.0002		0.0001		0.0005
HLW98-49				0.0261					0.0019		0.0002						0.0001		0.0002		0.0006
HLW98-50				0.0100					0.0017		0.0003						0.0004		0.0002		0.0008
HLW98-51R				0.0271					0.0020		0.0041						0.0002		0.0002		
HLW98-52																					
HLW98-53A			0.0000	0.0159					0.0011		0.0001								0.0001		0.0045
HLW98-54			0.0000	0.0157					0.0010		0.0000						0.0001		0.0001		0.0041
HLW98-55																					
HLW98-56				0.0028					0.0004												
HLW98-57																					
HLW98-58				0.0106					0.0005		0.0001						0.0001		0.0001		0.0006
HLW98-59			0.0000	0.0161					0.0010		0.0000										0.0038
HLW98-60				0.0072					0.0005		0.0000						0.0000		0.0001		
HLW98-61				0.0112					0.0019		0.0000						0.0000		0.0001		0.0007
HLW98-62			0.0000	0.0210					0.0009		0.0001						0.0001				0.0011
HLW98-63			0.0000	0.0562					0.0030		0.0000								0.0001		0.0005
HLW98-64																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
HLW98-41				0.0017		0.0382		0.0006		0.0010	0.0010		0.0497		0.0005	0.0006		0.0183		0.9151
HLW98-42																				
HLW98-43						0.0337		0.0007		0.0005	0.0008		0.0396			0.0006		0.0185		0.8598
HLW98-44	0.0000					0.0367		0.0007		0.0005	0.0009		0.0424			0.0006		0.0195		0.8854
HLW98-45	0.0000			0.0016		0.0416		0.0003		0.0006	0.0011		0.0414		0.0002	0.0005		0.0194		0.9183
HLW98-46	0.0000			0.0016		0.0395		0.0004		0.0006			0.0412					0.0192		0.9103
HLW98-47	0.0000					0.0366				0.0006			0.0391					0.0190		0.9107
HLW98-48	0.0001					0.0316		0.0003		0.0005			0.0309					0.0188		0.8648
HLW98-49	0.0000					0.0314		0.0004		0.0006			0.0289					0.0195		0.9286
HLW98-50	0.0002			0.0012		0.0007		0.0005		0.0006	0.0007		0.0341		0.0002	0.0004		0.0191		0.9360
HLW98-51R						0.0317				0.0006			0.0305					0.0204		0.9237
HLW98-52																				
HLW98-53A	0.0001					0.0219		0.0005		0.0002	0.0003		0.0006		0.0001	0.0006		0.0196		0.9526
HLW98-54						0.0218		0.0007		0.0003			0.0097					0.0196		0.9649
HLW98-55																				
HLW98-56						0.0010				0.0003			0.0154					0.0011		0.9671
HLW98-57																				
HLW98-58	0.0001					0.0120				0.0003			0.0146					0.0009		0.9296
HLW98-59	0.0004					0.0247		0.0008					0.0008					0.0190		0.9486
HLW98-60						0.0085				0.0004			0.0147					0.0195		0.9397
HLW98-61	0.0000			0.0018		0.0109		0.0009		0.0006	0.0003		0.0158		0.0005			0.0013		0.9315
HLW98-62				0.0007		0.0196				0.0003	0.0011		0.0015		0.0001	0.0005		0.0196		1.0060
HLW98-63	0.0002			0.0004		0.0731		0.0002		0.0007	0.0005		0.0018		0.0001	0.0003		0.0171		0.9685
HLW98-64																				

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
HLW98-41	1150		> 950 °C		Metallic looking glass with surface crystallization			
HLW98-42	1150		< 950°C		Homogeneous dark brown glass			
HLW98-43	1150		> 950 °C		Homogeneous dark brown glass			
HLW98-44	1150		> 950 °C		Homogeneous dark brown glass			
HLW98-45	1150		> 950 °C		Homogeneous dark brown glass			
HLW98-46	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-47	1150		< 950 °C		Dark brown glass with very small amount of undissolved solids			
HLW98-48	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-49	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-50	1150		< 950 °C		Clear, homogeneous dark brown glass			
HLW98-51R	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-52	1150		< 950 °C		Inhomogeneous brown opaque glass with light color swirls			
HLW98-53A	1150		< 950 °C		Inhomogeneous brown glass with apparently undissolved fractions			
HLW98-54	1150		< 950 °C		Inhomogeneous brown glass with multicolor swirls			
HLW98-55	1150				Inhomogeneous glass with many brown and green streaks			
HLW98-56	1150		< 950 °C		Homogeneous brown glass			
HLW98-57	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-58	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-59	1150		< 950 °C		Inhomogeneous brown glass with swirling patterns throughout			
HLW98-60	1150		» 950 °C		Homogeneous dark brown glass with some unmelted particles			
HLW98-61	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-62	1150		< 950 °C		Homogeneous dark brown glass			
HLW98-63	1150		> 1050 °C		Homogeneous dark brown glass			
HLW98-64	1150	About 1050 °C			Homogeneous brown glass			

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
HLW98-41					After 72 hours, 5-7 vol% of white crystals and 0.2 0.5 vol% of spinel
HLW98-42					After 72 hours, 0.2-0.5 vol% of magnetic spinel
HLW98-43					After 72 hours, 1-2 vol% of white/clear octahedra crystals and 0.1-0.2 vol% of magnetic spinel
HLW98-44					After 72 hours, 1-2 vol% of white/clear crystals and 0.1-0.2 vol% of magnetic spinel
HLW98-45					After 72 hours, about 1 vol% of white crystals (ThO2 with small amounts of Ce and Zr) and < 0.1 vol% of spinel (Cr, Mn, Fe, Ni, Zn)
HLW98-46					After 68 hours, 0.1 vol% of clear crystals and < 0.1 vol% of small dark crystals, probably spinel
HLW98-47					After 68 hours, much less than 1 vol% of clear crystals
HLW98-48					Clusters of dark globu-lar crystals (0.1 vol%, 20-200 mm). A few larger white crystals (0.1 vol%)
HLW98-49					After 72 hours, < 0.1 vol% of dark, globular clusters of acicular crystals
HLW98-50					After 72 hours, < 0.1 vol% of dark crystalss
HLW98-51R					After 68 hours, < 0.1 vol% of dark crystals. No evidence of magnetic crystals
HLW98-52					After 72 hours, 0.2-0.4 vol% of strongly magnetic spinel
HLW98-53A					After 72 hours, 0.2-0.5 vol% of magnetic spinel
HLW98-54					After 72 hours, 0.2-0.5 vol% of magnetic spinel
HLW98-55					
HLW98-56					After 68 hours, 0.01-0.05 vol% of magnetic spinel
HLW98-57					After 68 hours, 0.1 vol% of magnetic spinel
HLW98-58					After 70 hours, 0.1-0.2 vol% of magnetic spinel (large crystals) and trace amount of a white granular phase
HLW98-59					After 70 hours, 0.1-0.2 vol% of magnetic spinel
HLW98-60					After 70 hours, 0.5-1.0 vol% of magnetic spinel
HLW98-61					After 70 hours, about 0.1 vol% of magnetic spinel
HLW98-62					After 24 hours, reddish brown glass showed <0.1 vol% of magnetic spinel
HLW98-63					Dark reddish-brown glass with 5-7 vol% of magnetic spinel (30-50 mm)
HLW98-64					After 70 hours, about 1 vol% of magnetic spinel (30 - 50 mm)

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
HLW98-41															
HLW98-42							-10.165	15695.5	2.37				1000	8.833	1050
HLW98-43															
HLW98-44							-10.165	15695.5	2.37				1000	8.833	1050
HLW98-45															
HLW98-46															
HLW98-47							-11.392	16326.0	1.08				1000	4.251	1050
HLW98-48															
HLW98-49															
HLW98-50															
HLW98-51R		2.89					-11.433	18175.2	3.82				1000	17.67	1050
HLW98-52															
HLW98-53A		2.77													
HLW98-54															
HLW98-55															
HLW98-56		2.69													
HLW98-57		2.79													
HLW98-58															
HLW98-59															
HLW98-60															
HLW98-61		2.77					-10.920	19143.8	12.59				1000	62.031	1050
HLW98-62															
HLW98-63															
HLW98-64															

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
HLW98-41																					
HLW98-42	5.42	1100	3.502	1150	2.363	1200	1.656														
HLW98-43																					
HLW98-44	5.42	1100	3.502	1150	2.363	1200	1.656														
HLW98-45																					
HLW98-46																					
HLW98-47	2.558	1100	1.624	1150	1.079	1200	0.745														
HLW98-48																					
HLW98-49																					
HLW98-50																					
HLW98-51R	9.85	1100	5.916	1150	3.78	1200	2.542														
HLW98-52																					
HLW98-53A																					
HLW98-54																					
HLW98-55																					
HLW98-56																					
HLW98-57																					
HLW98-58																					
HLW98-59																					
HLW98-60																					
HLW98-61	34.638	1100	20.384	1150	12.557	1200	8.051														
HLW98-62																					
HLW98-63																					
HLW98-64																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
HLW98-41																
HLW98-42																
HLW98-43																
HLW98-44																
HLW98-45																
HLW98-46																
HLW98-47																
HLW98-48																
HLW98-49																
HLW98-50					1.765	1.265	1.095	0.45	10.51							
HLW98-51R					1.355	1.08	0.915	0.405	10.55							
HLW98-52																
HLW98-53A					0.425	0.405	0.355	0.225	10.43							
HLW98-54																
HLW98-55																
HLW98-56					0.695	0.445	0.455	0.265	10.61							
HLW98-57																
HLW98-58					0.475	0.55	0.67	0.33	11.32							
HLW98-59					0.695	0.445	0.455	0.265	10.61							
HLW98-60					0.485	0.505	0.59	0.295	11.38							
HLW98-61					0.23	0.33	0.345	0.275	11.01							
HLW98-62					0.285	0.305	0.23	0.135	10.16							
HLW98-63																
HLW98-64																

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
HLW98-41				0.02	0.05	0.126	0.082	0.024	0.291	0.162	0.0532	1.475
HLW98-42				0.02	NA	0.09	0.484	0.011	0.179	0.635	NA	0.692
HLW98-43				0.06	NA	0.122	0.077	0.017	0.213	0.242	NA	1.581
HLW98-44				0.065	NA	0.106	0.072	0.013	0.201	0.249	NA	1.449
HLW98-45												
HLW98-46												
HLW98-47				0.061	NA	0.106	0.066	0.011	0.183	0.232	NA	1.636
HLW98-48												
HLW98-49												
HLW98-50												
HLW98-51R				0.025	0.05	0.038	0.029	0.02	0.247	0.101	0.068	3.23
HLW98-52												
HLW98-53A												
HLW98-54				0.014	0.05	0.041	0.203	0.014	0.187	0.06	0.062	1.479
HLW98-55												
HLW98-56												
HLW98-57												
HLW98-58				<0.0031	0.05	0.465	0.268	<0.0055	0.11	0.081	0.0532	0.13
HLW98-59				0.007	0.118	0.469	0.157	<0.0055	0.095	<0.0243	0.0532	0.422
HLW98-60												
HLW98-61				<0.0031	<0.049	0.994	0.19	<0.0055	0.079	0.034	<0.0532	0.207
HLW98-62												
HLW98-63												
HLW98-64												

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
HLWMS-01	0.0500	0.0600					0.0600		0.0260		0.0100	0.3800									
HLWMS-02		0.1100					0.0600		0.0340			0.3500									
HLWMS-03	0.0100	0.0560					0.0600		0.0280			0.3800									
HLWMS-04	0.0400	0.0500					0.0500		0.0200		0.0050	0.3310									
HLWMS-05		0.0600					0.0450		0.0200			0.3390									
HLWMS-06	0.0100	0.0400					0.0450		0.0200			0.3340									
HLWMS-07	0.0300	0.1300					0.0600		0.0300			0.2500	0.0200								
HLWMS-08		0.1200					0.0600		0.0300			0.3350	0.0200								
HLWMS-09		0.1100					0.0450		0.0150			0.3350	0.0600								
HLWMS-10	0.0300	0.1100					0.0400		0.0150			0.3100	0.0600								
HLWMS-11	0.0500	0.1000					0.0350		0.0100			0.3000	0.0700								
HLWMS-12	0.1120	0.1000					0.0350		0.0100			0.3660	0.0700								
HLWMS-13	0.1120	0.1000					0.0350		0.0100			0.3340	0.0700								
HLWMS-14	0.1120	0.1000					0.0350		0.0100			0.3960	0.0400								
HLWMS-15	0.1320	0.1000					0.0350		0.0100			0.3760	0.0400								
HLW99-01	0.0000	0.0500	0.0700	0.0200		0.0100	0.0350	0.0200	0.0500	0.0300	0.0000	0.5500	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-02	0.0000	0.2000	0.0000	0.1250		0.0100	0.0000	0.0000	0.2000	0.0000	0.0270	0.3000	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-03	0.1100	0.2000	0.0000	0.0200		0.0100	0.0650	0.0200	0.0500	0.0300	0.0000	0.3000	0.0300	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-04	0.1100	0.0500	0.0000	0.0200		0.0100	0.0700	0.0000	0.0500	0.0000	0.0300	0.4900	0.0230	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-05	0.0000	0.0600	0.0000	0.0200		0.0100	0.0100	0.0200	0.2000	0.0300	0.0184	0.3100	0.1000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-06	0.1100	0.0500	0.0700	0.0200		0.0100	0.0000	0.0000	0.2000	0.0000	0.0000	0.4800	0.0050	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-07	0.0000	0.2000	0.0700	0.0200		0.0100	0.0350	0.0000	0.1500	0.0000	0.0037	0.3450	0.1000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-08	0.0000	0.0500	0.0700	0.1250		0.0100	0.0700	0.0000	0.0800	0.0000	0.0300	0.3800	0.0380	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-09	0.0000	0.2000	0.0700	0.0200		0.0100	0.0350	0.0173	0.0500	0.0259	0.0300	0.3000	0.0000	0.0025	0.0020	0.0345	0.0173		0.0259		0.0020
HLW99-10	0.0000	0.0500	0.0630	0.0200		0.0100	0.0000	0.0000	0.1300	0.0000	0.0300	0.5500	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-11	0.1100	0.2000	0.0700	0.0200		0.0100	0.0070	0.0000	0.1060	0.0000	0.0300	0.3000	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-12	0.0100	0.2000	0.0700	0.1250		0.0100	0.0350	0.0000	0.0500	0.0000	0.0000	0.4450	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
HLWMS-01															0.1200						
HLWMS-02															0.1300						
HLWMS-03								0.0200							0.1300						
HLWMS-04															0.1510						
HLWMS-05															0.1610						
HLWMS-06								0.0150							0.1610						
HLWMS-07															0.1500						
HLWMS-08															0.1360						
HLWMS-09															0.1360						
HLWMS-10															0.1360						
HLWMS-11															0.1360						
HLWMS-12															0.0960						
HLWMS-13															0.1060						
HLWMS-14															0.0960						
HLWMS-15															0.0960						
HLW99-01	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-02	0.0020	0.0020		0.0045	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-03	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-04	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-05	0.0020	0.0020		0.0031	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-06	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-07	0.0020	0.0020		0.0006	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-08	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-09	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0086	
HLW99-10	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-11	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-12	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
HLWMS-01																	0.2640				
HLWMS-02																	0.2860				
HLWMS-03																	0.2860				
HLWMS-04																	0.3330				
HLWMS-05																	0.3550				
HLWMS-06																	0.3550				
HLWMS-07																	0.3300				
HLWMS-08																	0.2990				
HLWMS-09																	0.2990				
HLWMS-10																	0.2990				
HLWMS-11																	0.2990				
HLWMS-12																	0.2110				
HLWMS-13																	0.2330				
HLWMS-14																	0.2110				
HLWMS-15																	0.2110				
HLW99-01	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-02	0.0004						0.0008		0.0013		0.0020	0.0020				0.0045	0.0020		0.0020	0.0018	0.0000
HLW99-03	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-04	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-05	0.0004						0.0008		0.0013		0.0020	0.0020				0.0031	0.0020		0.0020	0.0012	0.0100
HLW99-06	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0000
HLW99-07	0.0004						0.0008		0.0013		0.0020	0.0020				0.0006	0.0020		0.0020	0.0002	0.0000
HLW99-08	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-09	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0086
HLW99-10	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-11	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-12	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0000

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
HLWMS-01								0.0300		1.0000											
HLWMS-02								0.0300		1.0000											
HLWMS-03								0.0300		1.0000											
HLWMS-04								0.0200		1.0000											
HLWMS-05								0.0200		1.0000											
HLWMS-06								0.0200		1.0000											
HLWMS-07										1.0000											
HLWMS-08										1.0000											
HLWMS-09										1.0000											
HLWMS-10										1.0000											
HLWMS-11										1.0000											
HLWMS-12										1.0000											
HLWMS-13										1.0000											
HLWMS-14										1.0000											
HLWMS-15										1.0000											
HLW99-01	0.0020		0.0000			0.0020		0.0200		1.0000	0.0182	0.0488	0.0633	0.0206		0.0114	0.0340	0.0185	0.0475	0.0277	0.0012
HLW99-02	0.0020		0.0721			0.0020		0.0200		0.9999	0.0157	0.1860	0.0012	0.1101		0.0115	0.0003	0.0004	0.1742	0.0002	0.0280
HLW99-03	0.0020		0.0000			0.0020		0.0200		1.0000	0.1052	0.2003	0.0013	0.0201		0.0109	0.0576	0.0192	0.0471	0.0284	0.0013
HLW99-04	0.0020		0.0800			0.0020		0.0200		1.0000	0.1040	0.0529	0.0008	0.0241		0.0114	0.0604	0.0003	0.0507	0.0003	0.0309
HLW99-05	0.0020		0.0492			0.0020		0.0200		1.0000	0.0103	0.0564	0.0010	0.0200		0.0111	0.0114	0.0178	0.1807	0.0278	0.0196
HLW99-06	0.0020		0.0000			0.0020		0.0200		1.0000	0.1037	0.0504	0.0658	0.0203		0.0116	0.0009	0.0003	0.1748	0.0001	0.0013
HLW99-07	0.0020		0.0098			0.0020		0.0200		0.9999	0.0178	0.1947	0.0652	0.0209		0.0106	0.0368	0.0006	0.1338	0.0006	0.0056
HLW99-08	0.0020		0.0800			0.0020		0.0200		1.0000	0.0106	0.0487	0.0643	0.1131		0.0111	0.0618	0.0003	0.0734	0.0004	0.0346
HLW99-09	0.0020		0.0800			0.0020		0.0200		1.0001	0.0229	0.1771	0.0610	0.0194		0.0106	0.0322	0.0154	0.0449	0.0229	0.0293
HLW99-10	0.0020		0.0800			0.0020		0.0200		1.0000	0.0081	0.0506	0.0620	0.0206		0.0109	0.0012	0.0003	0.1140	0.0004	0.0351
HLW99-11	0.0020		0.0800			0.0020		0.0200		1.0000	0.1037	0.1838	0.0644	0.0218		0.0109	0.0099	0.0002	0.0924	0.0003	0.0330
HLW99-12	0.0020		0.0000			0.0020		0.0200		1.0000	0.0248	0.1858	0.0618	0.1136		0.0105	0.0324	0.0003	0.0444	0.0001	0.0015

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
HLWMS-01																					
HLWMS-02																					
HLWMS-03																					
HLWMS-04																					
HLWMS-05																					
HLWMS-06																					
HLWMS-07																					
HLWMS-08																					
HLWMS-09																					
HLWMS-10																					
HLWMS-11																					
HLWMS-12																					
HLWMS-13																					
HLWMS-14																					
HLWMS-15																					
HLW99-01	0.5228	0.0004	0.0023	0.0019	0.0366	0.0200		0.0276				0.0020		0.0000		0.0020					
HLW99-02	0.3053	0.0001	0.0023	0.0018	0.0001	0.0004		0.0001				0.0023		0.0038		0.0023					
HLW99-03	0.3035	0.0253	0.0025	0.0019	0.0373	0.0201		0.0283				0.0022		0.0000		0.0021					
HLW99-04	0.4705	0.0153	0.0025	0.0020	0.0001	0.0003		0.0000				0.0027		0.0031		0.0023					
HLW99-05	0.3185	0.0821	0.0024	0.0020	0.0372	0.0192		0.0268				0.0025		0.0027		0.0025					
HLW99-06	0.4527	0.0050	0.0017	0.0019	0.0002	0.0000		0.0000				0.0021		0.0000		0.0022					
HLW99-07	0.3588	0.0862	0.0020	0.0019	0.0008	0.0005		0.0005				0.0023		0.0007		0.0023					
HLW99-08	0.3771	0.0325	0.0027	0.0019	0.0004	0.0005		0.0002				0.0027		0.0043		0.0025					
HLW99-09	0.3122	0.0020	0.0021	0.0014	0.0302	0.0149		0.0225				0.0025		0.0039		0.0021					
HLW99-10	0.5336	0.0023	0.0026	0.0021	0.0003	0.0006		0.0002				0.0026		0.0043		0.0024					
HLW99-11	0.2956	0.0011	0.0026	0.0019	0.0001	0.0003		0.0000				0.0028		0.0030		0.0024					
HLW99-12	0.4305	0.0001	0.0023	0.0019	0.0002	0.0002		0.0001				0.0019		0.0000		0.0021					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
HLWMS-01																					
HLWMS-02																					
HLWMS-03																					
HLWMS-04																					
HLWMS-05																					
HLWMS-06																					
HLWMS-07																					
HLWMS-08																					
HLWMS-09																					
HLWMS-10																					
HLWMS-11																					
HLWMS-12																					
HLWMS-13																					
HLWMS-14																					
HLWMS-15																					
HLW99-01			0.0024						0.0033												0.0022
HLW99-02			0.0023						0.0010												0.0020
HLW99-03			0.0025						0.0032												0.0020
HLW99-04			0.0023						0.0007												0.0021
HLW99-05			0.0024						0.0108												0.0023
HLW99-06			0.0024						0.0001												0.0020
HLW99-07			0.0025						0.0008												0.0022
HLW99-08			0.0023						0.0008												0.0020
HLW99-09			0.0023						0.0089												0.0024
HLW99-10			0.0023						0.0008												0.0023
HLW99-11			0.0023						0.0008												0.0019
HLW99-12			0.0023						0.0002												0.0019

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
HLWMS-01																				
HLWMS-02																				
HLWMS-03																				
HLWMS-04																				
HLWMS-05																				
HLWMS-06																				
HLWMS-07																				
HLWMS-08																				
HLWMS-09																				
HLWMS-10																				
HLWMS-11																				
HLWMS-12																				
HLWMS-13																				
HLWMS-14																				
HLWMS-15																				
HLW99-01	0.0007					0.0026		0.0021		0.0101	0.0007		0.0002			0.0026		0.0196		0.9533
HLW99-02	0.0006					0.0019		0.0019		0.0006	0.0009		0.0486			0.0023		0.0192		0.9274
HLW99-03	0.0007					0.0025		0.0023		0.0109	0.0010		0.0004			0.0026		0.0198		0.9625
HLW99-04	0.0009					0.0019		0.0021		0.0006	0.0013		0.0693			0.0025		0.0189		0.9372
HLW99-05	0.0013					0.0024		0.0024		0.0106	0.0018		0.0412			0.0028		0.0200		0.9500
HLW99-06	0.0013					0.0024		0.0022		0.0003	0.0007		0.0004			0.0022		0.0193		0.9283
HLW99-07	0.0008					0.0023		0.0021		0.0010	0.0018		0.0107			0.0025		0.0204		0.9897
HLW99-08	0.0011					0.0021		0.0020		0.0006	0.0017		0.0617			0.0027		0.0192		0.9393
HLW99-09	0.0011					0.0023		0.0019		0.0090	0.0014		0.0556			0.0028		0.0184		0.9356
HLW99-10	0.0009					0.0022		0.0021		0.0004	0.0014		0.0753			0.0031		0.0203		0.9653
HLW99-11	0.0010					0.0020		0.0022		0.0004	0.0019		0.0695			0.0027		0.0191		0.9340
HLW99-12	0.0002					0.0021		0.0020		0.0009	0.0009		0.0006			0.0023		0.0188		0.9467

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
HLWMS-01	1150		< 950 °C		Homogeneous dark brown glass			
HLWMS-02	1150		< 950 °C		Homogeneous dark brown glass			
HLWMS-03	1150		> 950 °C		Brown glass with metallic blue appear-ance. Trace amount of secondary phase			
HLWMS-04	1150		> 950 °C		Homogeneous dark glass with metallic sheen			
HLWMS-05	1150		> 950 °C		Homogeneous glass with metallic appearance			
HLWMS-06	1150		> 950 °C		Metallic blue glass with extensive surface crystallization			
HLWMS-07	1150		< 950 °C		Mostly homogeneous with some metallic swirls			
HLWMS-08	1150		< 950 °C		Homogeneous glass with metallic appearance			
HLWMS-09	1200		< 950 °C		Homogeneous dark glass			
HLWMS-10	1200		< 950 °C		Homogeneous dark glass			
HLWMS-11	1200		< 950 °C		Homogeneous dark brown glass			
HLWMS-12	1200		> 950 °C		Homogeneous dark brown glass			
HLWMS-13	1200		> 950 °C		Homogeneous dark brown glass			
HLWMS-14	1200		< 950 °C		Homogeneous reddish brown glass			
HLWMS-15	1200		< 950 °C		Homogeneous dark brown glass			
HLW99-01	1150		1075		Homogeneous dark brown glass with a tinge of blue. Undis-solved materials left in crucible			
HLW99-02								
HLW99-03	1150		1075		Mostly homogeneous dark brown glass with some cloudiness on surface			
HLW99-04								
HLW99-05								
HLW99-06	1150		950		Homogeneous deep blue glass. Silver patches on blue glass in crucible			
HLW99-07								
HLW99-08								
HLW99-09								
HLW99-10	1150		> 1056 °C		Blue glass with metallic like fragments and brown regions			
HLW99-11	1150		> 978 °C		Mostly clear brown/blue glass with dull gray lumps on surface. Some gray-colored swirls			
HLW99-12	1150		950		Inhomogeneous olive green glass with blue patches. Traces of silvery clusters on crucible wall			

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
HLWMS-01					After 20 hours, no crystallization observed except two dark crystals
HLWMS-02					After 20 hours, no crystallization observed
HLWMS-03					After 20 hours, 5-10 vol% of large clear light blue Sr-silicate with oxides of Na, Al, Mn and Zn
HLWMS-04					After 20 hours, 0.5 vol% of Mn oxide and 23 vol% of clear Sr-silicate with Al, Mn and Zn
HLWMS-05					After 20 hours, 34 vol% of clear leaf-shaped Sr-silicate with Mn and Zn
HLWMS-06					After 20 hours, 35 vol% of leaf-shaped Sr-silicate with Al, Mn and Zn; 5 vol% of Mn oxide with Zn
HLWMS-07					After 20 hours, 0.2-0.4 vol% of dark spinel-like crystal
HLWMS-08					After 20 hours, no crystallization observed
HLWMS-09					After 20 hours, no crystallization
HLWMS-10					After 20 hours, no crystallization observed
HLWMS-11					After 20 hours, a few light color crystals at the glass/crucible interface
HLWMS-12					After 20 hours, 2.3 vol% of cubic or acicular ZrO2
HLWMS-13					After 20 hours, 3.6 vol% of ZrO2, 3-5 vol% of SrAl2Si2O8, and small amount of Mn3O4
HLWMS-14					After 20 hours, no crystallization observed
HLWMS-15					After 20 hours, no crystallization observed
HLW99-01					10 vol% of clinopy-roxene (calcium) crystal. Traces of RuO2
HLW99-02					
HLW99-03					Up to 2 vol% rod-shaped crystals. No spinel phase is apparent
HLW99-04					
HLW99-05					
HLW99-06					About 0.2 vol% of rhodium metal and RuO2. No spinel found
HLW99-07					
HLW99-08					
HLW99-09					
HLW99-10					At 1056 °C, 4 vol% of clear/white crystal of calcium phosphate (with some Na). Rhodium metal and RuO2 are also present
HLW99-11					At 978 °C, 2 vol% of calcium phosphate, 0.5 vol% of spinel (Cr, Zn) and 0.1vol% of RuO2
HLW99-12					Equiaxed crystals consisting of rhodium incorporating Fe and Zn (0.5-4 mm) and RuO2. Total 0.6 vol%

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
HLWMS-01															
HLWMS-02															
HLWMS-03															
HLWMS-04															
HLWMS-05															
HLWMS-06															
HLWMS-07															
HLWMS-08							-11.569	14636.0	0.28				1000	0.937	1050
HLWMS-09															
HLWMS-10															
HLWMS-11		3.37					-14.364	20240.2	0.87				1000	4.801	1050
HLWMS-12															
HLWMS-13															
HLWMS-14															
HLWMS-15							-13.883	22359.8	6.23				1000	41.183	1050
HLW99-01															
HLW99-02															
HLW99-03		2.8													
HLW99-04															
HLW99-05		3.15													
HLW99-06		2.64					-11.857	20819.7	16.02				1000	91.212	1050
HLW99-07		2.78													
HLW99-08		2.94													
HLW99-09		2.99													
HLW99-10		2.76													
HLW99-11		2.72													
HLW99-12		2.67													

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
HLWMS-01																					
HLWMS-02																					
HLWMS-03																					
HLWMS-04																					
HLWMS-05																					
HLWMS-06																					
HLWMS-07																					
HLWMS-08	0.598	1100	0.4	1150	0.279																
HLWMS-09																					
HLWMS-10																					
HLWMS-11	2.493	1100	1.412	1150	0.859	1200	0.554														
HLWMS-12																					
HLWMS-13																					
HLWMS-14																					
HLWMS-15	19.961	1100	10.656	1150	6.153	1200	3.79														
HLW99-01																					
HLW99-02																					
HLW99-03																					
HLW99-04																					
HLW99-05																					
HLW99-06	47.915	1100	26.862	1150	15.921	1200	9.9														
HLW99-07																					
HLW99-08																					
HLW99-09																					
HLW99-10																					
HLW99-11																					
HLW99-12																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
HLWMS-01																
HLWMS-02																
HLWMS-03																
HLWMS-04																
HLWMS-05																
HLWMS-06																
HLWMS-07																
HLWMS-08					1.205	1.455	1.41	0.465	11.43							
HLWMS-09					0.71	0.745	0.945	0.26	10.53							
HLWMS-10					0.56	0.575	0.64	0.18	10.43							
HLWMS-11																
HLWMS-12																
HLWMS-13																
HLWMS-14																
HLWMS-15																
HLW99-01																
HLW99-02																
HLW99-03																
HLW99-04																
HLW99-05																
HLW99-06																
HLW99-07																
HLW99-08																
HLW99-09																
HLW99-10																
HLW99-11																
HLW99-12																

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
HLWMS-01												
HLWMS-02												
HLWMS-03												
HLWMS-04												
HLWMS-05												
HLWMS-06												
HLWMS-07												
HLWMS-08												
HLWMS-09												
HLWMS-10												
HLWMS-11												
HLWMS-12												
HLWMS-13												
HLWMS-14												
HLWMS-15												
HLW99-01				0.068	0.049	1.283	0.875	<0.0055	0.66	0.111	0.0532	0.598
HLW99-02				0.079	0.049	0.053	0.171	0.573	0.357	0.4	0.108	38.928
HLW99-03				0.363	0.055	12.084	8.776	<0.0055	7.382	0.727	0.0532	5.47
HLW99-04				0.029	0.148	0.13	0.075	0.008	0.064	0.171	0.0532	0.942
HLW99-05				0.085	0.25	35.742	33.345	1.165	29.936	1.552	0.355	20.134
HLW99-06				0.09	0.049	0.013	0.006	<0.0055	<0.0079	<0.0243	0.0532	0.813
HLW99-07				0.088	0.406	0.139	0.18	0.056	0.275	0.502	0.708	40.201
HLW99-08				0.169	0.089	0.408	0.269	0.022	0.252	0.12	0.121	1.547
HLW99-09				0.023	0.205	26.083	53.865	0.089	49.261	1.991	0.402	39.512
HLW99-10				0.087	1.487	0.134	0.076	0.041	0.063	0.153	0.081	0.764
HLW99-11				0.256	0.049	0.099	0.026	0.073	0.071	0.178	0.164	3.577
HLW99-12				0.1	0.074	0.197	0.12	<0.0055	0.097	<0.0243	0.0532	1.084

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
HLW99-13	0.0000	0.0500	0.0000	0.0200		0.0100	0.0000	0.0200	0.2000	0.0300	0.0061	0.4800	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-14	0.0000	0.2000	0.0000	0.1250		0.0100	0.0350	0.0200	0.0500	0.0300	0.0000	0.3317	0.0333	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-15	0.0000	0.2000	0.0350	0.0200		0.0100	0.0100	0.0200	0.2000	0.0300	0.0000	0.3100	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-16	0.0000	0.0500	0.0000	0.1250		0.0100	0.0700	0.0113	0.0500	0.0169	0.0000	0.5500	0.0000	0.0025	0.0020	0.0225	0.0113		0.0169		0.0020
HLW99-17	0.0000	0.0500	0.0700	0.0200		0.0100	0.0100	0.0000	0.2000	0.0000	0.0300	0.3630	0.1000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-18	0.1100	0.0700	0.0700	0.0200		0.0100	0.0100	0.0156	0.2000	0.0234	0.0000	0.3000	0.0300	0.0025	0.0020	0.0313	0.0156		0.0234		0.0020
HLW99-19	0.0850	0.2000	0.0000	0.1250		0.0100	0.0530	0.0000	0.0500	0.0000	0.0300	0.3000	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-20	0.0530	0.0900	0.0000	0.0200		0.0100	0.0700	0.0200	0.0800	0.0300	0.0300	0.3400	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-21	0.0650	0.0500	0.0700	0.0200		0.0100	0.0700	0.0000	0.0750	0.0000	0.0000	0.5350	0.0500	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-22	0.0400	0.2000	0.0000	0.0230		0.0100	0.0000	0.0000	0.1500	0.0000	0.0300	0.3000	0.1000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-23	0.0000	0.0500	0.0700	0.0200		0.0100	0.0000	0.0179	0.2000	0.0268	0.0300	0.3300	0.0000	0.0025	0.0020	0.0358	0.0179		0.0268		0.0020
HLW99-24R	0.0000	0.1550	0.0700	0.1100		0.0100	0.0000	0.0000	0.2000	0.0000	0.0000	0.3000	0.1000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-25	0.1100	0.0900	0.0700	0.1000		0.0100	0.0700	0.0094	0.0800	0.0141	0.0000	0.3400	0.0000	0.0025	0.0020	0.0188	0.0094		0.0141		0.0020
HLW99-26	0.0000	0.0500	0.0000	0.0730		0.0100	0.0350	0.0200	0.0500	0.0300	0.0300	0.4450	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-27	0.0000	0.1600	0.0700	0.1250		0.0100	0.0700	0.0200	0.0500	0.0300	0.0000	0.3000	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-28	0.0250	0.1600	0.0700	0.0200		0.0100	0.0000	0.0200	0.1200	0.0300	0.0000	0.3000	0.0800	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-29	0.0000	0.0500	0.0000	0.0200		0.0100	0.0300	0.0123	0.1300	0.0184	0.0000	0.5200	0.0867	0.0025	0.0020	0.0246	0.0123		0.0184		0.0020
HLW99-30	0.0400	0.1250	0.0000	0.0200		0.0100	0.0100	0.0056	0.2000	0.0084	0.0000	0.3950	0.1000	0.0025	0.0020	0.0113	0.0056		0.0084		0.0020
HLW99-31	0.1100	0.1830	0.0000	0.0200		0.0100	0.0000	0.0000	0.2000	0.0000	0.0300	0.3000	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-32	0.0000	0.0500	0.0000	0.1250		0.0100	0.0463	0.0029	0.1275	0.0043	0.0300	0.3563	0.0850	0.0025	0.0020	0.0058	0.0029		0.0043		0.0020

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
HLW99-13	0.0020	0.0020		0.0010	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-14	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-15	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-16	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0056	
HLW99-17	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-18	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0078	
HLW99-19	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-20	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-21	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-22	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-23	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0089	
HLW99-24R	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-25	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0047	
HLW99-26	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-27	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-28	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-29	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0061	
HLW99-30	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0028	
HLW99-31	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-32	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0014	

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
HLW99-13	0.0004						0.0008		0.0013		0.0020	0.0020				0.0010	0.0020		0.0020	0.0004	0.0100
HLW99-14	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-15	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-16	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0056
HLW99-17	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-18	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0078
HLW99-19	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-20	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0100
HLW99-21	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0000
HLW99-22	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-23	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0089
HLW99-24R	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0000
HLW99-25	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0047
HLW99-26	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0100
HLW99-27	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-28	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-29	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0061
HLW99-30	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0028
HLW99-31	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-32	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0014

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
HLW99-13	0.0020		0.0164			0.0020		0.0200		0.9999	0.0065	0.0511	0.0030	0.0199		0.0109	0.0004	0.0177	0.1879	0.0276	0.0080
HLW99-14	0.0020		0.0000			0.0020		0.0200		1.0000	0.0249	0.1885	0.0008	0.1138		0.0198	0.0328	0.0177	0.0487	0.0253	0.0010
HLW99-15	0.0020		0.0000			0.0020		0.0200		1.0000	0.0173	0.1924	0.0353	0.0214		0.0116	0.0116	0.0195	0.1808	0.0272	0.0004
HLW99-16	0.0020		0.0000			0.0020		0.0200		1.0001	0.0137	0.0516	0.0025	0.1228		0.0112	0.0666	0.0112	0.0503	0.0163	0.0016
HLW99-17	0.0020		0.0800			0.0020		0.0200		1.0000	0.0080	0.0488	0.0641	0.0197		0.0106	0.0104	0.0005	0.1829	0.0009	0.0258
HLW99-18	0.0020		0.0000			0.0020		0.0200		0.9999	0.1074	0.0708	0.0698	0.0214		0.0111	0.0123	0.0157	0.1859	0.0234	0.0012
HLW99-19	0.0020		0.0800			0.0020		0.0200		1.0000	0.0797	0.1924	0.0028	0.1127		0.0111	0.0462	0.0002	0.0485	0.0004	0.0354
HLW99-20	0.0020		0.0800			0.0020		0.0200		1.0000	0.0551	0.0970	0.0014	0.0227		0.0102	0.0635	0.0176	0.0737	0.0276	0.0354
HLW99-21	0.0020		0.0000			0.0020		0.0200		1.0000	0.0680	0.0501	0.0667	0.0202		0.0107	0.0648	0.0004	0.0757	0.0002	0.0012
HLW99-22	0.0020		0.0800			0.0020		0.0200		1.0000	0.0407	0.1856	0.0006	0.0229		0.0111	0.0026	0.0007	0.1355	0.0011	0.0337
HLW99-23	0.0020		0.0800			0.0020		0.0200		1.0000	0.0086	0.0615	0.0637	0.0201		0.0116	0.0014	0.0157	0.1754	0.0247	0.0327
HLW99-24R	0.0020		0.0000			0.0020		0.0200		1.0000	0.0072	0.1502	0.0676	0.1022		0.0112	0.0008	0.0002	0.1726	0.0003	0.0028
HLW99-25	0.0020		0.0000			0.0020		0.0200		1.0002	0.1126	0.0899	0.0686	0.0943		0.0114	0.0659	0.0100	0.0797	0.0132	0.0005
HLW99-26	0.0020		0.0800			0.0020		0.0200		1.0000	0.0051	0.0559	0.0041	0.0628		0.0106	0.0301	0.0171	0.0530	0.0260	0.0329
HLW99-27	0.0020		0.0000			0.0020		0.0200		1.0000	0.0297	0.1457	0.0642	0.1096		0.0109	0.0616	0.0182	0.0464	0.0263	0.0010
HLW99-28	0.0020		0.0000			0.0020		0.0200		1.0000	0.0397	0.1490	0.0630	0.0205		0.0106	0.0016	0.0185	0.1065	0.0268	0.0017
HLW99-29	0.0020		0.0000			0.0020		0.0200		0.9999	0.0046	0.0532	0.0012	0.0210		0.0099	0.0315	0.0122	0.1156	0.0187	0.0017
HLW99-30	0.0020		0.0000			0.0020		0.0200		0.9999	0.0437	0.1218	0.0009	0.0204		0.0117	0.0115	0.0059	0.1840	0.0078	0.0012
HLW99-31	0.0020		0.0800			0.0020		0.0200		1.0000	0.1018	0.1756	0.0011	0.0223		0.0113	0.0022	0.0012	0.1708	0.0017	0.0329
HLW99-32	0.0020		0.0800			0.0020		0.0200		1.0001	0.0116	0.0641	0.0008	0.1156		0.0115	0.0420	0.0031	0.1213	0.0044	0.0362

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
HLW99-13	0.4713	0.0004	0.0020	0.0020	0.0386	0.0190		0.0274				0.0021		0.0010		0.0023					
HLW99-14	0.3466	0.0312	0.0022	0.0019	0.0378	0.0186		0.0268				0.0017		0.0000		0.0021					
HLW99-15	0.3256	0.0004	0.0017	0.0018	0.0404	0.0196		0.0278				0.0018		0.0000		0.0021					
HLW99-16	0.5360	0.0001	0.0024	0.0019	0.0230	0.0115		0.0162				0.0018		0.0000		0.0022					
HLW99-17	0.3647	0.1009	0.0028	0.0019	0.0010	0.0006		0.0005				0.0029		0.0042		0.0021					
HLW99-18	0.3083	0.0285	0.0018	0.0020	0.0322	0.0159		0.0229				0.0023		0.0000		0.0023					
HLW99-19	0.3177	0.0032	0.0025	0.0020	0.0002	0.0002		0.0001				0.0027		0.0033		0.0023					
HLW99-20	0.3387	0.0007	0.0024	0.0021	0.0368	0.0199		0.0278				0.0027		0.0038		0.0024					
HLW99-21	0.4989	0.0483	0.0021	0.0020	0.0002	0.0000		0.0001				0.0023		0.0001		0.0023					
HLW99-22	0.3043	0.0878	0.0023	0.0023	0.0013	0.0009		0.0008				0.0027		0.0044		0.0023					
HLW99-23	0.3248	0.0045	0.0018	0.0020	0.0334	0.0183		0.0245				0.0028		0.0046		0.0023					
HLW99-24R	0.3042	0.0871	0.0028	0.0020	0.0003	0.0000		0.0001				0.0022		0.0001		0.0023					
HLW99-25	0.3496	0.0020	0.0022	0.0019	0.0188	0.0093		0.0135				0.0023		0.0000		0.0022					
HLW99-26	0.4072	0.0008	0.0025	0.0019	0.0373	0.0200		0.0279				0.0027		0.0032		0.0022					
HLW99-27	0.3299	0.0004	0.0021	0.0016	0.0372	0.0189		0.0270				0.0021		0.0001		0.0021					
HLW99-28	0.3204	0.0696	0.0024	0.0019	0.0371	0.0198		0.0276				0.0023		0.0001		0.0022					
HLW99-29	0.5209	0.0858	0.0026	0.0021	0.0254	0.0124		0.0182				0.0023		0.0002		0.0020					
HLW99-30	0.3965	0.0898	0.0024	0.0022	0.0113	0.0056		0.0080				0.0021		0.0000		0.0022					
HLW99-31	0.3014	0.0009	0.0020	0.0019	0.0025	0.0014		0.0016				0.0026		0.0046		0.0024					
HLW99-32	0.3593	0.0699	0.0023	0.0021	0.0065	0.0034		0.0044				0.0029		0.0045		0.0023					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
HLW99-13			0.0024						0.0109												0.0023
HLW99-14			0.0023						0.0032												0.0019
HLW99-15			0.0021						0.0035												0.0019
HLW99-16			0.0022						0.0019												0.0021
HLW99-17			0.0023						0.0011												0.0023
HLW99-18			0.0023						0.0030												0.0021
HLW99-19			0.0024						0.0007												0.0021
HLW99-20			0.0025						0.0112												0.0023
HLW99-21			0.0022						0.0002												0.0019
HLW99-22			0.0024						0.0010												0.0023
HLW99-23			0.0024						0.0099												0.0022
HLW99-24R			0.0025						0.0003												0.0018
HLW99-25			0.0024						0.0017												0.0020
HLW99-26			0.0023						0.0109												0.0023
HLW99-27			0.0022						0.0034												0.0020
HLW99-28			0.0022						0.0034												0.0020
HLW99-29			0.0021						0.0022												0.0022
HLW99-30			0.0023						0.0011												0.0022
HLW99-31			0.0025						0.0011												0.0024
HLW99-32			0.0025						0.0023												0.0025

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
HLW99-13	0.0011					0.0024		0.0020		0.0101	0.0010		0.0167			0.0030		0.0196		0.9706
HLW99-14	0.0006					0.0027		0.0021		0.0110	0.0013		0.0001			0.0024		0.0186		0.9884
HLW99-15	0.0006					0.0025		0.0020		0.0107	0.0005		0.0001			0.0025		0.0190		0.9841
HLW99-16	0.0010					0.0023		0.0020		0.0061	0.0009		0.0001			0.0024		0.0199		0.9838
HLW99-17	0.0011					0.0021		0.0020		0.0008	0.0029		0.0853			0.0033		0.0192		0.9757
HLW99-18	0.0017					0.0024		0.0020		0.0085	0.0008		0.0003			0.0027		0.0199		0.9809
HLW99-19	0.0005					0.0021		0.0018		0.0005	0.0012		0.0680			0.0026		0.0182		0.9637
HLW99-20	0.0014					0.0025		0.0022		0.0103	0.0015		0.0634			0.0029		0.0202		0.9619
HLW99-21	0.0013					0.0022		0.0021		0.0006	0.0010		0.0006			0.0022		0.0195		0.9481
HLW99-22	0.0008					0.0021		0.0020		0.0007	0.0021		0.0565			0.0027		0.0211		0.9373
HLW99-23	0.0013					0.0025		0.0020		0.0089	0.0009		0.0632			0.0031		0.0198		0.9506
HLW99-24R	0.0006					0.0024		0.0022		0.0006	0.0015		0.0008			0.0024		0.0200		0.9513
HLW99-25	0.0013					0.0025		0.0017		0.0056	0.0006		0.0003			0.0024		0.0200		0.9884
HLW99-26	0.0007					0.0023		0.0021		0.0099	0.0015		0.0712			0.0029		0.0190		0.9284
HLW99-27	0.0009					0.0024		0.0019		0.0115	0.0006		0.0004			0.0024		0.0193		0.9820
HLW99-28	0.0012					0.0023		0.0020		0.0110	0.0016		0.0006			0.0026		0.0190		0.9692
HLW99-29	0.0010					0.0022		0.0020		0.0066	0.0013		0.0006			0.0023		0.0235		0.9875
HLW99-30	0.0012					0.0022		0.0045		0.0031	0.0015		0.0003			0.0019		0.0199		0.9692
HLW99-31	0.0013					0.0022		0.0020		0.0009	0.0012		0.0454			0.0026		0.0203		0.9241
HLW99-32	0.0015					0.0022		0.0020		0.0020	0.0021		0.0686			0.0027		0.0198		0.9764

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
HLW99-13								
HLW99-14	1150		>1150		Dark brown glass with green swirls and streaks on the surface. Cross section appears uniform			
HLW99-15	1150		850		Dark green glass with black patches on top and bottom. Cross section appears uniform			
HLW99-16	1150		1100		Brown glass with brownish green streaks on top and bottom. Cross section appears uniform			
HLW99-17								
HLW99-18	1150		1075		Homogeneous black glass with silvery patches left in crucible			
HLW99-19	1150		> 950 °C		Brown glass with blue and green regions across cross sections. Crystals found in glass shards			
HLW99-20	1150		> 950 °C		Dark brown glass with gray swirls on surface and silvery patches. Some undissolved crystals			
HLW99-21	1150		975		Blue glass with green regions on surface and cross sections			
HLW99-22	1150		> 950 °C		Mostly uniform dark brown glass with gray patches on surface and small amount of undissolved crystals			
HLW99-23								
HLW99-24R	1200		925		Brown glass with multicolored regions and undissolved lumps. Glass cloudy after remelt at 1300 °C			
HLW99-25	1150		1125		Brown glass with streaks and silver patches on surface			
HLW99-26	1150		> 950 °C		Brown glass with green areas in cross section Glass shards with crystals			
HLW99-27	1150		1075		Brown glass with swirls on surface. Inhomogeneous cross section with undissolved material			
HLW99-28	1150		> 950 °C		Mostly homogeneous black glass with red tinge. Trace amount of undissolved material			
HLW99-29	1250		1150		Inhomogeneous glass with green and gray regions and silver patches. Trace amount of undissolved material			
HLW99-30	1150		925		Mostly homogeneous black glass with brown streaks on surface			
HLW99-31								
HLW99-32								

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
HLW99-13					
HLW99-14					Up to 2.5 vol% of magnetic spinel crystals, mostly settle to the bottom
HLW99-15					Homogeneous glass with trace RuO2 (20 ´ 70 mm)
HLW99-16					About 2 vol% of magnetic spinel throughout glass but concentrate at bottom
HLW99-17					
HLW99-18					1) Up to 1.5 vol% of rod shaped NiO 2) 0.2 vol% of ZrO2 (w/ Ce, Sb Ca) 3) > 0.1 vol% of RuO2 4) Trace amount of Pd/Rh alloy
HLW99-19					Up to 15 vol% of magnetic spinel crystals with heavy coverage at the glass/air interface
HLW99-20					Up to 0.6 vol% of rectangular prismatic crystals o NiO
HLW99-21					Dark crystals of RuO2 and Rh throughout the bulk of glass. Total 0.2 vol%
HLW99-22					Clusters of white zirconium containing crystals. Dark RuO2 crystals. Total 2.5 vol%. Inhomogeneous possibly due to silver
HLW99-23					
HLW99-24R					About 5 vol% of white zirconium containing crystals, mostly settle to the bottom
HLW99-25					5 vol% of spinel (trevorite) with minor incorporation (Al, Zn, Rh). About 0.2 vol% of RuO2
HLW99-26					Heavy crystallization with over 1 vol% of magnetic spinel and over 10 vol% of clino-pyroxene
HLW99-27					About 3 vol% of spinel (trevorite) with minor incorporation of other elements, centered around Rh/Pd metal
HLW99-28					About 1.5 vol% of NiO with incorpo-ration of Fe and Sb. Trace amount of Rh and RuO2
HLW99-29					1 vol% of small dark non-magnetic crystals
HLW99-30					0.5 vol% of RuO2 About 0.5 vol% of non-magnetic rod shaped crystals
HLW99-31					
HLW99-32					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
HLW99-13		2.98													
HLW99-14		2.93													
HLW99-15		2.86					-10.171	12934.2	0.34				1000	1.018	1050
HLW99-16															
HLW99-17															
HLW99-18															
HLW99-19															
HLW99-20															
HLW99-21															
HLW99-22															
HLW99-23															
HLW99-24R															
HLW99-25															
HLW99-26															
HLW99-27															
HLW99-28															
HLW99-29															
HLW99-30							-13.007	19960.0	2.77				1000	15.036	1050
HLW99-31															
HLW99-32															

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
HLW99-13																					
HLW99-14																					
HLW99-15	0.662	1100	0.459	1150	0.336	1200	0.256														
HLW99-16																					
HLW99-17																					
HLW99-18																					
HLW99-19																					
HLW99-20																					
HLW99-21																					
HLW99-22																					
HLW99-23																					
HLW99-24R																					
HLW99-25																					
HLW99-26																					
HLW99-27																					
HLW99-28																					
HLW99-29																					
HLW99-30	7.808	1100	4.452	1150	2.736	1200	1.787														
HLW99-31																					
HLW99-32																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
HLW99-13																
HLW99-14																
HLW99-15					13.27	12.93	11.83	1.385	11.35							
HLW99-16																
HLW99-17																
HLW99-18																
HLW99-19																
HLW99-20																
HLW99-21																
HLW99-22																
HLW99-23																
HLW99-24R																
HLW99-25																
HLW99-26																
HLW99-27					0.555	0.615	0.61	0.18	10.71							
HLW99-28																
HLW99-29																
HLW99-30																
HLW99-31																
HLW99-32																

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
HLW99-13				0.388	0.049	8.764	6.645	0.026	5.047	2.024	0.266	4.531
HLW99-14				0.079	0.049	3.804	2.648	0.008	1.945	0.211	0.075	1.63
HLW99-15				0.577	2.768	99.555	47.236	0.073	65.141	4.868	0.806	12.33
HLW99-16				0.064	0.049	0.404	0.276	<0.0055	0.207	<0.0243	0.0532	0.309
HLW99-17				0.028	0.219	0.053	0.057	1.43	0.102	0.185	0.719	16.94
HLW99-18				0.736	0.053	17.703	11.891	0.02	8.929	0.912	0.195	9.45
HLW99-19				0.07	0.049	0.048	0.011	0.021	0.022	0.082	0.138	0.96
HLW99-20				0.128	0.277	17.5	17.884	0.085	14.79	1.998	0.423	10.72
HLW99-21				0.026	0.049	0.089	0.048	<.0055	0.023	0.049	0.056	0.625
HLW99-22				0.392	0.049	0.29	0.188	0.085	0.2	0.105	0.185	4.481
HLW99-23				0.079	0.627	28.944	43.541	4.222	53.192	0.35	1.333	13.138
HLW99-24R				0.125	0.06	0.27	0.088	0.021	0.141	0.22	0.106	22.953
HLW99-25				0.072	0.049	2.239	1.626	0.011	0.967	0.156	0.0532	2.102
HLW99-26				0.033	0.049	2.344	1.521	0.037	1.24	0.492	0.138	1.102
HLW99-27				0.025	0.063	41.818	30.943	0.006	23.934	0.781	0.0532	18.43
HLW99-28				0.179	0.103	20.759	16.978	0.009	14.359	0.888	0.085	9.841
HLW99-29				0.086	0.049	0.719	0.482	<.0055	0.389	0.114	0.0532	0.611
HLW99-30				0.333	0.049	1.832	1.444	<0.0055	0.962	0.072	0.0532	3.187
HLW99-31				0.254	0.087	0.111	0.082	0.582	0.203	0.362	0.419	13.152
HLW99-32				0.088	0.049	0.303	0.185	0.033	0.133	0.079	0.116	1.024

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
HLW99-33	0.0000	0.2000	0.0700	0.0200		0.0100	0.0700	0.0000	0.0800	0.0000	0.0300	0.3730	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-34	0.0000	0.0500	0.0000	0.0297		0.0100	0.0700	0.0000	0.0800	0.0000	0.0300	0.5300	0.0533	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-35	0.0914	0.0500	0.0400	0.0700		0.0100	0.0536	0.0000	0.0729	0.0000	0.0000	0.5086	0.0486	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-36	0.0000	0.2000	0.0133	0.1250		0.0100	0.0700	0.0017	0.0800	0.0025	0.0000	0.3800	0.0533	0.0025	0.0020	0.0033	0.0017		0.0025		0.0020
HLW99-37	0.1100	0.0700	0.0000	0.0200		0.0100	0.0500	0.0094	0.1200	0.0141	0.0000	0.4900	0.0000	0.0025	0.0020	0.0188	0.0094		0.0141		0.0020
HLW99-38	0.0000	0.0500	0.0700	0.0200		0.0100	0.0700	0.0137	0.0500	0.0206	0.0300	0.4100	0.0333	0.0025	0.0020	0.0274	0.0137		0.0206		0.0020
HLW99-39	0.0000	0.1250	0.0700	0.1250		0.0100	0.0400	0.0013	0.1400	0.0019	0.0000	0.4250	0.0000	0.0025	0.0020	0.0025	0.0013		0.0019		0.0020
HLW99-40	0.1100	0.2000	0.0000	0.0675		0.0100	0.0000	0.0000	0.1200	0.0000	0.0000	0.4075	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-41	0.0516	0.1171	0.0303	0.0614		0.0100	0.0317	0.0062	0.1129	0.0094	0.0124	0.3973	0.0322	0.0025	0.0020	0.0125	0.0062		0.0094		0.0020
HLW99-42	0.1100	0.1775	0.0450	0.0200		0.0100	0.0350	0.0000	0.0500	0.0000	0.0000	0.4675	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-43	0.0850	0.2000	0.0700	0.1250		0.0100	0.0675	0.0000	0.0850	0.0000	0.0000	0.3025	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-44	0.0850	0.0700	0.0700	0.1250		0.0100	0.0100	0.0000	0.2000	0.0000	0.0184	0.3000	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-45	0.1067	0.1600	0.0700	0.0200		0.0100	0.0700	0.0004	0.0500	0.0006	0.0300	0.3000	0.0333	0.0025	0.0020	0.0008	0.0004		0.0006		0.0020
HLW99-46	0.0000	0.1158	0.0700	0.0200		0.0100	0.0700	0.0200	0.0800	0.0300	0.0000	0.3658	0.0533	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-47	0.0500	0.0500	0.0350	0.1250		0.0100	0.0300	0.0000	0.0950	0.0000	0.0000	0.5500	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-48	0.1100	0.0650	0.0000	0.0850		0.0100	0.0000	0.0200	0.2000	0.0300	0.0000	0.3150	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-49	0.0425	0.0650	0.0000	0.1250		0.0100	0.0000	0.0029	0.2000	0.0043	0.0300	0.3150	0.0425	0.0025	0.0020	0.0058	0.0029		0.0043		0.0020
HLW99-50	0.0500	0.0600	0.0000	0.0200		0.0100	0.0700	0.0000	0.0500	0.0000	0.0250	0.5500	0.0333	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-51R	0.0000	0.2000	0.0700	0.0200		0.0100	0.0000	0.0000	0.2000	0.0000	0.0300	0.3000	0.0230	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-52	0.0250	0.2000	0.0000	0.0200		0.0100	0.0000	0.0200	0.1600	0.0300	0.0000	0.3700	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-53	0.0000	0.0500	0.0700	0.1250		0.0100	0.0000	0.0124	0.1200	0.0186	0.0150	0.4100	0.0000	0.0025	0.0020	0.0248	0.0124		0.0186		0.0020
HLW99-54	0.1100	0.0500	0.0000	0.0200		0.0100	0.0350	0.0138	0.1200	0.0206	0.0000	0.4900	0.0000	0.0025	0.0020	0.0275	0.0138		0.0206		0.0020
HLW99-55	0.0400	0.0500	0.0700	0.0700		0.0100	0.0100	0.0094	0.2000	0.0141	0.0000	0.3200	0.1000	0.0025	0.0020	0.0188	0.0094		0.0141		0.0020
HLW99-56R	0.0367	0.0500	0.0000	0.1250		0.0100	0.0700	0.0200	0.0500	0.0300	0.0000	0.4100	0.0333	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-57	0.0000	0.0500	0.0000	0.1250		0.0100	0.0100	0.0000	0.2000	0.0000	0.0000	0.4700	0.0800	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-58	0.1100	0.2000	0.0700	0.0200		0.0100	0.0000	0.0044	0.2000	0.0066	0.0000	0.3000	0.0000	0.0025	0.0020	0.0088	0.0044		0.0066		0.0020
HLW99-59	0.1100	0.0500	0.0650	0.0200		0.0100	0.0700	0.0200	0.0500	0.0300	0.0000	0.4100	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
HLW99-33	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-34	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-35	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-36	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0008	
HLW99-37	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0047	
HLW99-38	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0069	
HLW99-39	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0006	
HLW99-40	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-41	0.0020	0.0020		0.0021	0.0020	0.0020		0.0020					0.0020	0.0020						0.0031	
HLW99-42	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-43	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-44	0.0020	0.0020		0.0031	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-45	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0002	
HLW99-46	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-47	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-48	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-49	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0014	
HLW99-50	0.0020	0.0020		0.0042	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-51R	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-52	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-53	0.0020	0.0020		0.0025	0.0020	0.0020		0.0020					0.0020	0.0020						0.0062	
HLW99-54	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0069	
HLW99-55	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0047	
HLW99-56R	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-57	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-58	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0022	
HLW99-59	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
HLW99-33	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-34	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-35	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0000
HLW99-36	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0008
HLW99-37	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0047
HLW99-38	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0069
HLW99-39	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0006
HLW99-40	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0000
HLW99-41	0.0004						0.0008		0.0013		0.0020	0.0020				0.0021	0.0020		0.0020	0.0008	0.0031
HLW99-42	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0000
HLW99-43	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0000
HLW99-44	0.0004						0.0008		0.0013		0.0020	0.0020				0.0031	0.0020		0.0020	0.0012	0.0000
HLW99-45	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0002
HLW99-46	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-47	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0000
HLW99-48	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-49	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0014
HLW99-50	0.0004						0.0008		0.0013		0.0020	0.0020				0.0042	0.0020		0.0020	0.0017	0.0000
HLW99-51R	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-52	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-53	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0020		0.0020	0.0010	0.0062
HLW99-54	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0069
HLW99-55	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0047
HLW99-56R	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-57	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0000
HLW99-58	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0022
HLW99-59	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
HLW99-33	0.0020		0.0800			0.0020		0.0200		1.0000	0.0118	0.1903	0.0631	0.0259		0.0117	0.0645	0.0005	0.0761	0.0007	0.0325
HLW99-34	0.0020		0.0800			0.0020		0.0200		1.0000	0.0060	0.0622	0.0038	0.0297		0.0113	0.0652	0.0003	0.0763	0.0004	0.0368
HLW99-35	0.0020		0.0000			0.0020		0.0200		1.0001	0.0895	0.0500	0.0387	0.0686		0.0102	0.0500	0.0004	0.0699	0.0004	0.0013
HLW99-36	0.0020		0.0000			0.0020		0.0200		0.9999	0.0140	0.1927	0.0137	0.1170		0.0101	0.0646	0.0020	0.0759	0.0023	0.0009
HLW99-37	0.0020		0.0000			0.0020		0.0200		1.0002	0.1076	0.0707	0.0009	0.0198		0.0101	0.0488	0.0096	0.1158	0.0134	0.0017
HLW99-38	0.0020		0.0800			0.0020		0.0200		1.0001	0.0086	0.0513	0.0651	0.0207		0.0115	0.0611	0.0133	0.0463	0.0189	0.0317
HLW99-39	0.0020		0.0000			0.0020		0.0200		1.0001	0.0098	0.1233	0.0680	0.1179		0.0115	0.0404	0.0015	0.1268	0.0018	0.0010
HLW99-40	0.0020		0.0000			0.0020		0.0200		1.0000	0.1037	0.1944	0.0003	0.0645		0.0117	0.0003	0.0001	0.1123	0.0001	0.0012
HLW99-41	0.0020		0.0332			0.0020		0.0200		1.0000	0.0521	0.1124	0.0292	0.0587		0.0105	0.0297	0.0060	0.0986	0.0087	0.0151
HLW99-42	0.0020		0.0000			0.0020		0.0200		1.0000	0.1060	0.1631	0.0426	0.0195		0.0109	0.0328	0.0003	0.0461	0.0001	0.0013
HLW99-43	0.0020		0.0000			0.0020		0.0200		1.0000	0.0913	0.1901	0.0666	0.1153		0.0112	0.0617	0.0003	0.0789	0.0001	0.0010
HLW99-44	0.0020		0.0492			0.0020		0.0200		1.0000	0.0835	0.0693	0.0658	0.1169		0.0114	0.0121	0.0004	0.1792	0.0003	0.0202
HLW99-45	0.0020		0.0800			0.0020		0.0200		1.0002	0.1003	0.1584	0.0664	0.0208		0.0103	0.0666	0.0007	0.0490	0.0010	0.0312
HLW99-46	0.0020		0.0000			0.0020		0.0200		0.9999	0.0152	0.1132	0.0657	0.0206		0.0111	0.0639	0.0188	0.0724	0.0284	0.0010
HLW99-47	0.0020		0.0000			0.0020		0.0200		1.0000	0.0481	0.0466	0.0338	0.1127		0.0111	0.0272	0.0003	0.0834	0.0003	0.0008
HLW99-48	0.0020		0.0000			0.0020		0.0200		1.0000	0.1050	0.0624	0.0008	0.0808		0.0118	0.0007	0.0187	0.1799	0.0281	0.0012
HLW99-49	0.0020		0.0800			0.0020		0.0200		1.0000	0.0404	0.0628	0.0002	0.1126		0.0110		0.0029	0.1765	0.0044	0.0313
HLW99-50	0.0020		0.0667			0.0020		0.0200		1.0001	0.0486	0.0603	0.0007	0.0208		0.0116	0.0607	0.0002	0.0484	0.0005	0.0280
HLW99-51R	0.0020		0.0800			0.0020		0.0200		1.0000	0.0098	0.1876	0.0644	0.0205		0.0118	0.0009	0.0004	0.1626	0.0004	0.0329
HLW99-52	0.0020		0.0000			0.0020		0.0200		1.0000	0.0301	0.1852	0.0008	0.0193		0.0105	0.0005	0.0182	0.1471	0.0276	0.0012
HLW99-53	0.0020		0.0400			0.0020		0.0200		1.0002	0.0077	0.0526	0.0598	0.1037		0.0093	0.0045	0.0112	0.0973	0.0157	0.0161
HLW99-54	0.0020		0.0000			0.0020		0.0200		1.0001	0.1043	0.0491	0.0010	0.0187		0.0106	0.0330	0.0133	0.1100	0.0195	0.0004
HLW99-55	0.0020		0.0000			0.0020		0.0200		1.0002	0.0443	0.0523	0.0666	0.0675		0.0117	0.0129	0.0095	0.1612	0.0129	0.0009
HLW99-56R	0.0020		0.0000			0.0020		0.0200		1.0000	0.0415	0.0531	0.0012	0.1153		0.0105	0.0638	0.0183	0.0470	0.0275	0.0015
HLW99-57	0.0020		0.0000			0.0020		0.0200		1.0000	0.0060	0.0516	0.0006	0.1184		0.0118	0.0138	0.0007	0.1743	0.0009	0.0017
HLW99-58	0.0020		0.0000			0.0020		0.0200		1.0002	0.1043	0.1881	0.0654	0.0230		0.0114	0.0011	0.0044	0.1708	0.0062	0.0011
HLW99-59	0.0020		0.0000			0.0020		0.0200		1.0000	0.1073	0.0533	0.0617	0.0209		0.0112	0.0623	0.0190	0.0456	0.0284	0.0020

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
HLW99-33	0.3727	0.0048	0.0024	0.0022	0.0008	0.0006		0.0005				0.0028		0.0045		0.0022					
HLW99-34	0.4976	0.0432	0.0026	0.0022	0.0003	0.0004		0.0002				0.0028		0.0044		0.0023					
HLW99-35	0.5114	0.0462	0.0024	0.0020	0.0005	0.0003		0.0002				0.0023		0.0001		0.0021					
HLW99-36	0.3884	0.0439	0.0024	0.0020	0.0036	0.0016		0.0023				0.0021		0.0001		0.0019					
HLW99-37	0.4988	0.0004	0.0022	0.0018	0.0191	0.0093		0.0137				0.0022		0.0001		0.0021					
HLW99-38	0.4222	0.0276	0.0025		0.0258			0.0180				0.0033		0.0047							
HLW99-39	0.4181	0.0005	0.0019	0.0021	0.0028	0.0013		0.0018				0.0020		0.0001		0.0020					
HLW99-40	0.4087	0.0228	0.0023	0.0018	0.0001	0.0002		0.0000				0.0021		0.0000		0.0020					
HLW99-41	0.3904	0.0301	0.0024	0.0016	0.0120	0.0065		0.0089				0.0022		0.0018		0.0021					
HLW99-42	0.4549	0.0230	0.0025	0.0020	0.0001	0.0003		0.0000				0.0022		0.0000		0.0021					
HLW99-43	0.3117	0.0002	0.0023	0.0022	0.0002	0.0006		0.0000				0.0022		0.0001		0.0023					
HLW99-44	0.3103	0.0007	0.0018	0.0023	0.0001	0.0003		0.0001				0.0026		0.0029		0.0022					
HLW99-45	0.3252	0.0275	0.0022	0.0018	0.0010	0.0008		0.0006				0.0031		0.0043		0.0023					
HLW99-46	0.3672	0.0438	0.0023	0.0020	0.0385	0.0216		0.0301				0.0022		0.0001		0.0020					
HLW99-47	0.5352	0.0005	0.0022	0.0021	0.0004	0.0010		0.0002				0.0021		0.0000		0.0018					
HLW99-48	0.3166	0.0175	0.0017	0.0020	0.0392	0.0204		0.0290				0.0023		0.0000		0.0021					
HLW99-49	0.3077	0.0394	0.0019	0.0013	0.0058	0.0031		0.0041				0.0026		0.0047		0.0022					
HLW99-50	0.5334	0.0262	0.0025		0.0001			0.0001				0.0030		0.0040							
HLW99-51R	0.2896	0.0209	0.0026	0.0019	0.0004	0.0006		0.0003				0.0025		0.0044		0.0031					
HLW99-52	0.3728	0.0001	0.0024	0.0018	0.0393	0.0195		0.0282				0.0019		0.0000		0.0022					
HLW99-53	0.3849	0.0037	0.0024	0.0020	0.0194	0.0110		0.0165				0.0019		0.0020		0.0021					
HLW99-54	0.4768	0.0003	0.0027	0.0015	0.0269	0.0133		0.0194				0.0020		0.0000		0.0023					
HLW99-55	0.3245	0.0808	0.0020		0.0186			0.0126				0.0024		0.0002							
HLW99-56R	0.4093	0.0292	0.0024	0.0020	0.0362	0.0192		0.0268				0.0020		0.0001		0.0021					
HLW99-57	0.4646	0.0654	0.0027	0.0020	0.0014	0.0006		0.0008				0.0020		0.0001		0.0022					
HLW99-58	0.3063	0.0019	0.0023	0.0020	0.0098	0.0044		0.0061				0.0021		0.0001		0.0022					
HLW99-59	0.4121	0.0003	0.0024	0.0021	0.0381	0.0199		0.0279				0.0022		0.0001		0.0022					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
HLW99-33			0.0023						0.0009												0.0023
HLW99-34			0.0023						0.0008												0.0023
HLW99-35			0.0023						0.0002												0.0020
HLW99-36			0.0022						0.0005												0.0019
HLW99-37			0.0023						0.0017												0.0019
HLW99-38			0.0024						0.0065		0.0003						0.0003		0.0003		0.0004
HLW99-39			0.0023						0.0003												0.0019
HLW99-40			0.0023						0.0002												0.0020
HLW99-41			0.0032						0.0035		0.0003						0.0003		0.0002		0.0030
HLW99-42			0.0025						0.0002												0.0020
HLW99-43			0.0026						0.0002												0.0018
HLW99-44			0.0025						0.0005		0.0003						0.0003		0.0004		0.0035
HLW99-45			0.0027						0.0009		0.0004						0.0005		0.0003		0.0039
HLW99-46			0.0025						0.0035												0.0020
HLW99-47			0.0024						0.0001												0.0020
HLW99-48			0.0026						0.0034												0.0019
HLW99-49			0.0024						0.0021		0.0004						0.0003		0.0003		0.0030
HLW99-50			0.0029						0.0005		0.0003						0.0002		0.0002		0.0026
HLW99-51R			0.0024						0.0006		0.0003						0.0003		0.0004		0.0022
HLW99-52			0.0024						0.0102												0.0022
HLW99-53			0.0039						0.0067		0.0003						0.0003		0.0002		0.0022
HLW99-54			0.0026						0.0074												0.0022
HLW99-55			0.0026						0.0045		0.0005						0.0004		0.0001		0.0025
HLW99-56R			0.0039						0.0101												0.0020
HLW99-57			0.0025						0.0005												0.0022
HLW99-58			0.0023						0.0026												0.0019
HLW99-59			0.0024						0.0109												0.0022

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
HLW99-33	0.0010					0.0022		0.0020		0.0007	0.0012		0.0680			0.0028		0.0199		0.9739
HLW99-34	0.0011					0.0021		0.0020		0.0005	0.0018		0.0714			0.0026		0.0193		0.9542
HLW99-35	0.0010					0.0021		0.0018		0.0005	0.0012		0.0006			0.0019		0.0281		0.9882
HLW99-36	0.0006					0.0020		0.0017		0.0016	0.0009		0.0005			0.0020		0.0218		0.9772
HLW99-37	0.0014					0.0022		0.0021		0.0049	0.0010		0.0004			0.0020		0.0229		0.9909
HLW99-38	0.0014					0.0024		0.0024		0.0072			0.0668					0.0191		0.9421
HLW99-39	0.0011					0.0023		0.0021		0.0011	0.0005		0.0004			0.0020		0.0203		0.9689
HLW99-40	0.0006					0.0022		0.0020		0.0003	0.0015		0.0002			0.0020		0.0194		0.9613
HLW99-41	0.0010					0.0030		0.0026		0.0037	0.0015		0.0294			0.0024		0.0191		0.9522
HLW99-42	0.0006					0.0021		0.0017		0.0004	0.0013		0.0004			0.0021		0.0204		0.9435
HLW99-43	0.0006					0.0022		0.0019		0.0008	0.0006		0.0005			0.0023		0.0207		0.9725
HLW99-44	0.0010					0.0023		0.0024		0.0005	0.0009		0.0422			0.0024		0.0193		0.9609
HLW99-45	0.0011					0.0025		0.0021		0.0007	0.0018		0.0698			0.0027		0.0199		0.9828
HLW99-46	0.0006					0.0027		0.0021		0.0112	0.0008		0.0005			0.0026		0.0203		0.9689
HLW99-47	0.0007					0.0022		0.0020		0.0003	0.0007		0.0003			0.0020		0.0210		0.9435
HLW99-48	0.0016					0.0026		0.0022		0.0112	0.0012		0.0002			0.0022		0.0003		0.9496
HLW99-49	0.0017					0.0021		0.0024		0.0018	0.0017		0.0611			0.0028		0.0188		0.9158
HLW99-50	0.0012					0.0027		0.0022		0.0004			0.0576					0.0194		0.9393
HLW99-51R	0.0006					0.0023		0.0017		0.0006	0.0012		0.0658			0.0030		0.0184		0.9174
HLW99-52	0.0004					0.0024		0.0021		0.0104	0.0008		0.0002			0.0023		0.0194		0.9615
HLW99-53	0.0011					0.0034		0.0025		0.0057	0.0010		0.0344			0.0026		0.0189		0.9070
HLW99-54	0.0012					0.0022		0.0021		0.0071	0.0011		0.0001			0.0022		0.0197		0.9530
HLW99-55	0.0017					0.0026		0.0021		0.0055			0.0010					0.0193		0.9237
HLW99-56R	0.0007					0.0034		0.0018		0.0105	0.0013		0.0003			0.0023		0.0201		0.9654
HLW99-57	0.0007					0.0024		0.0019		0.0007	0.0013		0.0003			0.0023		0.0207		0.9571
HLW99-58	0.0005					0.0024		0.0020		0.0026	0.0007		0.0005			0.0023		0.0198		0.9506
HLW99-59	0.0010					0.0028		0.0021		0.0110	0.0005		0.0004			0.0025		0.0197		0.9745

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
HLW99-33	1150		< 950 °C		Dark green glass with cross section fragment of white and green			
HLW99-34								
HLW99-35	1150		1025		Inhomogeneous glass with green and black regions. Silvery crystals and undis-solved material			
HLW99-36	1150		910		Mostly uniform black glass with green and silver patches			
HLW99-37	1150		1000		Mostly homogeneous black glass with grayish cross sections			
HLW99-38								
HLW99-39	1150		875		Brownish green glass with multicolored regions. Cross section appears uniform			
HLW99-40	1200		1150		Homogeneous black glass with a reddish yellow tinge			
HLW99-41								
HLW99-42	1150		1100		Homogeneous black glass			
HLW99-43	1150		950		Mostly homogeneous brown glass with small multicolored regions			
HLW99-44								
HLW99-45								
HLW99-46	1150		925		Green glass with multicolored patches on surface. Uniform cross section			
HLW99-47			1050					
HLW99-48			>1150					
HLW99-49	1150		> 950 °C		Dark brown glass with small amount of a yellow non-glassy phase. Yellow phase deposit on crucible			
HLW99-50								
HLW99-51R								
HLW99-52	1150		1000		Homogeneous black glass with trace amount of gray precipitate			
HLW99-53								
HLW99-54			1150					
HLW99-55	1150		1100		Dark brown glass with patches of metallic looking precipitates on surface. Crystal-lization throughout bulk			
HLW99-56R	1150		1100		Cloudy brown glass with traces of metallic precipitate on bottom			
HLW99-57	1150		1050		Cloudy green glass with multicolored bottom			
HLW99-58	1150		1000		Dark brown glass with light brown regions			
HLW99-59	1150		1100		Mostly uniform brown glass with small areas of light brown swirls			

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
HLW99-33					Trace amount of dark crystals, likely RuO2
HLW99-34					
HLW99-35					0.15 vol% of zircon and 0.1 vol% of ZrO2. 0.1 vol% of spinel with cores of Rh/Pd. 0.05 vol% of RuO2
HLW99-36					Trace amount of dark crystals, likely RuO2
HLW99-37					> 0.5 vol% of RuO2 and Rh metal
HLW99-38					
HLW99-39					0.1 vol% of spinel with Rh incorporation 0.1 vol% of Rh and RuO2
HLW99-40					About 0.2 vol% of ZrO2 and up to 1 vol% of spinel (Fe, Zn) (Premelt 1300 °C)
HLW99-41					
HLW99-42					About 0.3 vol% of RuO2 and <0.01 vol% of Rh (Premelt 1300 °C)
HLW99-43					Up to 0.5 vol% of spinel (Fe, Zn, Rh) and 0.1 vol% of RuO2
HLW99-44					
HLW99-45					
HLW99-46					About 0.1 vol% of Ni-based spinel (< 5 mm) with incorporation of Zn, Rh, Sb and small amount of Fe
HLW99-47					
HLW99-48					
HLW99-49					About 0.5 vol% of an unidentified phase that contains Na, S, P, W, Cr and O. Brownish white cluster of ZrO2 with trace amount of Fe, Na
HLW99-50					
HLW99-51R					
HLW99-52					OM study shows 2 vol% of rod shaped non-magnetic crystals in star like clusters
HLW99-53					
HLW99-54					
HLW99-55					About 15 vol% of zircon (with Ca, Ce and Na), 1 vol% of spinel (trevorite) with Rh cores, and 0.5 vol% of ZrO2
HLW99-56R					About 7 vol% of spinel (trevorite with Zn, Ti, Sb and Al) with little to no Rh. 0.1 vol% of RuO2
HLW99-57					0.1 vol% of rhodium spinel (Fe, Zn). No evidence of settling
HLW99-58					0.2 vol% of RuO2 and 0.1 vol% of Rh spinel (Ni, Zn, Al and Fe)
HLW99-59					1 vol% of NiO with some incorporation of Fe, Mg and Zn. 0.1 vol% of spinel rich in Ni, Fe and Sb

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
HLW99-33															
HLW99-34															
HLW99-35															
HLW99-36															
HLW99-37															
HLW99-38															
HLW99-39															
HLW99-40															
HLW99-41															
HLW99-42															
HLW99-43															
HLW99-44															
HLW99-45															
HLW99-46															
HLW99-47															
HLW99-48															
HLW99-49															
HLW99-50															
HLW99-51R															
HLW99-52															
HLW99-53															
HLW99-54															
HLW99-55															
HLW99-56R															
HLW99-57															
HLW99-58															
HLW99-59															

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
HLW99-33																					
HLW99-34																					
HLW99-35																					
HLW99-36																					
HLW99-37																					
HLW99-38																					
HLW99-39																					
HLW99-40																					
HLW99-41																					
HLW99-42																					
HLW99-43																					
HLW99-44																					
HLW99-45																					
HLW99-46																					
HLW99-47																					
HLW99-48																					
HLW99-49																					
HLW99-50																					
HLW99-51R																					
HLW99-52																					
HLW99-53																					
HLW99-54																					
HLW99-55																					
HLW99-56R																					
HLW99-57																					
HLW99-58																					
HLW99-59																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
HLW99-33																
HLW99-34																
HLW99-35																
HLW99-36																
HLW99-37																
HLW99-38																
HLW99-39																
HLW99-40																
HLW99-41																
HLW99-42																
HLW99-43																
HLW99-44																
HLW99-45																
HLW99-46																
HLW99-47																
HLW99-48																
HLW99-49																
HLW99-50																
HLW99-51R																
HLW99-52					9.775	1.735	7.545	0.57	9.75							
HLW99-53																
HLW99-54																
HLW99-55																
HLW99-56R																
HLW99-57																
HLW99-58																
HLW99-59																

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
HLW99-33				0.109	2.427	0.025	0.007	0.085	0.072	0.564	1.917	9.783
HLW99-34				0.057	NA	0.041	0.019	0.025	0.011	0.168	NA	0.812
HLW99-35				0.057	0.049	0.026	0.007	<.0055	<.0079	0.086	0.0532	0.435
HLW99-36				0.059	0.049	0.666	0.423	<.0055	0.308	0.118	0.0532	3.867
HLW99-37				0.049	0.049	0.538	0.362	<.0055	0.297	0.126	0.0532	0.596
HLW99-38				0.678	0.398	8.047	6.407	0.104	5.539	1.188	0.198	5.482
HLW99-39				0.03	0.157	3.292	2.498	0.014	2.135	0.164	0.095	23.696
HLW99-40				0.073	0.064	0.011	<0.0027	<0.0055	<0.0079	<0.0243	0.0532	0.607
HLW99-41				0.194	0.049	1.051	0.759	0.014	0.647	0.162	0.0532	1.475
HLW99-42				0.05	0.086	0.082	0.045	<0.0055	0.025	<0.0243	0.0532	0.504
HLW99-43				0.109	0.071	0.025	<0.0027	<0.0055	<0.0079	0.033	0.0532	4.6
HLW99-44				0.492	0.049	0.031	0.007	0.157	0.038	0.101	0.068	3.237
HLW99-45				0.209	NA	0.116	0.067	0.076	0.079	0.09	NA	2.138
HLW99-46				0.372	0.425	58.931	56.468	0.038	53.415	0.397	0.563	34.913
HLW99-47				0.058	0.049	0.005	<0.0027	<0.0055	<0.0079	<0.0243	0.079	0.273
HLW99-48				0.216	0.049	4.356	3.162	<0.0055	1.456	0.297	0.072	0.016
HLW99-49				0.197	0.375	1.213	0.408	5.363	0.334	0.06	0.062	1.479
HLW99-50				0.045	NA	0.031	0.013	0.016	0.014	1.497	NA	0.843
HLW99-51R				0.174	2.363	0.19	<0.0027	4.729	0.234	0.777	1.851	8.813
HLW99-52				0.206	0.499	76.9	68.73	0.022	62.646	4.361	0.789	43.693
HLW99-53				0.205	0.049	1.943	1.146	0.017	0.778	0.284	0.125	1.214
HLW99-54				0.047	0.098	0.742	0.484	<0.0055	0.39	0.148	0.084	0.436
HLW99-55				0.227	0.094	5.618	4.049	0.019	2.2	0.482	0.056	5.131
HLW99-56R				0.109	0.051	1.488	0.987	<0.0055	0.466	0.282	0.0532	0.624
HLW99-57				0.046	0.049	0.031	0.004	<0.0055	<0.0079	<0.0243	0.071	0.55
HLW99-58				0.054	0.189	7.817	13.979	0.05	12.915	0.681	0.958	37.847
HLW99-59				0.128	0.049	2.346	1.678	<0.0055	1.296	0.506	0.088	1.022

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
HLW99-60	0.0000	0.1350	0.0000	0.1250		0.0100	0.0233	0.0135	0.0733	0.0203	0.0300	0.3483	0.0000	0.0025	0.0020	0.0270	0.0135		0.0203		0.0020
HLW99-61	0.0250	0.2000	0.0000	0.0200		0.0100	0.0000	0.0200	0.1600	0.0300	0.0000	0.3700	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-62	0.0000	0.0500	0.0000	0.0200		0.0100	0.0300	0.0123	0.1300	0.0184	0.0000	0.5200	0.0867	0.0025	0.0020	0.0246	0.0123		0.0184		0.0020
HLW99-63	0.0516	0.1171	0.0303	0.0614		0.0100	0.0317	0.0062	0.1129	0.0094	0.0124	0.3973	0.0322	0.0025	0.0020	0.0125	0.0062		0.0094		0.0020
HLW99-64	0.0530	0.0900	0.0000	0.0200		0.0100	0.0700	0.0200	0.0800	0.0300	0.0300	0.3400	0.0000	0.0025	0.0020	0.0400	0.0200		0.0300		0.0020
HLW99-65	0.1100	0.1830	0.0000	0.0200		0.0100	0.0000	0.0000	0.2000	0.0000	0.0300	0.3000	0.0000	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-66	0.0735	0.0525	0.0210	0.0210		0.0105	0.0315	0.0000	0.0992	0.0000	0.0013	0.5008	0.0315	0.0026	0.0021	0.0000	0.0000		0.0000		0.0021
HLW99-67	0.0735	0.0525	0.0210	0.1176		0.0105	0.0315	0.0000	0.0525	0.0000	0.0013	0.3146	0.0315	0.0026	0.0021	0.0000	0.0000		0.0000		0.0021
HLW99-68	0.0735	0.0525	0.0210	0.1313		0.0105	0.0315	0.0131	0.0704	0.0197	0.0013	0.3145	0.0315	0.0026	0.0021	0.0263	0.0131		0.0197		0.0021
HLW99-69	0.0735	0.0525	0.0210	0.0210		0.0105	0.0315	0.0131	0.0525	0.0197	0.0013	0.3146	0.0315	0.0026	0.0021	0.0263	0.0131		0.0197		0.0021
HLW99-70	0.0735	0.0525	0.0210	0.0210		0.0105	0.0315	0.0000	0.1139	0.0000	0.0013	0.3495	0.0315	0.0026	0.0021	0.0000	0.0000		0.0000		0.0021
HLW99-71	0.0735	0.0525	0.0210	0.1313		0.0105	0.0315	0.0000	0.0771	0.0000	0.0013	0.4127	0.0315	0.0026	0.0021	0.0000	0.0000		0.0000		0.0021
HLW99-72	0.0735	0.0525	0.0210	0.0210		0.0105	0.0315	0.0131	0.0781	0.0197	0.0013	0.4169	0.0315	0.0026	0.0021	0.0263	0.0131		0.0197		0.0021
HLW99-73	0.0736	0.0525	0.0210	0.0210		0.0105	0.0315	0.0000	0.1412	0.0000	0.0013	0.4586	0.0315	0.0026	0.0021	0.0000	0.0000		0.0000		0.0021
HLW99-74	0.0735	0.0525	0.0210	0.1313		0.0105	0.0315	0.0066	0.0525	0.0098	0.0013	0.3146	0.0315	0.0026	0.0021	0.0131	0.0066		0.0098		0.0021
HLW99-75	0.0735	0.0525	0.0210	0.1313		0.0105	0.0315	0.0088	0.1051	0.0132	0.0013	0.3142	0.0315	0.0026	0.0021	0.0176	0.0088		0.0132		0.0021
HLW99-76	0.0735	0.0525	0.0210	0.0210		0.0105	0.0315	0.0131	0.1051	0.0197	0.0013	0.3142	0.0315	0.0026	0.0021	0.0263	0.0131		0.0197		0.0021
HLW99-77	0.0735	0.0525	0.0210	0.1313		0.0105	0.0315	0.0000	0.1051	0.0000	0.0013	0.3142	0.0315	0.0026	0.0021	0.0000	0.0000		0.0000		0.0021
HLW99-78	0.0735	0.0525	0.0210	0.0562		0.0105	0.0315	0.0044	0.0788	0.0066	0.0013	0.3144	0.0315	0.0026	0.0021	0.0088	0.0044		0.0066		0.0021
HLW99-79	0.0735	0.0525	0.0210	0.0210		0.0105	0.0315	0.0000	0.0718	0.0000	0.0013	0.3917	0.0315	0.0026	0.0021	0.0000	0.0000		0.0000		0.0021
HLW99-80	0.0700	0.1000	0.0200	0.0725		0.0100	0.0300	0.0125	0.0500	0.0188	0.0025	0.3000	0.0300	0.0025	0.0020	0.0250	0.0125		0.0188		0.0020
HLW99-81	0.0736	0.0525	0.0210	0.0210		0.0105	0.0315	0.0000	0.1276	0.0000	0.0013	0.4040	0.0315	0.0026	0.0021	0.0000	0.0000		0.0000		0.0021
HLW99-82	0.0700	0.1000	0.0200	0.0560		0.0100	0.0300	0.0125	0.1072	0.0188	0.0025	0.3288	0.0300	0.0025	0.0020	0.0250	0.0125		0.0188		0.0020
HLW99-83	0.0700	0.1000	0.0200	0.0804		0.0100	0.0300	0.0000	0.0672	0.0000	0.0025	0.3690	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-84	0.0700	0.1000	0.0200	0.0200		0.0100	0.0300	0.0073	0.0674	0.0110	0.0025	0.3698	0.0300	0.0025	0.0020	0.0146	0.0073		0.0110		0.0020
HLW99-85	0.0700	0.1000	0.0200	0.0725		0.0100	0.0300	0.0063	0.0739	0.0094	0.0025	0.3956	0.0300	0.0025	0.0020	0.0125	0.0063		0.0094		0.0020
HLW99-86	0.0700	0.1000	0.0200	0.0200		0.0100	0.0300	0.0000	0.0944	0.0000	0.0025	0.4776	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-87	0.0700	0.1000	0.0200	0.0535		0.0100	0.0300	0.0042	0.0750	0.0063	0.0025	0.3000	0.0300	0.0025	0.0020	0.0084	0.0042		0.0063		0.0020
HLW99-88	0.0700	0.1000	0.0200	0.1250		0.0100	0.0300	0.0125	0.0670	0.0188	0.0025	0.3000	0.0300	0.0025	0.0020	0.0250	0.0125		0.0188		0.0020
HLW99-89	0.0700	0.1000	0.0200	0.1250		0.0100	0.0300	0.0000	0.0734	0.0000	0.0025	0.3936	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-90R	0.0700	0.1000	0.0200	0.1250		0.0100	0.0300	0.0000	0.1000	0.0000	0.0025	0.3000	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-91	0.0700	0.1000	0.0200	0.1120		0.0100	0.0300	0.0000	0.0500	0.0000	0.0025	0.3000	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-92	0.0700	0.1000	0.0200	0.0200		0.0100	0.0300	0.0125	0.0500	0.0188	0.0025	0.3000	0.0300	0.0025	0.0020	0.0250	0.0125		0.0188		0.0020
HLW99-93R2	0.0700	0.1000	0.0200	0.0200		0.0100	0.0300	0.0000	0.1084	0.0000	0.0025	0.3336	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-94	0.0700	0.1000	0.0200	0.0200		0.0100	0.0300	0.0000	0.1344	0.0000	0.0025	0.4376	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-95	0.0700	0.1000	0.0200	0.0200		0.0100	0.0300	0.0000	0.1344	0.0000	0.0025	0.4376	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-96	0.0700	0.1000	0.0200	0.1250		0.0100	0.0300	0.0063	0.0500	0.0094	0.0025	0.3000	0.0300	0.0025	0.0020	0.0125	0.0063		0.0094		0.0020
HLW99-97	0.0700	0.1000	0.0200	0.1250		0.0100	0.0300	0.0084	0.1000	0.0126	0.0025	0.3000	0.0300	0.0025	0.0020	0.0168	0.0084		0.0126		0.0020
HLW99-98R	0.0700	0.1000	0.0200	0.0200		0.0100	0.0300	0.0125	0.1000	0.0188	0.0025	0.3000	0.0300	0.0025	0.0020	0.0250	0.0125		0.0188		0.0020
HLW99-99	0.0700	0.1000	0.0200	0.0200		0.0100	0.0300	0.0000	0.0684	0.0000	0.0025	0.3736	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020
HLW99-100	0.0700	0.1000	0.0200	0.0200		0.0100	0.0300	0.0000	0.1214	0.0000	0.0025	0.3856	0.0300	0.0025	0.0020	0.0000	0.0000		0.0000		0.0020

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
HLW99-60	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0068	
HLW99-61	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-62	0.0020	0.0020		0.0000	0.0020	0.0020		0.0020					0.0020	0.0020						0.0061	
HLW99-63	0.0020	0.0020		0.0021	0.0020	0.0020		0.0020					0.0020	0.0020						0.0031	
HLW99-64	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0100	
HLW99-65	0.0020	0.0020		0.0050	0.0020	0.0020		0.0020					0.0020	0.0020						0.0000	
HLW99-66	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0373						0.0000	
HLW99-67	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0912						0.0000	
HLW99-68	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0373						0.0066	
HLW99-69	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0878						0.0066	
HLW99-70	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0912						0.0000	
HLW99-71	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0373						0.0000	
HLW99-72	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0373						0.0066	
HLW99-73	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0373						0.0000	
HLW99-74	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0651						0.0033	
HLW99-75	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0373						0.0044	
HLW99-76	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0672						0.0066	
HLW99-77	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0651						0.0000	
HLW99-78	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0912						0.0022	
HLW99-79	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0912						0.0000	
HLW99-80	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0629						0.0063	
HLW99-81	0.0021	0.0063		0.0021	0.0021	0.0021		0.0021					0.0021	0.0643						0.0000	
HLW99-82	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0355						0.0063	
HLW99-83	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0653						0.0000	
HLW99-84	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0657						0.0037	
HLW99-85	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0355						0.0031	
HLW99-86	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0355						0.0000	
HLW99-87	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0868						0.0021	
HLW99-88	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0355						0.0063	
HLW99-89	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0355						0.0000	
HLW99-90R	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0620						0.0000	
HLW99-91	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0868						0.0000	
HLW99-92	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0837						0.0063	
HLW99-93R2	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0868						0.0000	
HLW99-94	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0355						0.0000	
HLW99-95	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0355						0.0000	
HLW99-96	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0620						0.0031	
HLW99-97	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0355						0.0042	
HLW99-98R	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0639						0.0063	
HLW99-99	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0868						0.0000	
HLW99-100	0.0020	0.0020		0.0020	0.0020	0.0020		0.0020					0.0020	0.0612						0.0000	

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
HLW99-60	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0068
HLW99-61	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0100
HLW99-62	0.0004						0.0008		0.0013		0.0020	0.0020				0.0000	0.0020		0.0020	0.0000	0.0061
HLW99-63	0.0004						0.0008		0.0013		0.0020	0.0020				0.0021	0.0020		0.0020	0.0008	0.0031
HLW99-64	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0100
HLW99-65	0.0004						0.0008		0.0013		0.0020	0.0020				0.0050	0.0020		0.0020	0.0020	0.0000
HLW99-66	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.0572		0.0021	0.0000	0.0000
HLW99-67	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.1398		0.0021	0.0000	0.0000
HLW99-68	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.0572		0.0021	0.0000	0.0066
HLW99-69	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.1348		0.0021	0.0000	0.0066
HLW99-70	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.1399		0.0021	0.0000	0.0000
HLW99-71	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.0572		0.0021	0.0000	0.0000
HLW99-72	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.0572		0.0021	0.0000	0.0066
HLW99-73	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.0573		0.0021	0.0000	0.0000
HLW99-74	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.0998		0.0021	0.0000	0.0033
HLW99-75	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.0572		0.0021	0.0000	0.0044
HLW99-76	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.1030		0.0021	0.0000	0.0066
HLW99-77	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.0999		0.0021	0.0000	0.0000
HLW99-78	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.1399		0.0021	0.0000	0.0022
HLW99-79	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.1399		0.0021	0.0000	0.0000
HLW99-80	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0966		0.0020	0.0000	0.0063
HLW99-81	0.0004						0.0008		0.0014		0.0021	0.0021				0.0026	0.0986		0.0021	0.0000	0.0000
HLW99-82	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0545		0.0020	0.0000	0.0063
HLW99-83	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.1001		0.0020	0.0000	0.0000
HLW99-84	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.1007		0.0020	0.0000	0.0037
HLW99-85	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0545		0.0020	0.0000	0.0031
HLW99-86	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0545		0.0020	0.0000	0.0000
HLW99-87	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.1332		0.0020	0.0000	0.0021
HLW99-88	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0545		0.0020	0.0000	0.0063
HLW99-89	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0545		0.0020	0.0000	0.0000
HLW99-90R	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0950		0.0020	0.0000	0.0000
HLW99-91	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.1332		0.0020	0.0000	0.0000
HLW99-92	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.1283		0.0020	0.0000	0.0063
HLW99-93R2	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.1332		0.0020	0.0000	0.0000
HLW99-94	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0545		0.0020	0.0000	0.0000
HLW99-95	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0545		0.0020	0.0000	0.0000
HLW99-96	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0950		0.0020	0.0000	0.0031
HLW99-97	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0545		0.0020	0.0000	0.0042
HLW99-98R	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0981		0.0020	0.0000	0.0063
HLW99-99	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.1332		0.0020	0.0000	0.0000
HLW99-100	0.0004						0.0008		0.0013		0.0020	0.0020				0.0025	0.0938		0.0020	0.0000	0.0000

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
HLW99-60	0.0020		0.0800			0.0020		0.0200		1.0001	0.0115	0.1289	0.0012	0.1029		0.0106	0.0209	0.0129	0.0640	0.0154	0.0333
HLW99-61	0.0020		0.0000			0.0020		0.0200		1.0000	0.0285	0.1873	0.0008	0.0191		0.0103	0.0003	0.0182	0.1456	0.0277	0.0002
HLW99-62	0.0020		0.0000			0.0020		0.0200		0.9999	0.0062	0.0521	0.0014	0.0207		0.0116	0.0318	0.0128	0.1112	0.0183	0.0013
HLW99-63	0.0020		0.0332			0.0020		0.0200		1.0000	0.0499	0.1151	0.0279	0.0583		0.0105	0.0281	0.0068	0.0875	0.0089	0.0151
HLW99-64	0.0020		0.0800			0.0020		0.0200		1.0000	0.0541	0.0890	0.0017	0.0211		0.0111	0.0605	0.0186	0.0721	0.0273	0.0333
HLW99-65	0.0020		0.0800			0.0020		0.0200		1.0000	0.1006	0.1821	0.0006	0.0194		0.0120	0.0020	0.0006	0.1653	0.0008	0.0365
HLW99-66	0.0021		0.0000			0.0021		0.0210		0.9997	0.0703	0.0541	0.0215	0.0205		0.0107	0.0303	0.0002	0.0874	0.0001	0.0021
HLW99-67	0.0021		0.0000			0.0021		0.0210		0.9999	0.0728	0.0542	0.0225	0.1062		0.0104	0.0293	0.0003	0.0541	0.0001	0.0028
HLW99-68	0.0021		0.0000			0.0021		0.0210		1.0000	0.0742	0.0553	0.0209	0.1172		0.0107	0.0285	0.0128	0.0634	0.0177	0.0027
HLW99-69	0.0021		0.0000			0.0021		0.0210		1.0000	0.0746	0.0568	0.0217	0.0209		0.0101	0.0293	0.0133	0.0491	0.0188	0.0032
HLW99-70	0.0021		0.0000			0.0021		0.0210		0.9997	0.0813	0.0533	0.0219	0.0264		0.0100	0.0312	0.0003	0.0988	0.0008	0.0008
HLW99-71	0.0021		0.0000			0.0021		0.0210		0.9998	0.0758	0.0547	0.0226	0.1180		0.0105	0.0307	0.0002	0.0754	0.0001	0.0025
HLW99-72	0.0021		0.0000			0.0021		0.0210		0.9998	0.0741	0.0567	0.0240	0.0232		0.0111	0.0335	0.0133	0.0772	0.0205	0.0020
HLW99-73	0.0021		0.0000			0.0021		0.0210		0.9997	0.0599	0.0575	0.0235	0.0233		0.0112	0.0383	0.0003	0.1209	0.0002	0.0024
HLW99-74	0.0021		0.0000			0.0021		0.0210		1.0000	0.0661	0.0543	0.0228	0.1191		0.0106	0.0364	0.0068	0.0521	0.0094	0.0020
HLW99-75	0.0021		0.0000			0.0021		0.0210		0.9997	0.0599	0.0548	0.0291	0.1220		0.0115	0.0398	0.0094	0.0909	0.0131	0.0038
HLW99-76	0.0021		0.0000			0.0021		0.0210		0.9998	0.0692	0.0541	0.0222	0.0212		0.0115	0.0366	0.0140	0.0898	0.0194	0.0024
HLW99-77	0.0021		0.0000			0.0021		0.0210		0.9998	0.0679	0.0558	0.0235	0.1161		0.0109	0.0381	0.0003	0.0849	0.0001	0.0027
HLW99-78	0.0021		0.0000			0.0021		0.0210		0.9999	0.0718	0.0544	0.0223	0.0546		0.0115	0.0352	0.0048	0.0768	0.0069	0.0029
HLW99-79	0.0021		0.0000			0.0021		0.0210		0.9998	0.0726	0.0553	0.0224	0.0194		0.0113	0.0299	0.0003	0.0697	0.0001	0.0024
HLW99-80	0.0020		0.0000			0.0020		0.0200		1.0002	0.0756	0.1035	0.0216	0.0677		0.0102	0.0281	0.0121	0.0483	0.0179	0.0030
HLW99-81	0.0021		0.0000			0.0021		0.0210		0.9998	0.0712	0.0543	0.0212	0.0213		0.0116	0.0305	0.0002	0.1116	0.0001	0.0028
HLW99-82	0.0020		0.0000			0.0020		0.0200		1.0002	0.0681	0.1034	0.0207	0.0553		0.0107	0.0290	0.0128	0.0926	0.0178	0.0043
HLW99-83	0.0020		0.0000			0.0020		0.0200		1.0000	0.0707	0.1054	0.0210	0.0777		0.0109	0.0289	0.0003	0.0637	0.0001	0.0037
HLW99-84	0.0020		0.0000			0.0020		0.0200		1.0002	0.0654	0.1007	0.0198	0.0189		0.0108	0.0273	0.0077	0.0591	0.0110	0.0034
HLW99-85	0.0020		0.0000			0.0020		0.0200		1.0001	0.0737	0.1125	0.0219	0.0655		0.0104	0.0292	0.0062	0.0715	0.0090	0.0041
HLW99-86	0.0020		0.0000			0.0020		0.0200		1.0000	0.0635	0.1000	0.0195	0.0190		0.0111	0.0270	0.0002	0.0808	0.0001	0.0035
HLW99-87	0.0020		0.0000			0.0020		0.0200		1.0001	0.0784	0.1047	0.0225	0.0504		0.0100	0.0301	0.0041	0.0752	0.0060	0.0034
HLW99-88	0.0020		0.0000			0.0020		0.0200		1.0002	0.0674	0.1038	0.0199	0.1124		0.0110	0.0280	0.0121	0.0600	0.0171	0.0028
HLW99-89	0.0020		0.0000			0.0020		0.0200		1.0000	0.0717	0.1036	0.0213	0.1090		0.0107	0.0289	0.0001	0.0714	0.0001	0.0040
HLW99-90R	0.0020		0.0000			0.0020		0.0200		1.0000	0.0680	0.0985	0.0193	0.1129		0.0109	0.0269	0.0002	0.0838	0.0001	0.0031
HLW99-91	0.0020		0.0000			0.0020		0.0200		1.0000	0.0712	0.0991	0.0206	0.1022		0.0100	0.0295	0.0002	0.0435	0.0001	0.0037
HLW99-92	0.0020		0.0000			0.0020		0.0200		1.0002	0.0742	0.1000	0.0195	0.0201		0.0105	0.0290	0.0117	0.0459	0.0171	0.0037
HLW99-93R2	0.0020		0.0000			0.0020		0.0200		1.0000	0.0795	0.1032	0.0215	0.0201		0.0112	0.0290	0.0004	0.0926	0.0001	0.0032
HLW99-94	0.0020		0.0000			0.0020		0.0200		1.0000	0.0687	0.1022	0.0197	0.0198		0.0114	0.0300	0.0002	0.1173	0.0001	0.0033
HLW99-95	0.0020		0.0000			0.0020		0.0200		1.0000	0.0680	0.0996	0.0198	0.0199		0.0116	0.0289	0.0002	0.1166	0.0001	0.0044
HLW99-96	0.0020		0.0000			0.0020		0.0200		1.0001	0.0751	0.1030	0.0209	0.1169		0.0109	0.0284	0.0064	0.0479	0.0094	0.0033
HLW99-97	0.0020		0.0000			0.0020		0.0200		1.0002	0.0714	0.1026	0.0214	0.1151		0.0109	0.0287	0.0082	0.0851	0.0124	0.0031
HLW99-98R	0.0020		0.0000			0.0020		0.0200		1.0002	0.0702	0.0992	0.0209	0.0202		0.0104	0.0274	0.0111	0.0858	0.0172	0.0033
HLW99-99	0.0020		0.0000			0.0020		0.0200		1.0000	0.0731	0.1032	0.0219	0.0208		0.0106	0.0321	0.0003	0.0654	0.0001	0.0013
HLW99-100	0.0020		0.0000			0.0020		0.0200		1.0000	0.0675	0.1002	0.0195	0.0193		0.0112	0.0286	0.0002	0.1063	0.0002	0.0042

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
HLW99-60	0.3278	0.0004	0.0026	0.0020	0.0218	0.0127		0.0181				0.0021		0.0021		0.0042					
HLW99-61	0.3710	0.0002	0.0024	0.0020	0.0384	0.0197		0.0269				0.0019		0.0001		0.0022					
HLW99-62	0.4978	0.0779	0.0026	0.0020	0.0243	0.0124		0.0176				0.0021		0.0000		0.0023					
HLW99-63	0.3686	0.0293	0.0027	0.0025	0.0113	0.0068		0.0095				0.0022		0.0018		0.0023					
HLW99-64	0.3541	0.0007	0.0026	0.0017	0.0330	0.0196		0.0275				0.0022		0.0035		0.0021					
HLW99-65	0.2851	0.0002	0.0025	0.0020	0.0010	0.0007		0.0006				0.0026		0.0046		0.0019					
HLW99-66	0.4843	0.0256	0.0022	0.0019	0.0012	0.0001		0.0000				0.0065		0.0020		0.0021					
HLW99-67	0.3144	0.0283	0.0026	0.0016	0.0024	0.0000						0.0060		0.0019		0.0024					
HLW99-68	0.3254	0.0297	0.0028	0.0018	0.0225	0.0135		0.0190				0.0058		0.0017		0.0022					
HLW99-69	0.3218	0.0276	0.0027	0.0015	0.0268	0.0139		0.0190				0.0061		0.0018		0.0020					
HLW99-70	0.3586	0.0238	0.0026	0.0022	0.0026	0.0000		0.0002				0.0058		0.0031		0.0025					
HLW99-71	0.4012	0.0313	0.0028	0.0022	0.0011	0.0007		0.0000				0.0060		0.0018		0.0023					
HLW99-72	0.4250	0.0298	0.0030	0.0020	0.0270	0.0143		0.0199				0.0065		0.0018		0.0023					
HLW99-73	0.4465	0.0345	0.0029	0.0020	0.0012	0.0003		0.0001				0.0062		0.0019		0.0023					
HLW99-74	0.3167	0.0332	0.0029	0.0021	0.0151	0.0074		0.0099				0.0059		0.0019		0.0024					
HLW99-75	0.3214	0.0277	0.0026	0.0021	0.0189	0.0096		0.0131				0.0064		0.0019		0.0023					
HLW99-76	0.3295	0.0271	0.0029	0.0019	0.0273	0.0138		0.0197				0.0064		0.0020		0.0022					
HLW99-77	0.3115	0.0300	0.0029	0.0021	0.0019	0.0007		0.0001				0.0061		0.0019		0.0025					
HLW99-78	0.3260	0.0279	0.0029	0.0021	0.0115	0.0053		0.0066				0.0064		0.0019		0.0021					
HLW99-79	0.3910	0.0227	0.0029	0.0023	0.0026	0.0015		0.0000				0.0064		0.0019		0.0024					
HLW99-80	0.3021	0.0256	0.0025	0.0015	0.0247	0.0131		0.0191				0.0020		0.0018		0.0022					
HLW99-81	0.4005	0.0274	0.0027	0.0022	0.0001	0.0014		0.0000				0.0064		0.0020		0.0031					
HLW99-82	0.3303	0.0274	0.0026	0.0021	0.0246	0.0131		0.0190				0.0021		0.0019		0.0021					
HLW99-83	0.3673	0.0244	0.0025	0.0023	0.0001	0.0012		0.0000				0.0022		0.0018		0.0022					
HLW99-84	0.3612	0.0249	0.0026	0.0018	0.0144	0.0073		0.0115				0.0021		0.0017		0.0026					
HLW99-85	0.3868	0.0278	0.0027	0.0016	0.0135	0.0067		0.0092				0.0020		0.0018		0.0036					
HLW99-86	0.4739	0.0285	0.0026	0.0021	0.0001	0.0003		0.0000				0.0022		0.0018		0.0019					
HLW99-87	0.3013	0.0277	0.0025	0.0017	0.0085	0.0045		0.0062				0.0020		0.0017		0.0022					
HLW99-88	0.3030	0.0261	0.0024	0.0020	0.0238	0.0127		0.0197				0.0020		0.0017		0.0022					
HLW99-89	0.3889	0.0252	0.0025	0.0020	0.0001	0.0004		0.0000				0.0021		0.0016		0.0023					
HLW99-90R	0.2948	0.0246	0.0027	0.0019	0.0001	0.0002		0.0000				0.0020		0.0018		0.0021					
HLW99-91	0.3069	0.0229	0.0025	0.0016	0.0001	0.0006		0.0000				0.0020		0.0017		0.0022					
HLW99-92	0.3067	0.0278	0.0023	0.0021	0.0246	0.0123		0.0179				0.0021		0.0019		0.0020					
HLW99-93R2	0.3465	0.0280	0.0026	0.0022	0.0024	0.0001		0.0000				0.0020		0.0018		0.0021					
HLW99-94	0.4262	0.0240	0.0020	0.0017	0.0001	0.0002		0.0001				0.0021		0.0021		0.0022					
HLW99-95	0.4293	0.0236	0.0021	0.0019	0.0010	0.0002		0.0001				0.0023		0.0020		0.0021					
HLW99-96	0.3099	0.0298	0.0027	0.0021	0.0142	0.0067		0.0102				0.0022		0.0018		0.0024					
HLW99-97	0.3048	0.0271	0.0024	0.0022	0.0177	0.0086		0.0134				0.0021		0.0018		0.0022					
HLW99-98R	0.3359	0.0257	0.0025	0.0023	0.0258	0.0126		0.0181				0.0020		0.0019		0.0023					
HLW99-99	0.3880	0.0240	0.0026	0.0022	0.0024	0.0003		0.0001				0.0019		0.0016		0.0026					
HLW99-100	0.3935	0.0217	0.0021	0.0021	0.0016	0.0002		0.0000				0.0021		0.0020		0.0021					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
HLW99-60			0.0024						0.0074		0.0003						0.0003		0.0002		0.0022
HLW99-61			0.0023						0.0104												0.0021
HLW99-62			0.0023						0.0006												0.0021
HLW99-63			0.0024						0.0040		0.0002						0.0003		0.0002		0.0023
HLW99-64			0.0023						0.0105		0.0003						0.0002		0.0002		0.0021
HLW99-65			0.0024						0.0007		0.0002						0.0001		0.0004		0.0022
HLW99-66			0.0376						0.0005		0.0003						0.0002		0.0001		0.0048
HLW99-67			0.0861						0.0009		0.0005						0.0009		0.0004		0.0042
HLW99-68			0.0364						0.0071		0.0005						0.0009		0.0002		0.0049
HLW99-69			0.0859						0.0078		0.0005						0.0008		0.0002		0.0044
HLW99-70			0.0908						0.0008		0.0004						0.0002		0.0002		0.0025
HLW99-71			0.0392						0.0005		0.0003						0.0008		0.0002		0.0028
HLW99-72			0.0400						0.0076		0.0003						0.0002		0.0002		0.0027
HLW99-73			0.0401						0.0005		0.0003						0.0003		0.0002		0.0030
HLW99-74			0.0653						0.0042		0.0004						0.0009		0.0002		0.0029
HLW99-75			0.0389						0.0053		0.0004						0.0009		0.0004		0.0023
HLW99-76			0.0669						0.0078		0.0005						0.0007		0.0001		0.0025
HLW99-77			0.0675						0.0007		0.0004						0.0009		0.0002		0.0029
HLW99-78			0.0900						0.0032		0.0004						0.0008		0.0002		0.0024
HLW99-79			0.0913						0.0008		0.0003						0.0002		0.0001		0.0025
HLW99-80			0.0633						0.0075		0.0003						0.0008		0.0002		0.0019
HLW99-81			0.0645						0.0007		0.0003						0.0003		0.0002		0.0025
HLW99-82			0.0362						0.0074		0.0004						0.0004		0.0002		0.0022
HLW99-83			0.0669						0.0007		0.0005						0.0002		0.0001		0.0024
HLW99-84			0.0624						0.0043		0.0003						0.0002		0.0001		0.0021
HLW99-85			0.0380						0.0039		0.0004						0.0003		0.0002		0.0019
HLW99-86			0.0352						0.0004		0.0003						0.0003		0.0001		0.0022
HLW99-87			0.0889						0.0030		0.0003						0.0006		0.0002		0.0020
HLW99-88			0.0364						0.0072		0.0004						0.0010		0.0003		0.0025
HLW99-89			0.0375						0.0004		0.0003						0.0005		0.0002		0.0024
HLW99-90R			0.0589						0.0007		0.0003						0.0009		0.0002		0.0022
HLW99-91			0.0829						0.0008		0.0004						0.0006		0.0002		0.0026
HLW99-92			0.0816						0.0082		0.0004						0.0004		0.0002		0.0022
HLW99-93R2			0.0853						0.0008		0.0004						0.0003		0.0001		0.0022
HLW99-94			0.0363						0.0008		0.0003						0.0004		0.0002		0.0021
HLW99-95			0.0359						0.0008		0.0004						0.0004		0.0002		0.0020
HLW99-96			0.0619						0.0038		0.0004						0.0009		0.0003		0.0023
HLW99-97			0.0368						0.0046		0.0008						0.0008		0.0003		0.0023
HLW99-98R			0.0613						0.0072		0.0005						0.0002		0.0001		0.0021
HLW99-99			0.0864						0.0008		0.0003						0.0003		0.0001		0.0024
HLW99-100			0.0599						0.0013		0.0003						0.0004		0.0001		0.0021

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
HLW99-60	0.0010					0.0023		0.0026		0.0069	0.0012		0.0683			0.0026		0.0180		0.9111
HLW99-61	0.0007					0.0023		0.0023		0.0100	0.0008		0.0004			0.0024		0.0203		0.9568
HLW99-62	0.0009					0.0025		0.0019		0.0071	0.0018		0.0003			0.0023		0.0204		0.9486
HLW99-63	0.0008					0.0024		0.0025		0.0035	0.0012		0.0304			0.0025		0.0184		0.9162
HLW99-64	0.0011					0.0024		0.0042		0.0102	0.0010		0.0687			0.0029		0.0188		0.9607
HLW99-65	0.0012					0.0023		0.0020		0.0005	0.0009		0.0670			0.0026		0.0192		0.9228
HLW99-66	0.0009					0.0534		0.0022		0.0002	0.0013		0.0014			0.0025		0.0211		0.9496
HLW99-67	0.0005					0.1239		0.0006		0.0006	0.0013		0.0030			0.0025		0.0204		0.9581
HLW99-68	0.0011					0.0522		0.0029		0.0069	0.0014		0.0015			0.0027		0.0201		0.9666
HLW99-69	0.0005					0.1229		0.0030		0.0068	0.0013		0.0029			0.0031		0.0207		0.9818
HLW99-70	0.0012					0.1217		0.0017		0.0006	0.0007		0.0042			0.0033		0.0212		0.9757
HLW99-71	0.0011					0.0562		0.0023		0.0003	0.0011		0.0023			0.0027		0.0218		0.9715
HLW99-72	0.0006					0.0561		0.0028		0.0071	0.0010		0.0015			0.0037		0.0222		1.0132
HLW99-73	0.0015					0.0584		0.0023		0.0004	0.0010		0.0023			0.0028		0.0216		0.9701
HLW99-74	0.0003					0.0824		0.0022		0.0037	0.0009		0.0030			0.0032		0.0213		0.9680
HLW99-75	0.0007					0.0556		0.0025		0.0052	0.0007		0.0018			0.0032		0.0216		0.9798
HLW99-76	0.0009					0.0889		0.0026		0.0075	0.0007		0.0028			0.0036		0.0210		0.9797
HLW99-77	0.0003					0.0831		0.0024		0.0006	0.0007		0.0033			0.0029		0.0215		0.9474
HLW99-78	0.0007					0.1177		0.0025		0.0032	0.0007		0.0035			0.0033		0.0209		0.9834
HLW99-79	0.0006					0.1218		0.0024		0.0002	0.0009		0.0036			0.0031		0.0214		0.9663
HLW99-80	0.0003					0.0833		0.0021		0.0066	0.0007		0.0031			0.0035		0.0202		0.9764
HLW99-81	0.0011					0.0898		0.0025		0.0004	0.0008		0.0029			0.0028		0.0217		0.9611
HLW99-82	0.0010					0.0529		0.0026		0.0069	0.0009		0.0019			0.0032		0.0201		0.9762
HLW99-83	0.0005					0.0895		0.0022		0.0004	0.0010		0.0028			0.0028		0.0206		0.9770
HLW99-84	0.0007					0.0942		0.0025		0.0040	0.0008		0.0013			0.0028		0.0201		0.9500
HLW99-85	0.0008					0.0559		0.0022		0.0035	0.0010		0.0022			0.0030		0.0210		0.9940
HLW99-86	0.0005					0.0509		0.0017		0.0003	0.0010		0.0009			0.0024		0.0202		0.9545
HLW99-87	0.0010					0.1189		0.0021		0.0024	0.0007		0.0040			0.0032		0.0199		0.9903
HLW99-88	0.0008					0.0522		0.0021		0.0068	0.0010		0.0023			0.0036		0.0200		0.9667
HLW99-89	0.0006					0.0554		0.0017		0.0003	0.0009		0.0023			0.0027		0.0200		0.9711
HLW99-90R	0.0002					0.0869		0.0018		0.0005	0.0007		0.0014			0.0026		0.0198		0.9310
HLW99-91	0.0001					0.1237		0.0021		0.0006	0.0006		0.0014			0.0030		0.0196		0.9592
HLW99-92	0.0000					0.1237		0.0032		0.0067	0.0007		0.0069			0.0027		0.0181		0.9864
HLW99-93R2	0.0004					0.1168		0.0020		0.0009	0.0007		0.0049			0.0029		0.0204		0.9866
HLW99-94	0.0003					0.0553		0.0025		0.0003	0.0009		0.0039			0.0025		0.0182		0.9574
HLW99-95	0.0008					0.0535		0.0028		0.0002	0.0009		0.0040			0.0025		0.0187		0.9568
HLW99-96	0.0005					0.0827		0.0020		0.0039	0.0009		0.0041			0.0033		0.0203		0.9915
HLW99-97	0.0008					0.0525		0.0021		0.0046	0.0007		0.0028			0.0031		0.0205		0.9739
HLW99-98R	0.0010					0.0858		0.0023		0.0063	0.0007		0.0044			0.0036		0.0200		0.9903
HLW99-99	0.0003					0.1216		0.0022		0.0004	0.0007		0.0045			0.0029		0.0204		0.9978
HLW99-100	0.0007					0.0917		0.0025		0.0002	0.0008		0.0058			0.0025		0.0186		0.9715

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
HLW99-60								
HLW99-61	1150		950		Homogeneous red glass			
HLW99-62	1150		1075		Mostly homogeneous greenish blue glass			
HLW99-63								
HLW99-64								
HLW99-65								
HLW99-66			>1150					
HLW99-67			>1150					
HLW99-68								
HLW99-69			1150					
HLW99-70			1050					
HLW99-71			>1150					
HLW99-72			1150					
HLW99-73			1050					
HLW99-74			>1150					
HLW99-75			>1150					
HLW99-76			1125					
HLW99-77			1125					
HLW99-78			1125					
HLW99-79			1050					
HLW99-80			1160					
HLW99-81			1050					
HLW99-82			>1160					
HLW99-83			1100					
HLW99-84			1050					
HLW99-85			1175					
HLW99-86			1050					
HLW99-87			1050					
HLW99-88			>1160					
HLW99-89			1150					
HLW99-90R			1125					
HLW99-91								
HLW99-92								
HLW99-93R2								
HLW99-94								
HLW99-95								
HLW99-96								
HLW99-97								
HLW99-98R								
HLW99-99								
HLW99-100								

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
HLW99-60					
HLW99-61					Less than 0.5 vol% of NiO (rod shaped or rectangular prismatic) with Rh cores. 0.1 vol% of RuO2
HLW99-62					Less than 0.1 vol% of small clusters of Rh spinel (Ni, Zn, Fe) Trace amount of Rh/Ru
HLW99-63					
HLW99-64					
HLW99-65					
HLW99-66					
HLW99-67					
HLW99-68					
HLW99-69					
HLW99-70					
HLW99-71					
HLW99-72					
HLW99-73					
HLW99-74					
HLW99-75					
HLW99-76					
HLW99-77					
HLW99-78					
HLW99-79					
HLW99-80					
HLW99-81					
HLW99-82					
HLW99-83					
HLW99-84					
HLW99-85					
HLW99-86					
HLW99-87					
HLW99-88					
HLW99-89					
HLW99-90R					
HLW99-91					
HLW99-92					
HLW99-93R2					
HLW99-94					
HLW99-95					
HLW99-96					
HLW99-97					
HLW99-98R					
HLW99-99					
HLW99-100					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
HLW99-60															
HLW99-61															
HLW99-62															
HLW99-63															
HLW99-64															
HLW99-65															
HLW99-66															
HLW99-67															
HLW99-68															
HLW99-69															
HLW99-70															
HLW99-71															
HLW99-72															
HLW99-73															
HLW99-74															
HLW99-75															
HLW99-76															
HLW99-77															
HLW99-78															
HLW99-79															
HLW99-80															
HLW99-81															
HLW99-82															
HLW99-83															
HLW99-84															
HLW99-85															
HLW99-86															
HLW99-87															
HLW99-88															
HLW99-89															
HLW99-90R															
HLW99-91															
HLW99-92															
HLW99-93R2															
HLW99-94															
HLW99-95															
HLW99-96															
HLW99-97															
HLW99-98R															
HLW99-99															
HLW99-100															

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
HLW99-60																					
HLW99-61																					
HLW99-62																					
HLW99-63																					
HLW99-64																					
HLW99-65																					
HLW99-66																					
HLW99-67																					
HLW99-68																					
HLW99-69																					
HLW99-70																					
HLW99-71																					
HLW99-72																					
HLW99-73																					
HLW99-74																					
HLW99-75																					
HLW99-76																					
HLW99-77																					
HLW99-78																					
HLW99-79																					
HLW99-80																					
HLW99-81																					
HLW99-82																					
HLW99-83																					
HLW99-84																					
HLW99-85																					
HLW99-86																					
HLW99-87																					
HLW99-88																					
HLW99-89																					
HLW99-90R																					
HLW99-91																					
HLW99-92																					
HLW99-93R2																					
HLW99-94																					
HLW99-95																					
HLW99-96																					
HLW99-97																					
HLW99-98R																					
HLW99-99																					
HLW99-100																					

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
HLW99-60																
HLW99-61																
HLW99-62																
HLW99-63																
HLW99-64																
HLW99-65																
HLW99-66																
HLW99-67																
HLW99-68																
HLW99-69																
HLW99-70																
HLW99-71																
HLW99-72																
HLW99-73																
HLW99-74																
HLW99-75																
HLW99-76																
HLW99-77																
HLW99-78																
HLW99-79																
HLW99-80																
HLW99-81																
HLW99-82																
HLW99-83																
HLW99-84																
HLW99-85																
HLW99-86																
HLW99-87																
HLW99-88																
HLW99-89																
HLW99-90R																
HLW99-91																
HLW99-92																
HLW99-93R2																
HLW99-94																
HLW99-95																
HLW99-96																
HLW99-97																
HLW99-98R																
HLW99-99																
HLW99-100																

RPP-WTP HLW Formulation (Kot and Pegg 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
HLW99-60				0.056	0.074	2.242	1.553	0.019	0.862	0.369	0.072	1.489
HLW99-61				0.072	0.291	77.997	67.006	0.019	63.71	3.922	0.951	44.108
HLW99-62				0.054	0.056	0.699	0.451	<0.0055	0.352	0.148	0.0532	0.459
HLW99-63				0.129	0.049	1.238	0.524	0.017	0.381	0.143	0.17	1.109
HLW99-64				0.448	0.201	10.856	11.492	0.123	9.62	1.352	0.338	6.956
HLW99-65				0.368	0.054	0.833	0.151	0.318	0.255	0.166	0.27	8.745
HLW99-66				0.064	0.065	0.48	<0.0027	<0.0055	<0.0079	<0.0243	0.105	0.614
HLW99-67				0.15	0.049	0.575	<0.0027	0.01	0.01	0.078	0.111	1.145
HLW99-68				0.137	0.049	1.571	0.956	<0.0055	0.147	0.311	0.0532	1.01
HLW99-69				0.309	0.049	3.725	2.592	0.037	1.738	0.828	0.094	2.521
HLW99-70				0.519	0.099	1.097	0.006	0.102	0.026	0.416	0.124	5.859
HLW99-71				0.069	0.061	0.46	<0.0027	<0.0055	0.008	<0.0243	0.065	0.591
HLW99-72				0.105	0.11	1.511	0.848	0.015	0.584	0.268	0.0532	0.871
HLW99-73				0.187	0.063	0.883	<0.0027	0.041	0.016	0.042	0.0532	1.622
HLW99-74				0.148	0.063	1.64	0.562	0.028	0.134	0.203	0.062	1.105
HLW99-75				0.208	0.212	2.195	1.102	0.032	0.374	0.29	0.057	1.606
HLW99-76				1.097	0.149	11.832	10.328	0.127	7.274	1.554	0.248	11.355
HLW99-77				0.213	0.164	1.022	0.029	0.018	0.022	0.039	0.105	1.473
HLW99-78				0.326	<0.049	2.29	0.918	0.024	0.579	0.246	<0.0532	2.427
HLW99-79				0.203	0.214	1.2	0.006	0.034	<0.0079	0.124	0.144	1.774
HLW99-80				0.249	0.128	3.673	2.343	0.027	1.287	0.641	0.172	2.127
HLW99-81				0.254	0.049	1.169	0.101	0.019	0.039	0.124	0.072	2.155
HLW99-82				0.334	0.049	4.458	2.875	0.02	2.089	0.69	0.0532	2.823
HLW99-83				0.111	0.105	1.019	0.016	<0.0055	<0.0079	0.044	0.0532	1.097
HLW99-84				0.231	0.172	2.512	1.2	<0.0055	0.937	0.388	0.055	2.171
HLW99-85				0.081	0.238	1.373	0.337	0.036	0.27	0.115	0.0532	0.0779
HLW99-86				0.07	0.049	0.816	0.011	0.035	0.039	<0.0243	0.121	0.73
HLW99-87				0.559	0.122	2.737	1.64	0.073	1.171	0.583	0.0532	4.627
HLW99-88				0.233	0.055	2.659	1.508	<0.0055	0.399	0.416	0.0532	1.376
HLW99-89				0.105	0.049	0.807	0.017	0.015	<0.0079	<0.0243	0.0532	0.649
HLW99-90R				0.201	0.049	0.767	<0.0027	0.02	0.015	0.085	0.0532	1.714
HLW99-91				0.18	<0.049	0.819	0.011	<0.0055	<0.0079	0.066	<0.0532	1.627
HLW99-92				0.527	0.063	6.268	4.021	0.04	3.913	1.016	<0.0532	4.434
HLW99-93R2				0.739	0.224	1.415	<0.0027	0.081	0.019	0.233	0.081	8.326
HLW99-94				0.253	0.083	1.206	0.072	0.019	0.061	0.055	<0.0532	2.307
HLW99-95				0.195	0.083	0.974	<0.0027	0.018	<0.0079	<0.0243	0.064	1.812
HLW99-96				0.164	<0.0490	1.605	0.616	<0.0055	0.212	0.147	0.075	1.151
HLW99-97				0.225	<0.0490	2.453	1.151	<0.0055	0.523	0.275	<0.0532	1.781
HLW99-98R				0.605	0.072	10.716	8.643	0.081	7.903	1.292	0.081	9.125
HLW99-99				0.267	<0.0490	1.262	0.018	0.024	0.009	0.077	0.125	2.486
HLW99-100				0.795	0.186	1.627	0.02	0.072	0.022	0.227	0.12	8.829

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
LAWA41	0.0620	0.0750	0.0200	0.0698		0.0310		0.0199	0.2000		0.0008	0.4341	0.0300								
LAWA42	0.0620	0.0903	0.0240	0.0841		0.0310	0.0000	0.0240	0.2000	0.0000	0.0008	0.3800	0.0361	0.0000		0.0000					
LAWA43	0.1200	0.0739	0.0197	0.0688		0.0310	0.0000	0.0197	0.2000	0.0000	0.0008	0.3800	0.0295	0.0000		0.0000					
LAWA44	0.0620	0.0890	0.0199	0.0698		0.0050		0.0199	0.2000		0.0003	0.4455	0.0299	0.0000							
LAWA45	0.0620	0.1190		0.0698		0.0050		0.0148	0.2000		0.0003	0.4455	0.0299	0.0000							
LAWA46	0.0620	0.0890		0.0698		0.0050		0.0148	0.2000		0.0003	0.4455	0.0299	0.0000							
LAWA47	0.0620	0.0890		0.0698		0.0050		0.0148	0.2000		0.0003	0.4455	0.0299	0.0000							
LAWA48	0.0620	0.0890		0.0698		0.0300		0.0148	0.2000		0.0003	0.4455	0.0299	0.0000							
LAWA49	0.0620	0.0890		0.0998				0.0148	0.2000		0.0003	0.4455	0.0299	0.0000							
LAWA50	0.0620	0.0890		0.1198				0.0148	0.2000		0.0003	0.4255	0.0299	0.0000							
LAWA51	0.0620	0.1197		0.0700				0.0148	0.1800		0.0003	0.4657	0.0300	0.0000							
LAWA52	0.0618	0.0619	0.0788	0.0751		0.0050		0.0148	0.2000		0.0003	0.4225	0.0299	0.0000							
LAWA53	0.0609	0.0611	0.0777	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA54	0.0609	0.0611		0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA55	0.0609	0.0611		0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295			0.0777					
LAWA56	0.0609	0.1193	0.0195	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA57	0.0609	0.0611	0.0284	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA58	0.0609	0.0611	0.0284	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295				0.0493				
LAWA59	0.0609	0.0611	0.0482	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA60	0.0853	0.1123	0.0432			0.0050		0.0199	0.2000		0.0003	0.4455	0.0299	0.0000							
LAWA61	0.0609	0.0611	0.0477	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA62	0.0609	0.0611	0.0477	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA63	0.0609	0.0611	0.0477	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA64	0.0618	0.0619		0.0751		0.0050		0.0148	0.2000		0.0003	0.4225	0.0299	0.0000							
LAWA65	0.0609	0.0611	0.0326	0.0740		0.0049		0.0597	0.1972		0.0003	0.4166	0.0295								
LAWA66	0.0609	0.0611	0.0477	0.0740		0.0049		0.0146	0.1972		0.0303	0.4166	0.0295								
LAWA67	0.0609	0.0611	0.0477	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA68	0.0609	0.0611	0.0316	0.0740		0.0049		0.0146	0.1972		0.0003	0.4327	0.0295								
LAWA69	0.0609	0.1088		0.0740		0.0049		0.0146	0.1972		0.0303	0.4166	0.0295								
LAWA70	0.0609	0.0611	0.0577	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA71	0.0609	0.1085	0.0777	0.0740		0.0049		0.0146	0.1499		0.0003	0.4166	0.0295								
LAWA72	0.0609	0.1085		0.0740		0.0049		0.0146	0.1499		0.0003	0.4166	0.0295								
LAWA73	0.0609	0.0611	0.0777	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
LAWA41	0.0058			0.0002				0.0004												0.0000	
LAWA42	0.0058			0.0002	0.0000			0.0004						0.0000						0.0000	
LAWA43	0.0058			0.0002	0.0000			0.0004						0.0000						0.0000	
LAWA44	0.0065			0.0002	0.0000			0.0001												0.0000	
LAWA45	0.0065			0.0002	0.0000			0.0001												0.0000	
LAWA46	0.0065			0.0002	0.0000			0.0001	0.0300											0.0000	
LAWA47	0.0065			0.0002	0.0000			0.0001												0.0000	
LAWA48	0.0065			0.0002	0.0000			0.0001	0.0050											0.0000	
LAWA49	0.0065			0.0002	0.0000			0.0001	0.0050											0.0000	
LAWA50	0.0065			0.0002	0.0000			0.0001	0.0050											0.0000	
LAWA51	0.0059			0.0002	0.0000			0.0001	0.0045											0.0000	
LAWA52	0.0065			0.0002	0.0000			0.0001													
LAWA53	0.0064			0.0002				0.0001									0.0001				
LAWA54	0.0064			0.0002				0.0001									0.0001				
LAWA55	0.0064			0.0002				0.0001									0.0001				
LAWA56	0.0064			0.0002				0.0001									0.0001				
LAWA57	0.0064			0.0002				0.0001									0.0001				
LAWA58	0.0064			0.0002				0.0001									0.0001				
LAWA59	0.0064			0.0002				0.0001									0.0001				
LAWA60	0.0065			0.0002	0.0000			0.0001													
LAWA61	0.0064			0.0002				0.0001						0.0300			0.0001				
LAWA62	0.0064	0.0300		0.0002				0.0001									0.0001				
LAWA63	0.0064			0.0002		0.0300		0.0001									0.0001				
LAWA64	0.0065			0.0002	0.0000			0.0001													
LAWA65	0.0064			0.0002				0.0001									0.0001				
LAWA66	0.0064			0.0002				0.0001									0.0001				
LAWA67	0.0064			0.0002				0.0001									0.0001				
LAWA68	0.0064			0.0002				0.0301									0.0001				
LAWA69	0.0064			0.0002				0.0001									0.0001				
LAWA70	0.0064			0.0002				0.0201									0.0001				
LAWA71	0.0064			0.0002				0.0001									0.0001				
LAWA72	0.0064			0.0002				0.0001									0.0001				
LAWA73	0.0064			0.0002				0.0001									0.0001				

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
LAWA41												0.0001				0.0010					0.0200
LAWA42												0.0001				0.0010					0.0240
LAWA43												0.0001				0.0010					0.0197
LAWA44						0.0010										0.0010					0.0199
LAWA45						0.0010										0.0010					0.0199
LAWA46						0.0010										0.0010					0.0199
LAWA47						0.0010										0.0010					0.0199
LAWA48						0.0010										0.0010					0.0199
LAWA49						0.0010										0.0010					0.0199
LAWA50						0.0010										0.0010					0.0199
LAWA51						0.0010										0.0009					0.0200
LAWA52						0.0010										0.0010					0.0111
LAWA53																0.0148					0.0109
LAWA54																0.0148	0.0777				0.0109
LAWA55																0.0148					0.0109
LAWA56																0.0148					0.0109
LAWA57															0.0493	0.0148					0.0109
LAWA58																0.0148					0.0109
LAWA59										0.0295						0.0148					0.0109
LAWA60						0.0010										0.0010					0.0199
LAWA61																0.0148					0.0109
LAWA62																0.0148					0.0109
LAWA63																0.0148					0.0109
LAWA64						0.0010										0.0010	0.0788				0.0111
LAWA65																0.0148					0.0109
LAWA66																0.0148					0.0109
LAWA67																0.0148					0.0109
LAWA68																0.0148					0.0109
LAWA69																0.0148					0.0109
LAWA70																0.0148					0.0109
LAWA71																0.0148					0.0109
LAWA72																0.0148	0.0777				0.0109
LAWA73																0.0148					0.0404

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
LAWA41								0.0299		0.9999	0.0592	0.0735	0.0218	0.0650		0.0283	0.0003	0.0195	0.1698	0.0001	0.0025
LAWA42								0.0360		1.0000	0.0582	0.0849	0.0248	0.0783		0.0279	0.0003	0.0227	0.1694	0.0001	0.0025
LAWA43								0.0295		1.0000	0.1118	0.0733	0.0208	0.0642		0.0291	0.0003	0.0190	0.1778	0.0001	0.0020
LAWA44								0.0297		0.9999	0.0586	0.0881	0.0203	0.0659		0.0061	0.0003	0.0185	0.1792	0.0001	0.0017
LAWA45								0.0248		0.9999	0.0578	0.1183	0.0006	0.0661		0.0060	0.0002	0.0151	0.1803	0.0001	0.0020
LAWA46								0.0248		0.9999	0.0590	0.0914	0.0009	0.0664		0.0061	0.0002	0.0157	0.1878	0.0000	0.0016
LAWA47							0.0300	0.0248		0.9999	0.0557	0.0944	0.0006	0.0653		0.0060	0.0003	0.0145	0.1799	0.0001	0.0017
LAWA48								0.0248		0.9999	0.0621	0.0935	0.0007	0.0663		0.0036	0.0002	0.0160	0.1858	0.0001	0.0017
LAWA49								0.0248		0.9999	0.0537	0.0854	0.0006	0.0868			0.0002	0.0145	0.1772	0.0001	0.0014
LAWA50								0.0248		0.9999	0.0588	0.0886	0.0006	0.1091			0.0002	0.0151	0.1832	0.0001	0.0019
LAWA51								0.0249		0.9999	0.0592	0.1179	0.0006	0.0660			0.0002	0.0149	0.1675	0.0001	0.0015
LAWA52								0.0299		0.9999	0.0595	0.0640	0.0769	0.0774		0.0053	0.0006	0.0144	0.1900	0.0004	0.0007
LAWA53								0.0295		0.9988											
LAWA54								0.0295		0.9988											
LAWA55								0.0295		0.9988											
LAWA56								0.0295		0.9988											
LAWA57								0.0295		0.9988											
LAWA58								0.0295		0.9988											
LAWA59								0.0295		0.9988											
LAWA60								0.0297		0.9999	0.0824	0.1172	0.0432	0.0011		0.0054	0.0005	0.0193	0.1823	0.0000	0.0017
LAWA61								0.0295		0.9988											
LAWA62								0.0295		0.9988											
LAWA63								0.0295		0.9988											
LAWA64								0.0299		0.9999	0.0576	0.0593	0.0009	0.0751		0.0049	0.0008	0.0138	0.1747	0.0002	0.0007
LAWA65								0.0295		0.9988											
LAWA66								0.0295		0.9988											
LAWA67					0.0300			0.0295		0.9988											
LAWA68								0.0295		0.9988											
LAWA69								0.0295		0.9988											
LAWA70								0.0295		0.9988											
LAWA71								0.0295		0.9989											
LAWA72								0.0295		0.9989											
LAWA73										0.9988											

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
LAWA41	0.4160	0.0258	0.0001		0.0000									0.0002							
LAWA42	0.3584	0.0324	0.0001		0.0000									0.0002							
LAWA43	0.3576	0.0260	0.0001		0.0000			0.0002						0.0002							
LAWA44	0.4202	0.0254	0.0001		0.0000			0.0000						0.0003							
LAWA45	0.4274	0.0266	0.0001		0.0000			0.0000						0.0002							
LAWA46	0.4183	0.0262	0.0001		0.0000			0.0000						0.0001					0.0321		
LAWA47	0.4256	0.0261	0.0001		0.0000			0.0000						0.0002							
LAWA48	0.4280	0.0256	0.0001		0.0001			0.0000						0.0002					0.0062		
LAWA49	0.4124	0.0251	0.0001		0.0000			0.0000						0.0001					0.0056		
LAWA50	0.4161	0.0254	0.0001		0.0001			0.0000						0.0001					0.0059		
LAWA51	0.4315	0.0272	0.0001		0.0000			0.0000						0.0002					0.0052		
LAWA52	0.4188	0.0284			0.0000									0.0014							
LAWA53																					
LAWA54																					
LAWA55																					
LAWA56																					
LAWA57																					
LAWA58																					
LAWA59																					
LAWA60	0.4322	0.0283			0.0001									0.0001							
LAWA61																					
LAWA62																					
LAWA63																					
LAWA64	0.4080	0.0306			0.0006									0.0003							
LAWA65																					
LAWA66																					
LAWA67																					
LAWA68																					
LAWA69																					
LAWA70																					
LAWA71																					
LAWA72																					
LAWA73																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
LAWA41			0.0001						0.0007												
LAWA42			0.0001						0.0002												
LAWA43			0.0001						0.0003												
LAWA44			0.0001						0.0002												
LAWA45			0.0000						0.0002												
LAWA46			0.0000						0.0002												
LAWA47			0.0001						0.0002												
LAWA48			0.0000						0.0002												
LAWA49			0.0000						0.0003												
LAWA50			0.0001						0.0002												
LAWA51			0.0001						0.0002												
LAWA52			0.0001																		
LAWA53																					
LAWA54																					
LAWA55																					
LAWA56																					
LAWA57																					
LAWA58																					
LAWA59																					
LAWA60			0.0001																		
LAWA61																					
LAWA62																					
LAWA63																					
LAWA64			0.0003																		
LAWA65																					
LAWA66																					
LAWA67																					
LAWA68																					
LAWA69																					
LAWA70																					
LAWA71																					
LAWA72																					
LAWA73																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
LAWA41	0.0001					0.0001				0.0209								0.0283		0.9320
LAWA42	0.0003					0.0001				0.0242								0.0338		0.9189
LAWA43	0.0002					0.0001				0.0202								0.0275		0.9310
LAWA44	0.0002									0.0199								0.0293		0.9342
LAWA45	0.0002									0.0197								0.0243		0.9452
LAWA46										0.0211								0.0247		0.9518
LAWA47	0.0002									0.0192							0.0012	0.0240		0.9153
LAWA48										0.0211								0.0247		0.9361
LAWA49	0.0001									0.0198								0.0229		0.9061
LAWA50										0.0207								0.0242		0.9504
LAWA51										0.0205								0.0243		0.9371
LAWA52						0.0001				0.0116								0.0291		0.9788
LAWA53																				
LAWA54																				
LAWA55																				
LAWA56																				
LAWA57																				
LAWA58																				
LAWA59																				
LAWA60						0.0000				0.0199								0.0289		0.9629
LAWA61																				
LAWA62																				
LAWA63																				
LAWA64						0.0727				0.0110								0.0303		0.9417
LAWA65																				
LAWA66																				
LAWA67																				
LAWA68																				
LAWA69																				
LAWA70																				
LAWA71																				
LAWA72																				
LAWA73																				

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
LAWA41								
LAWA42								
LAWA43								
LAWA44								
LAWA45								
LAWA46								
LAWA47								
LAWA48								
LAWA49								
LAWA50								
LAWA51								
LAWA52								
LAWA53								
LAWA54								
LAWA55								
LAWA56								
LAWA57								
LAWA58								
LAWA59								
LAWA60								
LAWA61								
LAWA62								
LAWA63								
LAWA64								
LAWA65								
LAWA66								
LAWA67								
LAWA68								
LAWA69								
LAWA70								
LAWA71								
LAWA72								
LAWA73								

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
LAWA41					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA42					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA43					After 1200°C 1hr and 950°C 20 hr - Trace amount (~0.01 vol%) ZrO2
LAWA44					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass ; After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWA45					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA46					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA47					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA48					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA49					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA50					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA51					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA52					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA53					
LAWA54					
LAWA55					
LAWA56					
LAWA57					
LAWA58					
LAWA59					
LAWA60					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA61					
LAWA62					
LAWA63					
LAWA64					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA65					
LAWA66					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA67					
LAWA68					
LAWA69					
LAWA70					
LAWA71					
LAWA72					
LAWA73					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
LAWA41		2.68					-12.546	20602.7	6.91				900	159.5	950
LAWA42							-12.723	19749.5	3.18				900	66.9	950
LAWA43							-13.231	21937.8	8.90				900	260.4	950
LAWA44		2.67					-12.592	20696.1	7.04				900	168.7	950
LAWA45							-12.440	20387.4	6.60				900	154.3	950
LAWA46							-12.402	20780.7	9.04				900	218.9	950
LAWA47							-13.309	22023.0	8.74				900	265.3	950
LAWA48							-12.563	20880.7	8.25				900	205	950
LAWA49		2.64					-12.532	20937.5	8.86				900	220.4	950
LAWA50							-12.477	20604.5	7.41				900	175.8	950
LAWA51							-12.672	21443.3	10.99				900	304.8	950
LAWA52							-13.542	21659.8	5.36				900	155.4	950
LAWA53															
LAWA54															
LAWA55															
LAWA56															
LAWA57															
LAWA58															
LAWA59															
LAWA60		2.64					-11.417	18952.1	6.70				(900)	(245.6)	(950)
LAWA61															
LAWA62															
LAWA63															
LAWA64							-12.688	20668.1	6.27				900	149.6	950
LAWA65															
LAWA66															
LAWA67															
LAWA68															
LAWA69															
LAWA70															
LAWA71															
LAWA72															
LAWA73															

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
LAWA41	73.7	1000	36.9	1050	19.9	1100	11.3	1150	6.8	1200	4.3	1250	2.8								
LAWA42	30.7	1000	15.5	1050	8.5	1100	5	1150	3.1	1200	2	1250	1.4								
LAWA43	110.4	1000	52	1050	26.7	1100	14.8	1150	8.7	1200	5.4	1250	3.5								
LAWA44	75.9	1000	37.5	1050	20	1100	11.4	1150	6.9	1200	4.4	1250	2.9								
LAWA45	68.5	1000	33.8	1050	18.2	1100	10.5	1150	6.4	1200	4.2	1250	2.8								
LAWA46	98.2	1000	48.4	1050	25.8	1100	14.7	1150	8.9	1200	5.6	1250	3.7								
LAWA47	109.2	1000	50.7	1050	25.9	1100	14.4	1150	8.5	1200	5.3	1250	3.5								
LAWA48	90.6	1000	44.3	1050	23.6	1100	13.4	1150	8.1	1200	5.1	1250	3.4								
LAWA49	98	1000	48	1050	25.5	1100	14.5	1150	8.7	1200	5.5	1250	3.6								
LAWA50	78.9	1000	39	1050	20.9	1100	12	1150	7.2	1200	4.6	1250	3.1								
LAWA51	128.8	1000	61	1050	31.8	1100	17.8	1150	10.7	1200	6.8	1250	4.5								
LAWA52	64.4	1000	30.1	1050	15.5	1100	8.7	1150	5.2	1200	3.3	1250	2.2								
LAWA53																					
LAWA54																					
LAWA55																					
LAWA56																					
LAWA57																					
LAWA58																					
LAWA59																					
LAWA60	(82.3)	1000	35.1	1050	17.7	1100	10.1	1150	6.3	1200	4.3	1250	3								
LAWA61																					
LAWA62																					
LAWA63																					
LAWA64	67.3	1000	33.3	1050	17.8	1100	10.2	1150	6.1	1200	3.9	1250	2.6								
LAWA65																					
LAWA66																					
LAWA67																					
LAWA68																					
LAWA69																					
LAWA70																					
LAWA71																					
LAWA72																					
LAWA73																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
LAWA41					0.47		0.52	0.2	11.11							
LAWA42					0.78		0.7	0.22	11.27							
LAWA43					0.38		0.43	0.16	11.21							
LAWA44					0.37		0.36	0.16	10.27							
LAWA45					0.77		0.51	0.15	10.17							
LAWA46					0.43		0.35	0.16	10.33							
LAWA47					0.38		0.33	0.15	10.55							
LAWA48					0.39		0.33	0.15	10.55							
LAWA49					0.31		0.29	0.15	10.51							
LAWA50					0.31		0.3	0.15	10.62							
LAWA51					0.35		0.26	0.12	10.03							
LAWA52					0.43		0.55	0.17	10.82							
LAWA53																
LAWA54																
LAWA55																
LAWA56																
LAWA57																
LAWA58																
LAWA59																
LAWA60					0.29		0.31	0.11	10.21							
LAWA61																
LAWA62																
LAWA63																
LAWA64					0.38		0.5	0.18	10.94							
LAWA65																
LAWA66																
LAWA67																
LAWA68																
LAWA69																
LAWA70																
LAWA71																
LAWA72																
LAWA73																

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
LAWA41												
LAWA42												
LAWA43												
LAWA44				<0.0031	<0.0490	0.005	<0.0027	<0.0055	<0.0079	<0.0243	<0.0532	1.121
LAWA45												
LAWA46												
LAWA47												
LAWA48												
LAWA49												
LAWA50												
LAWA51												
LAWA52												
LAWA53												
LAWA54												
LAWA55												
LAWA56												
LAWA57												
LAWA58												
LAWA59												
LAWA60												
LAWA61												
LAWA62												
LAWA63												
LAWA64												
LAWA65												
LAWA66												
LAWA67												
LAWA68												
LAWA69												
LAWA70												
LAWA71												
LAWA72												
LAWA73												

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
LAWA74	0.0609	0.0688	0.0777	0.0813		0.0049		0.0219	0.1972		0.0003	0.4166	0.0295								
LAWA75	0.0609	0.1580	0.0777	0.0740		0.0049		0.0146	0.1003		0.0003	0.4166	0.0295								
LAWA76	0.0609	0.1085	0.0777	0.0740		0.0049	0.0495	0.0146	0.1003		0.0003	0.4166	0.0295								
LAWA77	0.1105	0.1085	0.0777	0.0740		0.0049		0.0146	0.1003		0.0003	0.4166	0.0295								
LAWA78	0.0609	0.1085	0.1273	0.0740		0.0049		0.0146	0.1003		0.0003	0.4166	0.0295								
LAWA79	0.1105	0.0611	0.0777	0.0740		0.0049		0.0146	0.1972		0.0003	0.3670	0.0295								
LAWA80	0.1105	0.0611	0.0777	0.0245		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA81	0.0620	0.0890	0.0399	0.0698		0.0050		0.0199	0.2000		0.0003	0.4455	0.0299	0.0000							
LAWA82	0.0620	0.0890		0.0698		0.0050		0.0199	0.2000		0.0003	0.4455	0.0299	0.0000							
LAWA83	0.0620	0.0890	0.0199	0.0499		0.0050		0.0199	0.2000		0.0203	0.4455	0.0299	0.0000							
LAWA84	0.0620	0.0890	0.0199	0.0299		0.0050		0.0199	0.2000		0.0402	0.4455	0.0299	0.0000							
LAWA85	0.0620	0.0890		0.0499		0.0050		0.0199	0.2000		0.0203	0.4455	0.0299	0.0000							
LAWA86	0.0620	0.0890		0.0299		0.0050		0.0199	0.2000		0.0402	0.4455	0.0299	0.0000							
LAWA87	0.0448	0.0887	0.0199	0.0697		0.0258		0.0199	0.2000		0.0007	0.4446	0.0299								
LAWA88	0.0608	0.0970	0.0199	0.0553		0.0258		0.0148	0.2000		0.0007	0.4399	0.0299								
LAWA89	0.0608	0.0970		0.0553		0.0258		0.0148	0.2000		0.0007	0.4399	0.0299								
LAWA90	0.0608	0.0970	0.0398	0.0553		0.0258		0.0148	0.2000		0.0007	0.4399	0.0299								
LAWA91	0.0609	0.0611		0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA92	0.0609	0.0611		0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0295								
LAWA93	0.0618	0.1110	0.0788	0.0751		0.0050	0.0507	0.0148	0.1003		0.0003	0.4225	0.0299	0.0000							
LAWA94	0.0609	0.0611	0.0632	0.0740		0.0049		0.0146	0.1972		0.0003	0.4166	0.0441								
LAWA95	0.0609	0.0611	0.0559	0.0376		0.0049		0.0146	0.1972		0.0295	0.4166	0.0295								
LAWA96	0.0620	0.0791	0.0399	0.0299		0.0050		0.0199	0.2000		0.0402	0.4356	0.0299	0.0000							
LAWA97S	0.0612	0.0878	0.0197	0.0397		0.0049		0.0197	0.1972		0.0003	0.4394	0.0292								
LAWA98S	0.0603	0.1074	0.0508	0.0750		0.0037	0.0306	0.0149	0.1480		0.0003	0.4300	0.0302	0.0000							
LAWA99S	0.0603	0.1074	0.0613	0.0452		0.0037	0.0202	0.0149	0.1480		0.0003	0.4300	0.0302	0.0000							
LAWA100S	0.0603	0.1074	0.0613	0.0750		0.0037	0.0202	0.0149	0.1480		0.0003	0.4300	0.0302	0.0000							
LAWA101S	0.0603	0.1074	0.0710	0.0750		0.0037	0.0105	0.0149	0.1480		0.0003	0.4300	0.0302	0.0000							

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
LAWA74	0.0064			0.0002				0.0001									0.0001				
LAWA75	0.0064			0.0002				0.0001									0.0001				
LAWA76	0.0064			0.0002				0.0001									0.0001				
LAWA77	0.0064			0.0002				0.0001									0.0001				
LAWA78	0.0064			0.0002				0.0001									0.0001				
LAWA79	0.0064			0.0002				0.0001									0.0001				
LAWA80	0.0064			0.0002				0.0001									0.0001				
LAWA81	0.0065			0.0002	0.0000			0.0001													
LAWA82	0.0065			0.0002	0.0000			0.0001													
LAWA83	0.0065			0.0002	0.0000			0.0001													
LAWA84	0.0065			0.0002	0.0000			0.0001													
LAWA85	0.0065			0.0002	0.0000			0.0001													
LAWA86	0.0065			0.0002	0.0000			0.0001													
LAWA87	0.0033			0.0001	0.0000																
LAWA88	0.0033			0.0001	0.0000																
LAWA89	0.0033			0.0001	0.0000																
LAWA90	0.0033			0.0001	0.0000																
LAWA91	0.0064			0.0002				0.0001					0.0777				0.0001				
LAWA92	0.0064			0.0002				0.0001		0.0777							0.0001				
LAWA93	0.0065			0.0002	0.0000			0.0001													
LAWA94	0.0064			0.0002				0.0001									0.0001				
LAWA95	0.0064			0.0002				0.0001									0.0001				
LAWA96	0.0065			0.0002	0.0000			0.0001													
LAWA97S	0.0064			0.0002				0.0001									0.0001				
LAWA98S	0.0048			0.0002	0.0000			0.0001													
LAWA99S	0.0048			0.0002	0.0000			0.0001												0.0000	
LAWA100S	0.0048			0.0002	0.0000			0.0001												0.0000	
LAWA101S	0.0048			0.0002	0.0000			0.0001												0.0000	

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
LAWA74																0.0148					0.0182
LAWA75																0.0148					0.0109
LAWA76																0.0148					0.0109
LAWA77																0.0148					0.0109
LAWA78																0.0148					0.0109
LAWA79																0.0148					0.0109
LAWA80																0.0148					0.0109
LAWA81						0.0010										0.0010					
LAWA82						0.0010										0.0010					0.0399
LAWA83						0.0010										0.0010					0.0199
LAWA84						0.0010										0.0010					0.0199
LAWA85						0.0010										0.0010	0.0199				0.0199
LAWA86						0.0010										0.0010	0.0199				0.0199
LAWA87						0.0010										0.0021					0.0199
LAWA88						0.0010										0.0021					0.0199
LAWA89						0.0010										0.0021					0.0398
LAWA90						0.0010										0.0021					
LAWA91																0.0148					0.0109
LAWA92																0.0148					0.0109
LAWA93						0.0010										0.0010					0.0111
LAWA94																0.0148					0.0109
LAWA95																0.0148					0.0109
LAWA96						0.0010										0.0010					0.0199
LAWA97S																0.0148					0.0197
LAWA98S						0.0010										0.0071					0.0113
LAWA99S						0.0010										0.0084					0.0113
LAWA100S						0.0010										0.0061					0.0113
LAWA101S						0.0010										0.0062					0.0113

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
LAWA74										0.9989											
LAWA75								0.0295		0.9988											
LAWA76								0.0295		0.9988											
LAWA77								0.0295		0.9989											
LAWA78								0.0295		0.9989											
LAWA79								0.0295		0.9988											
LAWA80								0.0295		0.9989											
LAWA81								0.0297		0.9999	0.0619	0.0883	0.0409	0.0704		0.0059	0.0011	0.0190	0.1982	0.0000	0.0004
LAWA82								0.0297		0.9999	0.0614	0.0878	0.0013	0.0663		0.0059	0.0002	0.0188	0.1925	0.0000	0.0015
LAWA83								0.0297		0.9999	0.0633	0.0911	0.0209	0.0502		0.0058	0.0002	0.0189	0.1897	0.0001	0.0210
LAWA84								0.0297		0.9999	0.0613	0.0901	0.0210	0.0299		0.0059	0.0002	0.0189	0.1860	0.0000	0.0373
LAWA85								0.0297		0.9999	0.0553	0.0862	0.0015	0.0467		0.0054	0.0002	0.0176	0.1728	0.0001	0.0209
LAWA86								0.0297		0.9999	0.0571	0.0862	0.0008	0.0286		0.0053	0.0002	0.0178	0.1711	0.0001	0.0400
LAWA87								0.0296		1.0000	0.0424	0.0870	0.0203	0.0653		0.0225	0.0003	0.0180	0.1840	0.0001	0.0022
LAWA88								0.0295		1.0000	0.0611	0.0966	0.0205	0.0546		0.0246	0.0004	0.0153	0.1693	0.0001	0.0023
LAWA89								0.0295		1.0000	0.0593	0.0940	0.0007	0.0487		0.0235	0.0004	0.0143	0.1735	0.0002	0.0026
LAWA90								0.0295		1.0000	0.0578	0.0948	0.0380	0.0516		0.0230	0.0004	0.0150	0.1691	0.0001	0.0016
LAWA91								0.0295		0.9988											
LAWA92								0.0295		0.9988											
LAWA93								0.0299		0.9999	0.0578	0.1087	0.0757	0.0710		0.0061	0.0465	0.0153	0.0864	0.0001	0.0017
LAWA94								0.0295		0.9989											
LAWA95					0.0291			0.0295		0.9990											
LAWA96								0.0297		0.9999	0.0610	0.0773	0.0394	0.0288		0.0055	0.0006	0.0182	0.1921	0.0001	0.0403
LAWA97S					0.0294			0.0292		0.9990											
LAWA98S								0.0307		1.0063	0.0574	0.1080	0.0482	0.0790		0.0039	0.0282	0.0157	0.1094	0.0013	0.0023
LAWA99S					0.0298			0.0307		1.0076											
LAWA100S								0.0307		1.0053											
LAWA101S								0.0307		1.0054											

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
LAWA74																					
LAWA75																					
LAWA76																					
LAWA77																					
LAWA78																					
LAWA79																					
LAWA80																					
LAWA81	0.4507	0.0272			0.0001									0.0002							
LAWA82	0.4563	0.0271			0.0000									0.0002							
LAWA83	0.4450	0.0298			0.0000									0.0002							
LAWA84	0.4403	0.0271			0.0000									0.0002							
LAWA85	0.4364	0.0258			0.0002									0.0002							
LAWA86	0.4287	0.0230			0.0002									0.0002							
LAWA87	0.4385	0.0253			0.0000									0.0002							
LAWA88	0.4272	0.0279			0.0000									0.0002							
LAWA89	0.4164	0.0275			0.0000									0.0002							
LAWA90	0.4217	0.0261			0.0000									0.0001							
LAWA91																					
LAWA92																					
LAWA93	0.4022	0.0278			0.0000									0.0003							
LAWA94																					
LAWA95																					
LAWA96	0.4038	0.0280			0.0000									0.0002							
LAWA97S																					
LAWA98S	0.4194	0.0298			0.0001									0.0027							
LAWA99S																					
LAWA100S																					
LAWA101S																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
LAWA74																					
LAWA75																					
LAWA76																					
LAWA77																					
LAWA78																					
LAWA79																					
LAWA80																					
LAWA81			0.0010																		
LAWA82			0.0001																		
LAWA83			0.0001																		
LAWA84			0.0001																		
LAWA85			0.0001																		
LAWA86			0.0001																		
LAWA87			0.0001																		
LAWA88			0.0002																		
LAWA89			0.0003																		
LAWA90			0.0001																		
LAWA91																					
LAWA92																					
LAWA93			0.0001																		
LAWA94																					
LAWA95																					
LAWA96			0.0001																		
LAWA97S																					
LAWA98S			0.0003																		
LAWA99S																					
LAWA100S																					
LAWA101S																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
LAWA74																				
LAWA75																				
LAWA76																				
LAWA77																				
LAWA78																				
LAWA79																				
LAWA80																				
LAWA81						0.0013				0.0003								0.0286		0.9952
LAWA82						0.0001				0.0401								0.0283		0.9881
LAWA83						0.0001				0.0207								0.0284		0.9852
LAWA84						0.0000				0.0199								0.0281		0.9663
LAWA85						0.0166				0.0189								0.0293		0.9342
LAWA86						0.0178				0.0190								0.0255		0.9217
LAWA87						0.0001				0.0182								0.0291		0.9535
LAWA88						0.0001				0.0192								0.0279		0.9476
LAWA89						0.0002				0.0365								0.0270		0.9252
LAWA90						0.0001				0.0005								0.0287		0.9286
LAWA91																				
LAWA92																				
LAWA93						0.0001				0.0121								0.0294		0.9414
LAWA94																				
LAWA95																				
LAWA96					0.0004	0.0000				0.0193								0.0294		0.9444
LAWA97S																				
LAWA98S					0.0089	0.0001				0.0120								0.0285		0.9552
LAWA99S																				
LAWA100S																				
LAWA101S																				

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
LAWA74								
LAWA75								
LAWA76								
LAWA77								
LAWA78								
LAWA79								
LAWA80								
LAWA81								
LAWA82								
LAWA83								
LAWA84								
LAWA85								
LAWA86								
LAWA87								
LAWA88								
LAWA89								
LAWA90								
LAWA91								
LAWA92								
LAWA93								
LAWA94								
LAWA95								
LAWA96								
LAWA97S								
LAWA98S								
LAWA99S								
LAWA100S								
LAWA101S								

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
LAWA74					
LAWA75					
LAWA76					
LAWA77					
LAWA78					
LAWA79					
LAWA80					
LAWA81					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA82					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA83					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA84					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA85					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA86					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA87					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA88					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass; After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWA89					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA90					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA91					
LAWA92					
LAWA93					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA94					
LAWA95					
LAWA96					After 1200°C 1hr and 950°C 20 hr - Less than 0.1 vol% of white, dendritic crystals
LAWA97S					
LAWA98S					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA99S					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass for the most part with one black, irregular nodule ~ 75mm dia.
LAWA100S					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass for the most part, with one white, cloudy nodule 300 mm dia. at the crucible contact surface
LAWA101S					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
LAWA74															
LAWA75															
LAWA76															
LAWA77															
LAWA78															
LAWA79															
LAWA80															
LAWA81							-13.382	21825.3	7.07				900	197.8	950
LAWA82							-12.527	21089.4	9.91				900	250.3	950
LAWA83							-12.882	21519.6	9.40				900	254.8	950
LAWA84							-12.603	21112.7	9.33				900	238.4	950
LAWA85							-12.525	20923.7	8.84				900	225.5	950
LAWA86															
LAWA87							-11.869	19176.9	4.99				900	94.5	950
LAWA88		2.67					-11.891	19487.1	6.07				900	119.9	950
LAWA89							-12.550	20570.0	6.72				900	163.9	950
LAWA90							-12.201	20053.1	6.63				900	143.9	950
LAWA91															
LAWA92															
LAWA93							-11.341	16831.1	1.63				900	21.6	950
LAWA94															
LAWA95															
LAWA96		2.67					-12.791	21146.3	7.92				900	210.4	950
LAWA97S							-12.661	20939.9	7.80				900	203.6	950
LAWA98S							-10.909	17329.9	3.56				900	51	950
LAWA99S							-12.393	19647.8	4.11				900	84.1	950
LAWA100S							-12.265	19509.2	4.24				900	83.1	950
LAWA101S							-12.888	20915.2	6.11				900	151.8	950

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
LAWA74																					
LAWA75																					
LAWA76																					
LAWA77																					
LAWA78																					
LAWA79																					
LAWA80																					
LAWA81	86.5	1000	41.5	1050	21.5	1100	11.9	1150	7	1200	4.3	1250	2.7								
LAWA82	111.7	1000	54.7	1050	28.9	1100	16.3	1150	9.7	1200	6.1	1250	4								
LAWA83	111.2	1000	53.5	1050	27.9	1100	15.6	1150	9.2	1200	5.8	1250	3.7								
LAWA84	105.5	1000	51.4	1050	27.1	1100	15.3	1150	9.2	1200	5.7	1250	3.8								
LAWA85	97.5	1000	47.1	1050	24.9	1100	14.2	1150	8.6	1200	5.5	1250	3.7								
LAWA86																					
LAWA87	45.1	1000	23.5	1050	13.2	1100	7.8	1150	4.9	1200	3.2	1250	2.2								
LAWA88	56.9	1000	29.4	1050	16.3	1100	9.6	1150	6	1200	3.9	1250	2.6								
LAWA89	71.2	1000	34.7	1050	18.5	1100	10.7	1150	6.5	1200	4.2	1250	2.9								
LAWA90	66.3	1000	33.4	1050	18.2	1100	10.6	1150	6.5	1200	4.2	1250	2.8								
LAWA91																					
LAWA92																					
LAWA93	11.3	1000	6.3	1050	3.8	1100	2.4	1150	1.6	1200	1.1	1250	0.8								
LAWA94																					
LAWA95																					
LAWA96	89.5	1000	42.8	1050	22.5	1100	12.8	1150	7.7	1200	4.9	1250	3.3								
LAWA97S	86.1	1000	41.2	1050	21.7	1100	12.4	1150	7.6	1200	4.9	1250	3.3								
LAWA98S	26.1	1000	14.4	1050	8.5	1100	5.3	1150	3.5	1200	2.4	1250	1.7								
LAWA99S	39.3	1000	20.1	1050	11.1	1100	6.5	1150	4	1200	2.6	1250	1.8								
LAWA100S	39.8	1000	20.7	1050	11.5	1100	6.8	1150	4.2	1200	2.7	1250	1.8								
LAWA101S	67.6	1000	33.1	1050	17.5	1100	9.9	1150	6	1200	3.8	1250	2.5								

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
LAWA74																
LAWA75																
LAWA76					0.71		0.66	0.2	10.82							
LAWA77																
LAWA78																
LAWA79																
LAWA80																
LAWA81					0.39		0.42	0.15	10.88							
LAWA82					0.34		0.33	0.17	10.51							
LAWA83					0.31		0.34	0.16	10.57							
LAWA84					0.3		0.33	0.16	10.41							
LAWA85					0.34		0.35	0.17	10.35							
LAWA86					0.39		0.39	0.18	10.31							
LAWA87					0.6		0.55	0.25	10.97							
LAWA88					0.43		0.43	0.17	10.91							
LAWA89					0.58		0.47	0.18	10.81							
LAWA90					0.49		0.49	0.18	10.98							
LAWA91																
LAWA92																
LAWA93					0.53		0.54	0.17	10.86							
LAWA94																
LAWA95																
LAWA96					0.31		0.38	0.17	10.63							
LAWA97S																
LAWA98S					0.36		0.28	0.12	10.36							
LAWA99S					0.74		0.54	0.19	10.96							
LAWA100S					0.54		0.38	0.16	9.86							
LAWA101S					0.43		0.32	0.14	9.87							

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
LAWA74												
LAWA75												
LAWA76												
LAWA77												
LAWA78												
LAWA79												
LAWA80												
LAWA81												
LAWA82												
LAWA83												
LAWA84												
LAWA85												
LAWA86												
LAWA87												
LAWA88												
LAWA89												
LAWA90												
LAWA91												
LAWA92												
LAWA93												
LAWA94												
LAWA95												
LAWA96												
LAWA97S												
LAWA98S												
LAWA99S												
LAWA100S												
LAWA101S												

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
LAWA102S	0.0606	0.1000	0.0507	0.0541		0.0026	0.0250	0.0150	0.1449		0.0013	0.4660	0.0302								
LAWA103S	0.0606	0.1000	0.0507	0.0500		0.0026	0.0250	0.0150	0.1449		0.0013	0.4551	0.0302			0.0000					
LAWA104	0.0661	0.0859	0.0192	0.0674		0.0055		0.0192	0.2200		0.0004	0.4299	0.0289	0.0000							
LAWA105	0.0703	0.0828	0.0185	0.0649		0.0060		0.0185	0.2400		0.0004	0.4142	0.0278	0.0000							
LAWB29*	0.0803	0.0807	0.0701	0.0802		0.0038	0.0408	0.0298	0.1000		0.0008	0.4383	0.0303								
LAWB30	0.0860	0.1004	0.0723	0.0827		0.0032	0.0407	0.0307	0.0790		0.0004	0.4272	0.0312								
LAWB31	0.0616	0.1209	0.0403	0.0717		0.0032	0.0296	0.0224	0.0790		0.0272	0.4691	0.0309								
LAWB32	0.0616	0.1509	0.0403	0.0417		0.0032	0.0296	0.0224	0.0790		0.0272	0.4691	0.0309								
LAWB33	0.0616	0.1209	0.0403	0.0515		0.0032	0.0296	0.0224	0.0790		0.0474	0.4691	0.0309								
LAWB34	0.0616	0.1209	0.0605	0.0515		0.0032	0.0296	0.0224	0.0790		0.0272	0.4691	0.0309								
LAWB35	0.0616	0.1209	0.0403	0.0515		0.0032	0.0296	0.0426	0.0790		0.0272	0.4691	0.0309								
LAWB36S	0.0616	0.1209	0.0403	0.0515		0.0032	0.0385	0.0224	0.0790		0.0474	0.4333	0.0309								
LAWB37	0.0616	0.1209	0.0470	0.0515		0.0032	0.0296	0.0291	0.0790		0.0340	0.4691	0.0309								
LAWB38	0.0616	0.1209	0.0475	0.0515		0.0032	0.0381	0.0224	0.0790		0.0317	0.4691	0.0309								
LAWB39	0.0616	0.1209	0.0470	0.0515		0.0032	0.0296	0.0291	0.0790		0.0004	0.4691	0.0309								
LAWB40	0.0616	0.1209	0.0470	0.0515		0.0032	0.0632	0.0291	0.0790		0.0004	0.4691	0.0309								
LAWB41	0.0616	0.1209	0.0650	0.0515		0.0032	0.0452	0.0291	0.0790		0.0004	0.4692	0.0309								
LAWB42S	0.0607	0.1192	0.0463	0.0605		0.0031		0.0287	0.0779		0.0004	0.4623	0.0305								
LAWB43S	0.0607	0.1192	0.0463	0.1033		0.0031		0.0287	0.0779		0.0004	0.4623	0.0305								
LAWB44S	0.0607	0.1192	0.0463	0.1320		0.0031			0.0779		0.0004	0.4623	0.0305								
LAWB45	0.0613	0.1234	0.0663	0.0526		0.0026	0.0462	0.0297	0.0650		0.0003	0.4786	0.0315								
LAWB47	0.0613	0.1234	0.0601	0.0526		0.0026	0.0409	0.0297	0.0650		0.0003	0.4786	0.0315								
LAWB48	0.0613	0.1234	0.0540	0.0526		0.0026	0.0356	0.0297	0.0650		0.0003	0.4786	0.0315								
LAWB49	0.0613	0.1234	0.0480	0.0526		0.0026	0.0302	0.0297	0.0650		0.0003	0.4786	0.0315								
LAWB50	0.0616	0.1209	0.0649	0.0515		0.0032	0.0452	0.0291	0.0790		0.0004	0.4691	0.0309								

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
LAWA102S	0.0033			0.0002	0.0000			0.0003													
LAWA103S	0.0033			0.0002	0.0000			0.0003													
LAWA104	0.0072			0.0002	0.0000			0.0001												0.0000	
LAWA105	0.0078			0.0002	0.0000			0.0001												0.0000	
LAWB29*	0.0001			0.0007	0.0000			0.0012													
LAWB30	0.0001			0.0009	0.0000			0.0010													
LAWB31	0.0001			0.0009	0.0000			0.0010													
LAWB32	0.0001			0.0009	0.0000			0.0010													
LAWB33	0.0001			0.0009	0.0000			0.0010													
LAWB34	0.0001			0.0009	0.0000			0.0010													
LAWB35	0.0001			0.0009	0.0000			0.0010													
LAWB36S	0.0001			0.0009	0.0000			0.0010													
LAWB37	0.0001			0.0009	0.0000			0.0010													
LAWB38	0.0001			0.0009	0.0000			0.0010													
LAWB39	0.0001			0.0009	0.0000			0.0010													
LAWB40	0.0001			0.0009	0.0000			0.0010													
LAWB41	0.0001			0.0009	0.0000			0.0010													
LAWB42S	0.0001			0.0009	0.0000			0.0010													
LAWB43S	0.0001			0.0009	0.0000			0.0010													
LAWB44S	0.0001			0.0009	0.0000			0.0010													
LAWB45	0.0001			0.0007	0.0000			0.0008													
LAWB47	0.0001			0.0007	0.0000			0.0008													
LAWB48	0.0001			0.0007	0.0000			0.0008													
LAWB49	0.0001			0.0007	0.0000			0.0008													
LAWB50	0.0050			0.0009	0.0000			0.0010													

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
LAWA102S						0.0010										0.0068					0.0114
LAWA103S						0.0010										0.0055					0.0114
LAWA104						0.0010										0.0011					0.0192
LAWA105						0.0010										0.0011					0.0185
LAWB29*						0.0010										0.0020					
LAWB30						0.0010										0.0020					
LAWB31						0.0010										0.0103					
LAWB32						0.0010										0.0103					
LAWB33						0.0010										0.0103					
LAWB34						0.0010										0.0103					
LAWB35						0.0010										0.0103					
LAWB36S						0.0010										0.0087					
LAWB37						0.0010										0.0103					
LAWB38						0.0010										0.0103					
LAWB39						0.0010										0.0103					
LAWB40						0.0010										0.0103					
LAWB41						0.0010										0.0102					
LAWB42S																0.0061					
LAWB43S																0.0062					
LAWB44S																0.0052					
LAWB45						0.0010										0.0084					
LAWB47						0.0010										0.0084					
LAWB48						0.0010										0.0084					
LAWB49						0.0010										0.0084					
LAWB50						0.0010															

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
LAWA102S								0.0306		1.0041											
LAWA103S					0.0150			0.0306		1.0028											
LAWA104								0.0286		0.9999											
LAWA105								0.0276		0.9999											
LAWB29*								0.0399		1.0000	0.0648	0.0778	0.0700	0.0813		0.0050	0.0391	0.0275	0.0869		0.0021
LAWB30								0.0411		1.0000	0.0840	0.0986	0.0700	0.0793		0.0033		0.0283	0.0750		0.0019
LAWB31								0.0309		1.0000	0.0569	0.1113	0.0380	0.0657		0.0035	0.0262	0.0191	0.0724		0.0270
LAWB32								0.0309		1.0000	0.0599	0.1500	0.0395	0.0399		0.0036	0.0294	0.0202	0.0727		0.0282
LAWB33								0.0309		1.0000	0.0558	0.1174	0.0371	0.0469		0.0035	0.0263	0.0195	0.0696		0.0438
LAWB34								0.0309		1.0000	0.0553	0.1143	0.0550	0.0476		0.0035	0.0274	0.0195	0.0704		0.0269
LAWB35								0.0309		1.0000	0.0584	0.1196	0.0387	0.0493		0.0039	0.0270	0.0369	0.0732		0.0270
LAWB36S					0.0269			0.0309		0.9984											
LAWB37								0.0309		1.0000	0.0625	0.1145	0.0451	0.0470		0.0035	0.0285	0.0253	0.0764		0.0340
LAWB38								0.0309		1.0000											
LAWB39					0.0336			0.0309		1.0000	0.0601	0.1163	0.0446	0.0487		0.0035	0.0287	0.0255	0.0752		0.0014
LAWB40								0.0309		1.0000											
LAWB41								0.0309		1.0000											
LAWB42S					0.0428			0.0402		0.9805											
LAWB43S								0.0402		0.9806											
LAWB44S								0.0402		0.9796											
LAWB45								0.0315		1.0000	0.0586	0.1296	0.0620	0.0500		0.0023	0.0426	0.0263	0.0541		0.0009
LAWB47					0.0114			0.0315		1.0000											
LAWB48					0.0229			0.0315		1.0000											
LAWB49					0.0343			0.0315		1.0000											
LAWB50								0.0309		0.9947											

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
LAWA102S																					
LAWA103S																					
LAWA104																					
LAWA105																					
LAWB29*	0.4540	0.0276												0.0035							
LAWB30	0.4092	0.0309												0.0007							
LAWB31	0.4322	0.0275												0.0010							
LAWB32	0.4584	0.0250												0.0009							
LAWB33	0.4383	0.0246												0.0008							
LAWB34	0.4552	0.0247												0.0008							
LAWB35	0.4540	0.0281												0.0009							
LAWB36S																					
LAWB37	0.4728	0.0265												0.0008							
LAWB38																					
LAWB39	0.4670	0.0276												0.0008							
LAWB40																					
LAWB41																					
LAWB42S																					
LAWB43S																					
LAWB44S																					
LAWB45	0.4624	0.0304												0.0005							
LAWB47																					
LAWB48																					
LAWB49																					
LAWB50																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
LAWA102S																					
LAWA103S																					
LAWA104																					
LAWA105																					
LAWB29*																					
LAWB30																					
LAWB31																					
LAWB32																					
LAWB33																					
LAWB34																					
LAWB35																					
LAWB36S																					
LAWB37																					
LAWB38																					
LAWB39																					
LAWB40																					
LAWB41																					
LAWB42S																					
LAWB43S																					
LAWB44S																					
LAWB45																					
LAWB47																					
LAWB48																					
LAWB49																					
LAWB50																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
LAWA102S																				
LAWA103S																				
LAWA104																				
LAWA105																				
LAWB29*										0.0005								0.0370		0.9770
LAWB30										0.0004								0.0402		0.9217
LAWB31					0.0062					0.0002								0.0290		0.9163
LAWB32					0.0067					0.0002								0.0285		0.9630
LAWB33					0.0075					0.0002								0.0285		0.9198
LAWB34					0.0068					0.0002								0.0295		0.9370
LAWB35					0.0073					0.0002								0.0308		0.9551
LAWB36S																				
LAWB37					0.0067					0.0003								0.0312		0.9751
LAWB38																				
LAWB39					0.0077					0.0002					0.0339			0.0310		0.9719
LAWB40																				
LAWB41																				
LAWB42S																				
LAWB43S																				
LAWB44S																				
LAWB45					0.0058					0.0003								0.0305		0.9563
LAWB47																				
LAWB48																				
LAWB49																				
LAWB50																				

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
LAWA102S								
LAWA103S								
LAWA104								
LAWA105								
LAWB29*								
LAWB30								
LAWB31								
LAWB32								
LAWB33								
LAWB34								
LAWB35								
LAWB36S								
LAWB37								
LAWB38								
LAWB39								
LAWB40								
LAWB41								
LAWB42S								
LAWB43S								
LAWB44S								
LAWB45								
LAWB47								
LAWB48								
LAWB49								
LAWB50								

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
LAWA102S					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWA103S					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWA104					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWA105					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWB29*					
LAWB30					After 1200°C 1hr and 950°C 20 hr - trace amount of high Fe spinel.
LAWB31					After 1200°C 1hr and 850°C 20 hr - ~2.4%*
LAWB32					After 1200°C 1hr and 850°C 20 hr - ~2.9 vol%*
LAWB33					After 1200°C 1hr and 950°C 20 hr - 2.9% (Ca3(PO4)2); After 1200°C 1hr and 850°C 20 hr - ~6.2 vol%*
LAWB34					After 1200°C 1hr and 950°C 20 hr - Trace amount of crystals; After 1200°C 1hr and 850°C 20 hr - ~4.8 vol%*
LAWB35					After 1200°C 1hr and 850°C 20 hr - 0.26%*
LAWB36S					After 1200°C 1hr and 850°C 20 hr - 4.16%*
LAWB37					After 1200°C 1hr and 850°C 20 hr - 4.8%*
LAWB38					After 1200°C 1hr and 850°C 20 hr - 4.0%*
LAWB39					After 1200°C 1hr and 850°C 20 hr - Less than 0.1 vol% of clear cubic-shaped crystal
LAWB40					After 1200°C 1hr and 850°C 20 hr - One small submicron crystal
LAWB41					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWB42S					After 1200°C 1hr and 850°C 20 hr - Trace amount of 1 to 10 mm zircon crystals and Fe-Zn spinel; ~1vol.%
LAWB43S					After 1200°C 1hr and 850°C 20 hr - Presence of spinel, Ca-Mg-Fe silicate (augite) and zircon. In total ~14.9 vol%
LAWB44S					After 1200°C 1hr and 850°C 20 hr - Presence of spinel, Ca-Mg-Fe silicate (augite) and zircon. In total ~12.3 vol%
LAWB45					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWB47					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWB48					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass for the most part, with one black irregular particle of ~5 mm dia. possibly spinel.
LAWB49					After 1200°C 1hr and 850°C 20 hr - trace
LAWB50					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
LAWA102S		2.61					-12.037	19589.0	5.63				900	117	950
LAWA103S															
LAWA104							-12.240	19811.5	5.38				900	112.3	950
LAWA105							-11.682	18560.1	3.90				900	67.3	950
LAWB29*															
LAWB30							-12.879	19959.4	3.15				900	71.5	950
LAWB31															
LAWB32															
LAWB33															
LAWB34		2.63					-13.262	21953.9	8.72				900	253.3	950
LAWB35		2.64													
LAWB36S															
LAWB37		2.61					-12.737	21299.0	9.31				900	243.4	950
LAWB38							-12.102	19910.6	6.62				900	139.8	950
LAWB39							-12.495	20494.0	6.73				900	156.1	950
LAWB40							-11.338	17384.8	2.41				900	36.6	950
LAWB41							-12.255	19259.7	3.60				900	69.2	950
LAWB42S							-15.794	27581.7	36.19				900	2490.2	950
LAWB43S															
LAWB44S															
LAWB45		2.65					-12.549	19966.7	4.40				900	96.4	950
LAWB47							-12.234	20101.0	6.63				900	145.1	950
LAWB48							-13.247	21931.3	8.71				900	260.4	950
LAWB49							-12.819	21371.8	9.02				900	239	950
LAWB50															

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
LAWA102S	53.3	1000	27	1050	14.9	1100	8.8	1150	5.5	1200	3.6	1250	2.5								
LAWA103S																					
LAWA104	52.3	1000	26.7	1050	14.6	1100	8.6	1150	5.3	1200	3.4	1250	2.3								
LAWA105	32.9	1000	17.5	1050	10	1100	6	1150	3.8	1200	2.5	1250	1.8								
LAWB29*																					
LAWB30	30.9	1000	15.2	1050	8.3	1100	4.9	1150	3.1	1200	2	1250	1.4								
LAWB31																					
LAWB32																					
LAWB33																					
LAWB34	108.5	1000	51.4	1050	26.4	1100	14.6	1150	8.5	1200	5.3	1250	3.4								
LAWB35																					
LAWB36S																					
LAWB37	107.2	1000	52	1050	27.3	1100	15.4	1150	9.2	1200	5.7	1250	3.7								
LAWB38	65.1	1000	33.1	1050	18.2	1100	10.6	1150	6.5	1200	4.2	1250	2.8								
LAWB39	70.8	1000	35.3	1050	19	1100	10.9	1150	6.6	1200	4.2	1250	2.8								
LAWB40	17.6	1000	9.5	1050	5.6	1100	3.5	1150	2.4	1200	1.6	1250	1.2								
LAWB41	32.9	1000	17.1	1050	9.5	1100	5.6	1150	3.5	1200	2.3	1250	1.6								
LAWB42S	859.3	1000	336	1050	145.9	1100	69.1	1150	35.3	1200	19.2	1250	11.1								
LAWB43S																					
LAWB44S																					
LAWB45	43.4	1000	21.8	1050	11.9	1100	7	1150	4.3	1200	2.8	1250	1.9								
LAWB47	66.7	1000	33.6	1050	18.3	1100	10.6	1150	6.5	1200	4.2	1250	2.8								
LAWB48	107.9	1000	50.3	1050	25.8	1100	14.3	1150	8.5	1200	5.3	1250	3.5								
LAWB49	104.9	1000	50.7	1050	26.6	1100	14.9	1150	8.9	1200	5.5	1250	3.6								
LAWB50																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
LAWA102S					0.27		0.22	0.16	9.84							
LAWA103S																
LAWA104					0.58		0.53	0.21	11.23							
LAWA105					0.96		0.79	0.28	11.35							
LAWB29*																
LAWB30					0.24		0.24	0.09	10.11							
LAWB31					0.21		0.11	0.1	9.41							
LAWB32					0.25		0.14	0.11	9.33							
LAWB33					0.19		0.12	0.1	9.18							
LAWB34					0.22		0.13	0.1	9.51							
LAWB35					0.5		0.34	0.14	9.56							
LAWB36S																
LAWB37					0.26		0.18	0.11	9.43							
LAWB38					0.25		0.18	0.12	9.56							
LAWB39					0.5		0.4	0.13	9.43							
LAWB40					1.59		1.17	0.32	10.41							
LAWB41					0.85		0.7	0.19	10.17							
LAWB42S																
LAWB43S																
LAWB44S																
LAWB45					0.53		0.44	0.14	10.13							
LAWB47																
LAWB48																
LAWB49																
LAWB50																

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
LAWA102S				<0.0031	<0.0490	0.003	<0.0027	0.016	0.017	<0.0243	<0.0532	1.327
LAWA103S												
LAWA104												
LAWA105												
LAWB29*												
LAWB30												
LAWB31												
LAWB32												
LAWB33												
LAWB34												
LAWB35												
LAWB36S												
LAWB37												
LAWB38												
LAWB39												
LAWB40												
LAWB41												
LAWB42S												
LAWB43S												
LAWB44S												
LAWB45				<0.0031	0.051	0.004	<0.0027	0.015	0.016	<0.0243	<0.0532	1.014
LAWB47												
LAWB48												
LAWB49												
LAWB50												

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
LAWB51S	0.0609	0.1254	0.0674	0.0534		0.0023	0.0473	0.0300	0.0500		0.0001	0.4888	0.0318								
LAWB52S	0.0609	0.1002	0.0674	0.0674		0.0023	0.0585	0.0300	0.0500		0.0001	0.4888	0.0318								
LAWB53S	0.0609	0.1002	0.0674	0.0534		0.0023	0.0585	0.0300	0.0500		0.0001	0.4888	0.0318								
LAWC11 for AN107	0.1197	0.0862	0.0160	0.0571		0.0016		0.0139	0.2200	0.0005	0.0003	0.3830	0.0247	0.0000		0.0000			0.0001		
LAWC12 for AN107	0.1197	0.0913	0.0159	0.0571		0.0014		0.0139	0.2000	0.0004	0.0003	0.3933	0.0246	0.0000		0.0000			0.0001		
LAWC13	0.0612	0.0616	0.0550	0.0347		0.0025		0.0154	0.2000	0.0003	0.0296	0.4234	0.0308								
LAWC14	0.0612	0.0616	0.0550	0.0347		0.0025		0.0154	0.2000	0.0003	0.0019	0.4234	0.0308								
LAWC15*	0.0623	0.0895	0.0201	0.0702		0.0014		0.0201	0.2000	0.0004	0.0002	0.4480	0.0301					0.0008	0.0000		
LAWC16S	0.0613	0.1010	0.0637	0.0752		0.0015	0.0397	0.0151	0.1180		0.0012	0.4454	0.0302								
LAWC17S	0.0613	0.1010	0.0736	0.0450		0.0015	0.0298	0.0151	0.1180		0.0012	0.4454	0.0302								
LAWC18S	0.0613	0.1010	0.0736	0.0752		0.0015	0.0298	0.0151	0.1180		0.0012	0.4454	0.0302								
LAWC19S	0.0613	0.1010	0.0836	0.0752		0.0015	0.0199	0.0151	0.1180		0.0012	0.4454	0.0302								
LAWC20S	0.0613	0.1010	0.0736	0.0748		0.0015		0.0151	0.1180		0.0012	0.4454	0.0302								
LAWC21S	0.0613	0.1010	0.0641	0.0648		0.0015	0.0274	0.0151	0.1188		0.0012	0.4677	0.0302								
LAWC22**	0.0607	0.1005	0.0511	0.0542		0.0008	0.0251	0.0151	0.1440	0.0003	0.0007	0.4662	0.0303					0.0005	0.0000		
LAWC23	0.0612	0.1008	0.0640	0.0647		0.0288		0.0151	0.1186		0.0012	0.4677	0.0302								
LAWC24	0.0595	0.0980	0.0623	0.0629		0.0555		0.0147	0.1153		0.0012	0.4539	0.0294								
LAWC25	0.0579	0.0954	0.0606	0.0612		0.0809		0.0143	0.1122		0.0011	0.4418	0.0286								
LAWABP1	0.1000	0.0925		0.0250		0.0220		0.0100	0.2000		0.0008	0.4189	0.0525								
PNLREF (LD6-5412)	0.1200	0.0500	0.0400	0.0000		0.0146		0.0000	0.2000		0.0019	0.5591									
TFA-BASE (HLP-01)	0.0700	0.1000		0.0550		0.0041		0.0150	0.2000		0.0006	0.4907	0.0150								

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
LAWB51S	0.0001			0.0011				0.0006													
LAWB52S	0.0001			0.0011				0.0006													
LAWB53S	0.0001			0.0011				0.0006													
LAWC11 for AN107	0.0013			0.0002				0.0001						0.0006						0.0003	
LAWC12 for AN107	0.0012			0.0002				0.0001						0.0006						0.0003	
LAWC13	0.0020			0.0002	0.0000			0.0010						0.0000							
LAWC14	0.0020			0.0002	0.0000			0.0010						0.0000							
LAWC15*	0.0008			0.0000	0.0000			0.0047									0.0000			0.0000	
LAWC16S	0.0012			0.0002				0.0006						0.0000							
LAWC17S	0.0012			0.0002				0.0006						0.0000							
LAWC18S	0.0012			0.0002				0.0006						0.0000							
LAWC19S	0.0012			0.0002				0.0006						0.0000							
LAWC20S	0.0012			0.0002				0.0006						0.0000							
LAWC21S	0.0012			0.0002				0.0006						0.0000							
LAWC22**	0.0005			0.0001				0.0034									0.0000			0.0001	
LAWC23	0.0012			0.0002				0.0006						0.0000							
LAWC24	0.0012			0.0002				0.0006						0.0000							
LAWC25	0.0012			0.0002				0.0006						0.0000							
LAWABP1	0.0058			0.0002				0.0004					0.0200								
PNLREF (LD6-5412)	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
TFA-BASE (HLP-01)	0.0028			0.0008																	

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
LAWB51S						0.0010										0.0106					
LAWB52S						0.0010										0.0106					
LAWB53S						0.0010										0.0110					0.0140
LAWC11 for AN107																0.0020					0.0292
LAWC12 for AN107																0.0020					0.0341
LAWC13						0.0010										0.0060					0.0154
LAWC14						0.0010										0.0060					0.0154
LAWC15*						0.0010										0.0013	0.0000				0.0200
LAWC16S						0.0010										0.0071					0.0112
LAWC17S						0.0010										0.0066					0.0112
LAWC18S						0.0010										0.0075					0.0112
LAWC19S						0.0010										0.0073					0.0112
LAWC20S						0.0010										0.0055					0.0112
LAWC21S						0.0010										0.0070					0.0112
LAWC22**						0.0010										0.0032	0.0002				0.0114
LAWC23						0.0010										0.0044					0.0112
LAWC24						0.0010										0.0042					0.0109
LAWC25						0.0009										0.0041					0.0106
LAWABP1																0.0010					0.0249
PNLREF (LD6-5412)																0.0021	0.0011				
TFA-BASE (HLP-01)																					0.0300

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
LAWB51S								0.0318		1.0025											
LAWB52S								0.0318		1.0025											
LAWB53S								0.0318		1.0029											
LAWC11 for AN107								0.0423		0.9990	0.1139	0.0882	0.0185	0.0525		0.0023		0.0131	0.1954	0.0005	0.0019
LAWC12 for AN107								0.0427		0.9991	0.0846	0.0972	0.0192	0.0546		0.0022		0.0133	0.1863	0.0004	0.0022
LAWC13					0.0293			0.0308		1.0000	0.0602	0.0626	0.0529	0.0340		0.0027	0.0008	0.0154	0.1679	0.0006	0.0297
LAWC14					0.0570			0.0308		1.0000	0.0648	0.0583	0.0530	0.0354		0.0026	0.0005	0.0160	0.1814	0.0012	0.0021
LAWC15*						0.0001		0.0300		1.0010	0.0568	0.0917	0.0201	0.0725		0.0018	0.0004	0.0187	0.1789	0.0012	0.0024
LAWC16S								0.0302		1.0039											
LAWC17S					0.0302			0.0302		1.0033											
LAWC18S								0.0302		1.0042											
LAWC19S								0.0302		1.0041											
LAWC20S					0.0302			0.0302		1.0022											
LAWC21S								0.0302		1.0046											
LAWC22**						0.0001		0.0307		1.0000											
LAWC23								0.0301		1.0009											
LAWC24								0.0293		1.0000											
LAWC25								0.0285		1.0000											
LAWABP1								0.0260		1.0000											
PNLREF (LD6-5412)										1.0000											
TFA-BASE (HLP-01)								0.0150		0.9990											

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
LAWB51S																					
LAWB52S																					
LAWB53S																					
LAWC11 for AN107	0.3756	0.0196	0.0001		0.0000			0.0002						0.0004							
LAWC12 for AN107	0.3885	0.0219	0.0001		0.0000			0.0001						0.0002							
LAWC13	0.4124	0.0303			0.0001									0.0002							
LAWC14	0.4032	0.0289			0.0001									0.0010							
LAWC15*	0.4382	0.0281			0.0000							0.0003		0.0018							
LAWC16S																					
LAWC17S																					
LAWC18S																					
LAWC19S																					
LAWC20S																					
LAWC21S																					
LAWC22**																					
LAWC23																					
LAWC24																					
LAWC25																					
LAWABP1																					
PNLREF (LD6-5412)																					
TFA-BASE (HLP-01)																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
LAWB51S																					
LAWB52S																					
LAWB53S																					
LAWC11 for AN107			0.0008						0.0005												
LAWC12 for AN107			0.0005						0.0005												
LAWC13			0.0000																		
LAWC14			0.0002																		
LAWC15*																					
LAWC16S																					
LAWC17S																					
LAWC18S																					
LAWC19S																					
LAWC20S																					
LAWC21S																					
LAWC22**																					
LAWC23																					
LAWC24																					
LAWC25																					
LAWABP1																					
PNLREF (LD6-5412)																					
TFA-BASE (HLP-01)																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
LAWB51S																				
LAWB52S																				
LAWB53S																				
LAWC11 for AN107					0.0018					0.0290								0.0405		0.9546
LAWC12 for AN107					0.0018					0.0336								0.0425		0.9497
LAWC13					0.0018					0.0165					0.0298			0.0322		0.9500
LAWC14					0.0033					0.0157					0.0550			0.0309		0.9535
LAWC15*					0.0011	0.0001				0.0190								0.0295		0.9624
LAWC16S																				
LAWC17S																				
LAWC18S																				
LAWC19S																				
LAWC20S																				
LAWC21S																				
LAWC22**																				
LAWC23																				
LAWC24																				
LAWC25																				
LAWABP1																				
PNLREF (LD6-5412)																				
TFA-BASE (HLP-01)																				

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
LAWB51S								
LAWB52S								
LAWB53S								
LAWC11 for AN107								
LAWC12 for AN107								
LAWC13								
LAWC14								
LAWC15*								
LAWC16S								
LAWC17S								
LAWC18S								
LAWC19S								
LAWC20S								
LAWC21S								
LAWC22**								
LAWC23								
LAWC24								
LAWC25								
LAWABP1								
PNLREF (LD6-5412)								
TFA-BASE (HLP-01)								

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
LAWB51S					After 1200°C 1hr and 850°C 20 hr - ~ 0.2 vol. % of a Ca-Fe-Mg Silicate
LAWB52S					After 1200°C 1hr and 850°C 20 hr - ~ 0.3 vol. % of a Ca-Fe-Mg Silicate
LAWB53S					After 1200°C 1hr and 850°C 20 hr - ~ 0.3 vol. % of a Ca-Fe-Mg Silicate
LAWC11 for AN107					
LAWC12 for AN107					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWC13					After 1200°C 1hr and 950°C 20 hr - Less than 0.1 vol% of white clear dendritic crystals
LAWC14					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWC15*					After 1200°C 1hr and 950°C 20 hr - Not Heat Treated
LAWC16S					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWC17S					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWC18S					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWC19S					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWC20S					After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWC21S					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWC22**					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass; After 1200°C 1hr and 850°C 20 hr - Clear homogeneous glass
LAWC23					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
LAWC24					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass for the most part, with white granular nodule at the crucible contact surface
LAWC25					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass for the most part, with one on ~200 mm dia. white granular nodule at the crucible contact surface
LAWABP1					After 1200°C 1hr and 950°C 20 hr - Clear homogeneous glass
PNLREF (LD6-5412)					
TFA-BASE (HLP-01)					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
LAWB51S							-13.034	21298.8	6.91				900	191.5	950
LAWB52S							-12.114	19560.8	5.11				900	102.9	950
LAWB53S		2.67					-12.528	20045.7	4.75				900	102.8	950
LAWC11 for AN107							-12.483	20316.5	6.01				900	135.5	950
LAWC12 for AN107		2.69					-12.560	20343.6	5.68				900	131.9	950
LAWC13		2.69					-13.823	22785.2	8.93				900	321.2	950
LAWC14		2.67					-13.517	21544.8	5.07				900	143.2	950
LAWC15*		2.68					-12.432	20561.6	7.52				900	176.1	950
LAWC16S							-11.926	18581.6	3.10				900	53.7	950
LAWC17S															
LAWC18S							-12.437	19884.8	4.65				900	98.4	950
LAWC19S							-12.822	20494.0	4.85				900	111.1	950
LAWC20S															
LAWC21S		2.66					-12.398	20130.8	5.75				900	129.3	950
LAWC22**		2.67					-11.375	18136.1	3.94				900	63.6	950
LAWC23							-13.499	23080.7	15.19				900	523.1	950
LAWC24							-13.494	22857.8	13.05				900	434.6	950
LAWC25							-13.437	22364.5	9.77				900	301.2	950
LAWABP1							-14.107	23857.5	14.28				900	554.3	950
PNLREF (LD6-5412)															
TFA-BASE (HLP-01)															

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
LAWB51S	79.5	1000	37.5	1050	19.5	1100	11.1	1150	6.7	1200	4.3	1250	2.9								
LAWB52S	48.4	1000	24.8	1050	13.7	1100	8.1	1150	5	1200	3.3	1250	2.2								
LAWB53S	47.4	1000	24	1050	13.1	1100	7.6	1150	4.7	1200	3	1250	2								
LAWC11 for AN107	62	1000	31.1	1050	16.8	1100	9.7	1150	5.9	1200	3.8	1250	2.5								
LAWC12 for AN107	58.6	1000	28.9	1050	15.6	1100	9	1150	5.6	1200	3.6	1250	2.4								
LAWC13	121.1	1000	53.4	1050	26.6	1100	14.6	1150	8.6	1200	5.4	1250	3.6								
LAWC14	60.2	1000	28.4	1050	14.7	1100	8.2	1150	4.9	1200	3.1	1250	2.1								
LAWC15*	79.7	1000	39.6	1050	21.2	1100	12.2	1150	7.4	1200	4.7	1250	3.1								
LAWC16S	26.2	1000	13.9	1050	7.9	1100	4.8	1150	3.1	1200	2	1250	1.4								
LAWC17S																					
LAWC18S	45.6	1000	23.1	1050	12.7	1100	7.4	1150	4.6	1200	2.9	1250	2								
LAWC19S	51.1	1000	25.6	1050	13.8	1100	7.9	1150	4.8	1200	3	1250	2								
LAWC20S																					
LAWC21S	57.9	1000	28.8	1050	15.6	1100	9.1	1150	5.6	1200	3.6	1250	2.5								
LAWC22**	31.6	1000	17	1050	9.8	1100	6	1150	3.9	1200	2.6	1250	1.8								
LAWC23	214.9	1000	98	1050	48.8	1100	26.1	1150	14.9	1200	9	1250	5.6								
LAWC24	180.1	1000	82.7	1050	41.5	1100	22.3	1150	12.8	1200	7.7	1250	4.9								
LAWC25	127.2	1000	59.5	1050	30.3	1100	16.5	1150	9.6	1200	5.9	1250	3.7								
LAWABP1	220.9	1000	98.1	1050	47.7	1100	25	1150	14	1200	8.3	1250	5.1								
PNLREF (LD6-5412)																					
TFA-BASE (HLP-01)																					

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
LAWB51S					0.48		0.33	0.14	9.61							
LAWB52S					0.49		0.34	0.16	9.74							
LAWB53S					0.42		0.27	0.14	10.08							
LAWC11 for AN107																
LAWC12 for AN107					0.42		0.409	0.184	10.81							
LAWC13					0.354		0.37	0.172	10.43							
LAWC14					0.54		3.609	0.208	11.22							
LAWC15*					0.329		0.335	0.161	10.45							
LAWC16S					0.584		0.408	0.178	10.12							
LAWC17S					0.399		0.294	0.137	10.02							
LAWC18S					0.413		0.295	0.136	10.22							
LAWC19S					0.232		0.225	0.088	9.84							
LAWC20S					0.244		0.189	0.094	9.53							
LAWC21S					0.15		0.172	0.08	10.02							
LAWC22**					0.518		0.469	0.181	10.53							
LAWC23					0.239		0.273	0.096	9.74							
LAWC24					0.221		0.282	0.092	9.62							
LAWC25					0.32		0.385	0.109	9.76							
LAWABP1					0.29		0.31	0.13	10.43							
PNLREF (LD6-5412)					0.1		0.27	0.09	10.61							
TFA-BASE (HLP-01)					0.39		0.33	0.16	10.21							

RPP-WTP LAW Formulation (Muller et al. 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
LAWB51S												
LAWB52S												
LAWB53S												
LAWC11 for AN107												
LAWC12 for AN107												
LAWC13												
LAWC14												
LAWC15*												
LAWC16S												
LAWC17S												
LAWC18S												
LAWC19S												
LAWC20S												
LAWC21S				<0.0031	<0.0490	0.921	0.005	0.044	0.042	<0.0243	<0.0532	1.121
LAWC22**												
LAWC23												
LAWC24												
LAWC25												
LAWABP1												
PNLREF (LD6-5412)												
TFA-BASE (HLP-01)												

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
DP-1	0.1250	0.0600	0.1500	0.0000			0.0700		0.0800		0.0000	0.3650	0.0800								
DP-2	0.1250	0.0600	0.1500	0.0100			0.0450		0.1300		0.0000	0.3600	0.0400								
DP-3	0.1250	0.0600	0.0950	0.0500			0.0700		0.0800		0.0000	0.3750	0.0400								
DP-4	0.1250	0.0600	0.0950	0.0000			0.0450		0.0800		0.0250	0.3600	0.0800								
DP-5	0.1250	0.0600	0.0950	0.0500			0.0450		0.0800		0.0250	0.3600	0.0800								
DP-6	0.1250	0.0600	0.0950	0.0000			0.0700		0.1300		0.0250	0.3600	0.0400								
DP-7	0.1250	0.1350	0.0950	0.0000			0.0700		0.0800		0.0000	0.3600	0.0400								
DP-8	0.0700	0.1500	0.0950	0.0000			0.0450		0.0800		0.0250	0.3600	0.0800								
DP-9	0.0700	0.1500	0.0950	0.0000			0.0450		0.1300		0.0250	0.3650	0.0400								
DP-10	0.0700	0.1500	0.1000	0.0000			0.0700		0.0800		0.0000	0.3600	0.0400								
DP-11	0.0700	0.1500	0.1000	0.0500			0.0700		0.0800		0.0000	0.3600	0.0400								
DP-12	0.0700	0.0600	0.1500	0.0500			0.0450		0.0800		0.0250	0.3600	0.0400								
DP-13	0.0700	0.0600	0.1500	0.0000			0.0700		0.0800		0.0250	0.3600	0.0800								
DP-14	0.0700	0.0600	0.1500	0.0500			0.0700		0.0800		0.0250	0.3600	0.0400								
DP-15	0.0700	0.0600	0.1500	0.0000			0.0450		0.0800		0.0000	0.4500	0.0400								
DP-16	0.0700	0.0600	0.0950	0.0500			0.0450		0.0800		0.0000	0.4650	0.0400								
DP-17	0.0700	0.0600	0.0950	0.0000			0.0700		0.1300		0.0250	0.4150	0.0400								
DP-18	0.0700	0.0600	0.0950	0.0500			0.0450		0.1300		0.0000	0.3650	0.0800								
DP-19	0.0700	0.0600	0.0950	0.0500			0.0700		0.1300		0.0000	0.3750	0.0800								
DP-20	0.0700	0.0600	0.1000	0.0000			0.0450		0.0800		0.0000	0.4700	0.0800								
DP-21	0.0700	0.1450	0.1500	0.0000			0.0450		0.0800		0.0000	0.3600	0.0800								
DP-22	0.0700	0.0650	0.0950	0.0000			0.0700		0.1300		0.0000	0.3600	0.0800								
DP-23	0.1200	0.0600	0.1500	0.0000			0.0450		0.1300		0.0000	0.3600	0.0400								
DP-24	0.0800	0.0600	0.0950	0.0000			0.0700		0.0800		0.0250	0.4700	0.0400								
DP-BL1	0.0900	0.0900	0.1200	0.0250			0.0500		0.1050		0.0150	0.3875	0.0500								
DP-BL2	0.0859	0.0509	0.1132	0.0300			0.0600		0.1137		0.0117	0.4228	0.0471								
DP-centroid	0.0890	0.0819	0.1140	0.0183			0.0558		0.0983		0.0108	0.3802	0.0555								

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1	0.0700	0.0518	0.1152	0.0305		0.0014	0.0610		0.1157	0.0003	0.0119	0.4302	0.0479								
DZr-CV-2	0.1250	0.0487	0.1084	0.0287		0.0014	0.0574		0.1089	0.0003	0.0112	0.4047	0.0450								
DZr-CV-3	0.0851	0.0600	0.1121	0.0297		0.0014	0.0594		0.1126	0.0003	0.0116	0.4187	0.0466								
DZr-CV-4	0.0770	0.1500	0.1014	0.0268		0.0013	0.0537		0.1018	0.0003	0.0105	0.3786	0.0421								

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
DP-1								0.0400					0.0250								
DP-2								0.0400					0.0250								
DP-3								0.0650					0.0250								
DP-4								0.0650					0.0500								
DP-5								0.0400					0.0250								
DP-6								0.0400					0.0500								
DP-7								0.0400					0.0500								
DP-8								0.0650					0.0250								
DP-9								0.0400					0.0250								
DP-10								0.0650					0.0500								
DP-11								0.0400					0.0250								
DP-12								0.0650					0.0500								
DP-13								0.0650					0.0250								
DP-14								0.0400					0.0500								
DP-15								0.0400					0.0500								
DP-16								0.0650					0.0250								
DP-17								0.0650					0.0250								
DP-18								0.0400					0.0500								
DP-19								0.0400					0.0250								
DP-20								0.0400					0.0500								
DP-21								0.0400					0.0250								
DP-22								0.0650					0.0500								
DP-23								0.0650					0.0250								
DP-24								0.0400					0.0250								
DP-BL1								0.0500					0.0000								
DP-BL2								0.0470					0.0000								
DP-centroid								0.0508					0.0358								

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1	0.0003			0.0014				0.0478					0.0000		0.0013					0.0002	
DZr-CV-2	0.0003			0.0014				0.0450					0.0000		0.0012					0.0002	
DZr-CV-3	0.0003			0.0014				0.0466					0.0000		0.0012					0.0002	
DZr-CV-4	0.0003			0.0014				0.0421					0.0000		0.0011					0.0001	

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
DP-1																0.0050					
DP-2																0.0150					
DP-3																0.0150					
DP-4																0.0150					
DP-5																0.0150					
DP-6																0.0050					
DP-7																0.0050					
DP-8																0.0050					
DP-9																0.0150					
DP-10																0.0150					
DP-11																0.0150					
DP-12																0.0050					
DP-13																0.0150					
DP-14																0.0050					
DP-15																0.0150					
DP-16																0.0050					
DP-17																0.0050					
DP-18																0.0150					
DP-19																0.0050					
DP-20																0.0050					
DP-21																0.0050					
DP-22																0.0150					
DP-23																0.0050					
DP-24																0.0150					
DP-BL1																0.0100					
DP-BL2																0.0105					
DP-centroid																0.0098					

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1																0.0106	0.0024				
DZr-CV-2																0.0100	0.0023				
DZr-CV-3																0.0104	0.0024				
DZr-CV-4																0.0094	0.0022				

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
DP-1										1.0000	0.1270	0.0583	0.1440	0.0002			0.0703		0.0857		
DP-2										1.0000	0.1149	0.0554	0.1345	0.0176			0.0507		0.1291		0.0039
DP-3										1.0000	0.1304	0.0602	0.1015	0.0523			0.0714		0.0815		
DP-4										1.0000	0.1272	0.0576	0.0970	0.0001			0.0445		0.0770		0.0234
DP-5										1.0000	0.1312	0.0596	0.1000	0.0513			0.0460		0.0805		0.0170
DP-6										1.0000	0.1266	0.0586	0.0990	0.0001			0.0710		0.1316		0.0259
DP-7										1.0000	0.1240	0.1301	0.0966	0.0005			0.0688		0.0857		
DP-8										1.0000	0.0709	0.1462	0.0980	0.0003			0.0454		0.0698		0.0243
DP-9										1.0000	0.0709	0.1465	0.0988	0.0000			0.0449		0.1238		0.0252
DP-10										1.0000	0.0811	0.1658	0.1078	0.0003			0.0011		0.0868		
DP-11										1.0000	0.0726	0.1517	0.1046	0.0509			0.0718		0.0844		
DP-12										1.0000	0.0720	0.0663	0.1442	0.0499			0.0447		0.0744		0.0245
DP-13										1.0000	0.0716	0.0605	0.1442	0.0001			0.0710		0.0853		0.0259
DP-14										1.0000	0.0718	0.0592	0.1456	0.0513			0.0707		0.0840		0.0252
DP-15										0.9700	0.0722	0.0583	0.1442	0.0000			0.0449		0.0726		
DP-16										1.0000	0.0716	0.0583	0.0998	0.0511			0.0456		0.0830		
DP-17										1.0000	0.0720	0.0592	0.1009	0.0004			0.0718		0.1314		0.0254
DP-18										1.0000	0.0737	0.0615	0.0998	0.0521			0.0458		0.1288		
DP-19										1.0000	0.0748	0.0586	0.1019	0.0518			0.0716		0.1246		
DP-20										1.0000	0.0743	0.0599	0.1043	0.0017			0.0454		0.0803		
DP-21										1.0000	0.0718	0.1417	0.1442	0.0000			0.0452		0.0822		
DP-22										1.0000	0.0726	0.0657	0.1008	0.0004			0.0710		0.1418		
DP-23										1.0000	0.1223	0.0596	0.1414	0.0017			0.0464		0.1364		
DP-24										1.0000	0.0818	0.0592	0.1004	0.0003			0.0720		0.0929		0.0247
DP-BL1										0.9925	0.0932	0.1001	0.1224	0.0256			0.0503		0.1040		0.0152
DP-BL2										0.9928	0.0886	0.0538	0.1133	0.0330			0.0613		0.1131		0.0116
DP-centroid										1.0002	0.0903	0.0802	0.1165	0.0192			0.0568		0.0967		0.0112

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1										1.0000											
DZr-CV-2										1.0000											
DZr-CV-3										1.0000											
DZr-CV-4										1.0000											

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
DP-1	0.3890	0.0797																0.0366			
DP-2	0.3980	0.0427																0.0385			
DP-3	0.4109	0.0412																0.0599			
DP-4	0.3831	0.0774																0.0597			
DP-5	0.3938	0.0707																0.0362			
DP-6	0.3852	0.0401																0.0375			
DP-7	0.3788	0.0408																0.0369			
DP-8	0.3724	0.0791																0.0613			
DP-9	0.3831	0.0401																0.0368			
DP-10	0.4259	0.0446																0.0649			
DP-11	0.3766	0.0401																0.0368			
DP-12	0.3702	0.0401																0.0564			
DP-13	0.3681	0.0791																0.0587			
DP-14	0.3638	0.0408																0.0380			
DP-15	0.4622	0.0409																0.0350			
DP-16	0.4858	0.0405																0.0612			
DP-17	0.4066	0.0402																0.0602			
DP-18	0.3980	0.0776																0.0362			
DP-19	0.4002	0.0798																0.0338			
DP-20	0.4986	0.0784																0.0363			
DP-21	0.3831	0.0803																0.0367			
DP-22	0.3702	0.0805																0.0638			
DP-23	0.3766	0.0409																0.0615			
DP-24	0.5008	0.0401																0.0376			
DP-BL1	0.4066	0.0509																0.0424			
DP-BL2	0.4558	0.0471																0.0448			
DP-centroid	0.4002	0.0560																0.0468			

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1																					
DZr-CV-2																					
DZr-CV-3																					
DZr-CV-4																					

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
DP-1		0.0250																			
DP-2		0.0166																			
DP-3		0.0257																			
DP-4		0.0490																			
DP-5		0.0256																			
DP-6		0.0500																			
DP-7		0.0489																			
DP-8		0.0249																			
DP-9		0.0250																			
DP-10		0.0536																			
DP-11		0.0256																			
DP-12		0.0498																			
DP-13		0.0252																			
DP-14		0.0491																			
DP-15		0.0500																			
DP-16		0.0250																			
DP-17		0.0255																			
DP-18		0.0488																			
DP-19		0.0254																			
DP-20		0.0515																			
DP-21		0.0252																			
DP-22		0.0500																			
DP-23		0.0256																			
DP-24		0.0255																			
DP-BL1																					
DP-BL2		0.0012																			
DP-centroid		0.0360																			

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1																					
DZr-CV-2																					
DZr-CV-3																					
DZr-CV-4																					

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
DP-1																				1.0158
DP-2																				1.0019
DP-3																				1.0350
DP-4																				0.9960
DP-5																				1.0119
DP-6																				1.0256
DP-7																				1.0111
DP-8																				0.9926
DP-9																				0.9951
DP-10																				1.0319
DP-11																				1.0151
DP-12																				0.9925
DP-13																				0.9897
DP-14																				0.9995
DP-15																				0.9803
DP-16																				1.0219
DP-17																				0.9936
DP-18																				1.0223
DP-19																				1.0225
DP-20																				1.0307
DP-21																				1.0104
DP-22																				1.0168
DP-23																				1.0124
DP-24																				1.0353
DP-BL1																				1.0107
DP-BL2																				1.0236
DP-centroid																				1.0099

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1																				
DZr-CV-2																				
DZr-CV-3																				
DZr-CV-4																				

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
DP-1							Baddeleyite[a]	no
DP-2							Amorphous	yes
DP-3							Griceite[b], Calcium Fluoride[c]	no
DP-4							Fluorellestadite[d], Calcium Fluoride	no
DP-5							Fluorellestadite, Calcium Fluoride, Baddeleyite	no
DP-6							Amorphous	yes
DP-7							Amorphous	yes
DP-8							Calcium Fluoride, Fluorapatite	no
DP-9							Fluorapatite	no
DP-10							Calcium Fluoride	no
DP-11							Amorphous	yes
DP-12							Calcium Fluoride	no
DP-13							Calcium Fluoride, Zircon[e]	no
DP-14							Amorphous	yes
DP-15							Amorphous	yes
DP-16							Calcium Fluoride	no
DP-17							Amorphous	yes
DP-18							Baddeleyite, Fluorellestadite	no
DP-19							Baddeleyite	no
DP-20							Zircon	no
DP-21							Amorphous	yes
DP-22							Baddeleyite	no
DP-23							Amorphous	yes
DP-24							Fluorapatite	no
DP-BL1							Calcium Fluoride	no
DP-BL2							Amorphous	yes
DP-centroid							Amorphous	yes

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1					amorphous Homo.			
DZr-CV-2					slight phase speration			
DZr-CV-3					amorphous Homo.			
DZr-CV-4					amorphous Homo.			

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
DP-1			Zirconium Oxide[a], Nepheline[b], Lithium Silicate[c]		
DP-2			Sodium Aluminum Silicate[d], 1 unidentifiable		
DP-3			Lazurite[e], Calcium Fluoride[f], Lithium Sodium Sulfate[g]		
DP-4			Baddeleyite[h], Calcium Fluoride, Brotholite-(Ce)[i]		
DP-5			Hydroxylapatite[j], Britholite-(Ce), Fluorite[k]		
DP-6			Britholite-(Ce), Zirconium Oxide		
DP-7			Amorphous		
DP-8			Fluorite, Fluorellestadite[l]		
DP-9			Hydroxylapatite		
DP-10			Fluorite, Fluorellestadite		
DP-11			Amorphous		
DP-12			Calcium Fluoride, Britholite-(Y)[m], Britholite-(Ce)		
DP-13			Calcium Fluoride, Zircon[n], Nosean[o]		
DP-14			Britholite-(Ce)		
DP-15			1 unidentifiable		
DP-16			Fluorite		
DP-17			Hydroxylapatite		
DP-18			Baddeleyite		
DP-19			Baddeleyite		
DP-20			Zircon		
DP-21			Amorphous		
DP-22			Nosean, Baddeleyite		
DP-23			3 unidentifiable		
DP-24			Fluorapatite		
DP-BL1			Baddeleyite, Hydroxylapatite		
DP-BL2			Amorphous		
DP-centroid			Fluorite, Hydroxylapatite		

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1	crystallized homogenous		no crystal		
DZr-CV-2	phase separated		20.4 wt% hiortdahlite, 3.5 wt% nepheline, 13.1 wt% sodium aluminum silicate sulfide		
DZr-CV-3	crystallized phase separated		0.8 wt% fluorapatite, 0.4 wt% fluorite		
DZr-CV-4	crystallized homogenous		6.2 wt% cuspidine, 2.1 wt% sodium aluminum silicate sulfide		

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
DP-1															
DP-2															
DP-3															
DP-4															
DP-5															
DP-6															
DP-7															
DP-8															
DP-9															
DP-10															
DP-11															
DP-12															
DP-13															
DP-14															
DP-15															
DP-16															
DP-17															
DP-18															
DP-19															
DP-20															
DP-21															
DP-22															
DP-23															
DP-24															
DP-BL1															
DP-BL2															
DP-centroid															

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1															
DZr-CV-2															
DZr-CV-3															
DZr-CV-4															

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
DP-1																					
DP-2																					
DP-3																					
DP-4																					
DP-5																					
DP-6																					
DP-7																					
DP-8																					
DP-9																					
DP-10																					
DP-11																					
DP-12																					
DP-13																					
DP-14																					
DP-15																					
DP-16																					
DP-17																					
DP-18																					
DP-19																					
DP-20																					
DP-21																					
DP-22																					
DP-23																					
DP-24																					
DP-BL1																					
DP-BL2																					
DP-centroid																					

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1																					
DZr-CV-2																					
DZr-CV-3																					
DZr-CV-4																					

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
DP-1					0.0892	0.2158	0.1778		10.98	7.3820	5.5727	0.9082		11.53		
DP-2					0.1270	0.1934	0.2896		11.06	2.5972	2.1046	0.7435		11.42		
DP-3					0.1024	0.2091	0.1536		10.56	0.3546	0.6560	0.2695		10.74		
DP-4					0.2149	0.6946	0.1471		9.87	0.6589	4.6297	0.5133		10.27		
DP-5					0.1160	0.2526	0.1160		10.21	0.3079	0.3644	0.1509		10.42		
DP-6					0.4131	0.4761	0.5596		11.33	1.0486	1.9470	0.8039		11.68		
DP-7					0.2166	0.2813	0.2173		10.58	0.2137	0.2463	0.1994		10.61		
DP-8					1.4467	1.3760	0.8402		9.37	1.2929	1.7891	0.9326		9.53		
DP-9					2.0334	1.9860	1.7948		10.37	1.9231	1.9910	1.7661		10.32		
DP-10					0.5406	0.0000	0.4089		8.97	0.7942	0.0000	0.5231		9.07		
DP-11					1.0105	1.0939	0.9040		10.55	0.9915	1.0230	0.8564		10.68		
DP-12					0.1277	0.2134	0.2177		10.63	0.2184	0.2549	0.2282		10.69		
DP-13					0.2403	0.3654	0.2958		10.98	0.4733	2.7189	0.6607		11.51		
DP-14					0.2611	0.4345	0.3536		11.15	0.2449	0.3117	0.2814		11.21		
DP-15					0.1036	0.1840	0.1979		10.74	NR	0.1966	0.1885		10.69		
DP-16					0.1644	0.2809	0.1411		10.23	0.1805	0.2713	0.1409		10.37		
DP-17					0.7354	0.7711	0.8544		11.31	0.5586	0.8699	0.7295		11.43		
DP-18					0.2324	0.3078	0.3868		11.1	0.2062	0.2779	0.3463		11.09		
DP-19					0.5251	0.5098	0.7460		11.42	0.6218	0.8075	0.8065		11.59		
DP-20					0.1228	0.2207	0.2034		10.63	NR	0.2035	0.1660		10.61		
DP-21					0.2519	0.2899	0.2763		10.33	0.2293	0.2649	0.2434		10.42		
DP-22					0.4208	0.5245	0.6067		11.33	0.8330	1.8898	0.7674		11.61		
DP-23					0.1277	0.1887	0.2766		11.05	7.9731	6.2887	2.7311		11.35		
DP-24					0.1327	0.2571	0.1559		10.68	0.3509	0.2700	0.1701		10.75		
DP-BL1					0.1624	0.2525	0.2461		10.64	0.2675	0.2235	0.2245		10.61		
DP-BL2					0.1612	0.2571	0.2744		10.96	0.2191	0.2360	0.2450		11		
DP-centroid					0.1830	0.2528	0.2498		10.66	0.2001	0.2273	0.2224		10.7		

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1					0.3087	0.3426	0.3870	0.1058		0.2178	0.2840	0.3109	0.0953			
DZr-CV-2					0.1073	0.2098	0.2163	0.0633		3.1187	3.7289	0.9769	0.5709			
DZr-CV-3					0.2073	0.2697	0.3034	0.0857		0.1652	0.2634	0.2818	0.0910			
DZr-CV-4					0.8961	0.8938	0.8416	0.1273		0.0587	0.2522	0.3083	0.1089			

DP Glasses for INEEL HLW (Pittman et al. 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
DP-1												
DP-2												
DP-3												
DP-4												
DP-5												
DP-6												
DP-7												
DP-8												
DP-9												
DP-10												
DP-11												
DP-12												
DP-13												
DP-14												
DP-15												
DP-16												
DP-17												
DP-18												
DP-19												
DP-20												
DP-21												
DP-22												
DP-23												
DP-24												
DP-BL1												
DP-BL2												
DP-centroid												

INEEL DZr-CV Glasses (Riley et al. 2001)

DZr-CV-1												
DZr-CV-2												
DZr-CV-3												
DZr-CV-4												

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
DZr-CV-5	0.0877	0.0519	0.0950	0.0306		0.0015	0.0612		0.1161	0.0003	0.0120	0.4315	0.0480								
DZr-CV-6	0.0824	0.0488	0.1500	0.0287		0.0014	0.0575		0.1090	0.0003	0.0112	0.4052	0.0451								
DZr-CV-7	0.0866	0.0513	0.1140	0.0302		0.0014	0.0604		0.1146	0.0003	0.0118	0.4259	0.0474								
DZr-CV-8	0.0843	0.0499	0.1111	0.0294		0.0014	0.0589		0.1116	0.0003	0.0115	0.4148	0.0462								
DZr-CV-9	0.0886	0.0525	0.1167	0.0000		0.0015	0.0619		0.1173	0.0003	0.0121	0.4359	0.0485								
DZr-CV-10	0.0842	0.0498	0.1109	0.0500		0.0014	0.0588		0.1114	0.0003	0.0115	0.4141	0.0461								
DZr-CV-11	0.0838	0.0496	0.1104	0.0292		0.0014	0.0585		0.1109	0.0003	0.0114	0.4122	0.0459								
DZr-CV-12	0.0816	0.0483	0.1075	0.0285		0.0014	0.0570		0.1080	0.0003	0.0111	0.4016	0.0447								
DZr-CV-13	0.0873	0.0517	0.1150	0.0304		0.0014	0.0450		0.1156	0.0003	0.0119	0.4296	0.0478								
DZr-CV-14	0.0850	0.0504	0.1120	0.0297		0.0014	0.0700		0.1125	0.0003	0.0116	0.4183	0.0466								
DZr-CV-15	0.0892	0.0528	0.1175	0.0311		0.0015	0.0623		0.0800	0.0003	0.0122	0.4389	0.0488								
DZr-CV-16	0.0844	0.0500	0.1111	0.0294		0.0014	0.0589		0.1300	0.0003	0.0115	0.4150	0.0462								
DZr-CV-17	0.0870	0.0515	0.1146	0.0303		0.0014	0.0607		0.1151	0.0003	0.0000	0.4278	0.0476								
DZr-CV-18	0.0848	0.0502	0.1117	0.0296		0.0014	0.0592		0.1122	0.0003	0.0250	0.4171	0.0464								
DZr-CV-19	0.0864	0.0512	0.1138	0.0301		0.0014	0.0603		0.1144	0.0003	0.0118	0.4251	0.0473								
DZr-CV-20	0.0856	0.0507	0.1127	0.0298		0.0014	0.0597		0.1132	0.0003	0.0117	0.4209	0.0468								
DZr-CV-21	0.0953	0.0564	0.1256	0.0332		0.0016	0.0665		0.1261	0.0003	0.0130	0.3600	0.0522								
DZr-CV-22	0.0789	0.0467	0.1039	0.0275		0.0013	0.0551		0.1044	0.0003	0.0108	0.4699	0.0432								
DZr-CV-23	0.0866	0.0513	0.1140	0.0302		0.0014	0.0604		0.1146	0.0003	0.0118	0.4259	0.0400								
DZr-CV-24	0.0830	0.0491	0.1093	0.0289		0.0014	0.0579		0.1098	0.0003	0.0113	0.4082	0.0800								

HLP glasses (Vienna et al. 2001)

HLP-01	0.0700	0.1000	0.0001	0.0550		0.0041	0.0000	0.0150	0.2000		0.0006	0.4907	0.0150								
HLP-02	0.0879	0.1257	0.0002	0.0692		0.0052	0.0000	0.0188	0.2514		0.0007	0.3600	0.0188								
HLP-03	0.0660	0.0943	0.0001	0.0519		0.0039	0.0000	0.0141	0.1885		0.0005	0.5200	0.0141								
HLP-04	0.0824	0.1178	0.0001	0.0648		0.0049	0.0000	0.0177	0.2357		0.0007	0.4000	0.0177								
HLP-05	0.0400	0.1032	0.0001	0.0568		0.0043	0.0000	0.0155	0.2065		0.0006	0.5065	0.0155								
HLP-06	0.1194	0.0947	0.0001	0.0521		0.0039	0.0000	0.0142	0.1894		0.0005	0.4646	0.0142								
HLP-07	0.0900	0.0979	0.0001	0.0538		0.0040	0.0000	0.0147	0.1957		0.0005	0.4801	0.0147								
HLP-08	0.0731	0.0600	0.0001	0.0575		0.0043	0.0000	0.0157	0.2089		0.0006	0.5125	0.0157								
HLP-09	0.0684	0.1200	0.0001	0.0538		0.0040	0.0000	0.0147	0.1956		0.0005	0.4798	0.0147								
HLP-10	0.0715	0.0800	0.0001	0.0563		0.0042	0.0000	0.0153	0.2045		0.0006	0.5016	0.0153								
HLP-11	0.0741	0.1058	0.0001	0.0000		0.0044	0.0000	0.0159	0.2117		0.0006	0.5193	0.0159								
HLP-12	0.0674	0.0963	0.0001	0.0900		0.0040	0.0000	0.0144	0.1926		0.0005	0.4725	0.0144								
HLP-13	0.0718	0.1027	0.0001	0.0300		0.0042	0.0000	0.0154	0.2053		0.0006	0.5037	0.0154								
HLP-14	0.0721	0.1031	0.0001	0.0567		0.0043	0.0000	0.0155	0.2062		0.0006	0.5059	0.0155								
HLP-15	0.0678	0.0969	0.0001	0.0533		0.0040	0.0000	0.0145	0.1939		0.0005	0.4755	0.0145								
HLP-16	0.0710	0.1015	0.0001	0.0559		0.0042	0.0000	0.0152	0.2031		0.0006	0.4982	0.0152								
HLP-17	0.0682	0.0975	0.0001	0.0536		0.0040	0.0000	0.0146	0.1950		0.0005	0.4782	0.0146								
HLP-18	0.0710	0.1015	0.0001	0.0559		0.0042	0.0000	0.0152	0.2031		0.0006	0.4982	0.0000								
HLP-19	0.0668	0.0955	0.0001	0.0525		0.0039	0.0000	0.0143	0.1909		0.0005	0.4683	0.0600								
HLP-20	0.0710	0.1015	0.0001	0.0559		0.0042	0.0000	0.0000	0.2031		0.0006	0.4982	0.0152								
HLP-21	0.0682	0.0975	0.0001	0.0536		0.0040	0.0000	0.0400	0.1950		0.0005	0.4782	0.0146								
HLP-22	0.0737	0.1053	0.0001	0.0579		0.0033	0.0000	0.0158	0.1600		0.0004	0.5167	0.0158								

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
DZr-CV-5	0.0003			0.0014				0.0480					0.0000		0.0013					0.0002	
DZr-CV-6	0.0003			0.0014				0.0451					0.0000		0.0012					0.0002	
DZr-CV-7	0.0003			0.0014				0.0400					0.0000		0.0013					0.0002	
DZr-CV-8	0.0003			0.0014				0.0650					0.0000		0.0012					0.0002	
DZr-CV-9	0.0003			0.0014				0.0485					0.0000		0.0013					0.0002	
DZr-CV-10	0.0003			0.0014				0.0460					0.0000		0.0012					0.0002	
DZr-CV-11	0.0003			0.0014				0.0458					0.0250		0.0012					0.0002	
DZr-CV-12	0.0003			0.0014				0.0447					0.0500		0.0012					0.0001	
DZr-CV-13	0.0003			0.0014				0.0478					0.0000		0.0013					0.0002	
DZr-CV-14	0.0003			0.0014				0.0465					0.0000		0.0012					0.0002	
DZr-CV-15	0.0003			0.0014				0.0488					0.0000		0.0013					0.0002	
DZr-CV-16	0.0003			0.0014				0.0461					0.0000		0.0012					0.0002	
DZr-CV-17	0.0003			0.0014				0.0476					0.0000		0.0013					0.0002	
DZr-CV-18	0.0003			0.0014				0.0464					0.0000		0.0012					0.0002	
DZr-CV-19	0.0003			0.0014				0.0473					0.0000		0.0013					0.0002	
DZr-CV-20	0.0003			0.0014				0.0468					0.0000		0.0012					0.0002	
DZr-CV-21	0.0003			0.0014				0.0521					0.0000		0.0014					0.0002	
DZr-CV-22	0.0003			0.0014				0.0432					0.0000		0.0011					0.0001	
DZr-CV-23	0.0003			0.0014				0.0474					0.0000		0.0013					0.0002	
DZr-CV-24	0.0003			0.0014				0.0454					0.0000		0.0012					0.0002	

HLP glasses (Vienna et al. 2001)

HLP-01	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-02	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-03	0.0026			0.0007				0.0001					0.0000				0.0000				
HLP-04	0.0033			0.0009				0.0001					0.0000				0.0000				
HLP-05	0.0029			0.0008				0.0001					0.0000				0.0000				
HLP-06	0.0026			0.0007				0.0001					0.0000				0.0000				
HLP-07	0.0027			0.0007				0.0001					0.0000				0.0000				
HLP-08	0.0029			0.0008				0.0001					0.0000				0.0000				
HLP-09	0.0027			0.0007				0.0001					0.0000				0.0000				
HLP-10	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-11	0.0029			0.0008				0.0001					0.0000				0.0000				
HLP-12	0.0027			0.0007				0.0001					0.0000				0.0000				
HLP-13	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-14	0.0029			0.0008				0.0001					0.0000				0.0000				
HLP-15	0.0027			0.0007				0.0001					0.0000				0.0000				
HLP-16	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-17	0.0027			0.0007				0.0001					0.0000				0.0000				
HLP-18	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-19	0.0026			0.0007				0.0001					0.0000				0.0000				
HLP-20	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-21	0.0027			0.0007				0.0001					0.0000				0.0000				
HLP-22	0.0022			0.0006				0.0001					0.0000				0.0000				

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
DZr-CV-5																0.0107	0.0025				
DZr-CV-6																0.0100	0.0023				
DZr-CV-7																0.0105	0.0024				
DZr-CV-8																0.0103	0.0024				
DZr-CV-9																0.0108	0.0025				
DZr-CV-10																0.0102	0.0024				
DZr-CV-11																0.0102	0.0023				
DZr-CV-12																0.0099	0.0023				
DZr-CV-13																0.0106	0.0024				
DZr-CV-14																0.0104	0.0024				
DZr-CV-15																0.0109	0.0025				
DZr-CV-16																0.0103	0.0024				
DZr-CV-17																0.0106	0.0024				
DZr-CV-18																0.0103	0.0024				
DZr-CV-19																0.0050	0.0024				
DZr-CV-20																0.0150	0.0024				
DZr-CV-21																0.0116	0.0027				
DZr-CV-22																0.0096	0.0022				
DZr-CV-23																0.0105	0.0024				
DZr-CV-24																0.0101	0.0023				

HLP glasses (Vienna et al. 2001)

HLP-01					0.0001											0.0007					0.0300
HLP-02					0.0001											0.0009					0.0377
HLP-03					0.0001											0.0007					0.0282
HLP-04					0.0001											0.0009					0.0353
HLP-05					0.0001											0.0008					0.0309
HLP-06					0.0001											0.0007					0.0284
HLP-07					0.0001											0.0007					0.0293
HLP-08					0.0001											0.0008					0.0313
HLP-09					0.0001											0.0007					0.0293
HLP-10					0.0001											0.0007					0.0306
HLP-11					0.0001											0.0008					0.0317
HLP-12					0.0001											0.0007					0.0289
HLP-13					0.0001											0.0008					0.0308
HLP-14					0.0001											0.0008					0.0000
HLP-15					0.0001											0.0007					0.0600
HLP-16					0.0001											0.0007					0.0304
HLP-17					0.0001											0.0007					0.0292
HLP-18					0.0001											0.0007					0.0304
HLP-19					0.0001											0.0007					0.0286
HLP-20					0.0001											0.0007					0.0304
HLP-21					0.0001											0.0007					0.0292
HLP-22					0.0001											0.0006					0.0316

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
DZr-CV-5										1.0000											
DZr-CV-6										1.0000											
DZr-CV-7										1.0000											
DZr-CV-8										1.0000											
DZr-CV-9										1.0000											
DZr-CV-10										1.0000											
DZr-CV-11										1.0000											
DZr-CV-12										1.0000											
DZr-CV-13										1.0000											
DZr-CV-14										1.0000											
DZr-CV-15										1.0000											
DZr-CV-16										1.0000											
DZr-CV-17										1.0000											
DZr-CV-18										1.0000											
DZr-CV-19										1.0000											
DZr-CV-20										1.0000											
DZr-CV-21										1.0000											
DZr-CV-22										1.0000											
DZr-CV-23										1.0000											
DZr-CV-24										1.0000											

HLP glasses (Vienna et al. 2001)

HLP-01								0.0150		1.0000	0.0704	0.0892	0.0001	0.0652		0.0040		0.0141	0.1840		
HLP-02								0.0188		0.9999	0.0895	0.1140		0.0763		0.0059		0.0181	0.2580		
HLP-03								0.0141		0.9999	0.0708	0.0909		0.0606		0.0041		0.0136	0.1790		
HLP-04								0.0177		1.0001	0.0874	0.1240		0.0772		0.0052		0.0168	0.2220		
HLP-05								0.0155		1.0001	0.0424	0.1030		0.0680		0.0050		0.0145	0.2030		
HLP-06								0.0142		0.9999	0.1230	0.0889		0.0596		0.0042		0.0134	0.1910		
HLP-07								0.0147		0.9998	0.0979	0.0945		0.0632		0.0043		0.0146	0.1930		
HLP-08								0.0157		1.0001	0.0706	0.0594		0.0584		0.0056		0.0131	0.1950		
HLP-09								0.0147		0.9999	0.0712	0.1180		0.0640		0.0041		0.0129	0.1860		
HLP-10								0.0153		0.9998	0.0704	0.0892		0.0633		0.0048		0.0136	0.1840		
HLP-11								0.0159		1.0001	0.0691	0.1060		0.0055		0.0040		0.0123	0.1820		
HLP-12								0.0144		0.9998	0.0644	0.1020	0.0005	0.0920		0.0046		0.0123	0.1800		
HLP-13								0.0154		1.0000	0.0644	0.1020	0.0006	0.0380		0.0041		0.0151	0.1850		
HLP-14								0.0155		1.0002	0.0723	0.1010	0.0006	0.0631		0.0045		0.0153	0.1940		
HLP-15								0.0145		0.9998	0.0652	0.0972	0.0007	0.0669		0.0038		0.0154	0.1860		
HLP-16								0.0000		0.9999	0.0679	0.1000	0.0008	0.0684		0.0041		0.0161	0.1900		
HLP-17								0.0400		0.9998	0.0684	0.0986		0.0636		0.0036		0.0153	0.1840		
HLP-18								0.0152		0.9999	0.0745	0.1020		0.0622		0.0043		0.0154	0.1920		
HLP-19								0.0143		0.9999	0.0694	0.0963		0.0640		0.0043		0.0147	0.1780		
HLP-20								0.0152		0.9999	0.0719	0.1010		0.0626		0.0040			0.1930		
HLP-21								0.0146		0.9998	0.0689	0.1020		0.0671		0.0037		0.0393	0.1830		
HLP-22								0.0158		1.0000	0.0767	0.1100		0.0702		0.0030		0.0166	0.1540		

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
DZr-CV-5																					
DZr-CV-6																					
DZr-CV-7																					
DZr-CV-8																					
DZr-CV-9																					
DZr-CV-10																					
DZr-CV-11																					
DZr-CV-12																					
DZr-CV-13																					
DZr-CV-14																					
DZr-CV-15																					
DZr-CV-16																					
DZr-CV-17																					
DZr-CV-18																					
DZr-CV-19																					
DZr-CV-20																					
DZr-CV-21																					
DZr-CV-22																					
DZr-CV-23																					
DZr-CV-24																					

HLP glasses (Vienna et al. 2001)

HLP-01	0.4880	0.0154												0.0025							
HLP-02	0.3520	0.0188												0.0022							
HLP-03	0.5150	0.0136												0.0019							
HLP-04	0.4040	0.0174												0.0024							
HLP-05	0.4730	0.0145												0.0027							
HLP-06	0.4460	0.0135												0.0014							
HLP-07	0.5030	0.0155												0.0020							
HLP-08	0.4890	0.0144												0.0009							
HLP-09	0.4330	0.0122												0.0021							
HLP-10	0.4790	0.0155												0.0022							
HLP-11	0.5080	0.0138												0.0021							
HLP-12	0.4480	0.0134												0.0023							
HLP-13	0.4990	0.0134												0.0024							
HLP-14	0.4730	0.0143												0.0024							
HLP-15	0.4780	0.0106												0.0026							
HLP-16	0.5340	0.0130												0.0026							
HLP-17	0.4830	0.0130												0.0023							
HLP-18	0.4620													0.0026							
HLP-19	0.4820	0.0564												0.0025							
HLP-20	0.4930	0.0151												0.0026							
HLP-21	0.4590	0.0134												0.0025							
HLP-22	0.5330	0.0126												0.0027							

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
DZr-CV-5																					
DZr-CV-6																					
DZr-CV-7																					
DZr-CV-8																					
DZr-CV-9																					
DZr-CV-10																					
DZr-CV-11																					
DZr-CV-12																					
DZr-CV-13																					
DZr-CV-14																					
DZr-CV-15																					
DZr-CV-16																					
DZr-CV-17																					
DZr-CV-18																					
DZr-CV-19																					
DZr-CV-20																					
DZr-CV-21																					
DZr-CV-22																					
DZr-CV-23																					
DZr-CV-24																					

HLP glasses (Vienna et al. 2001)

HLP-01		0.0002																			
HLP-02																					
HLP-03																					
HLP-04																					
HLP-05																					
HLP-06																					
HLP-07																					
HLP-08																					
HLP-09																					
HLP-10		0.0001																			
HLP-11																					
HLP-12																					
HLP-13																					
HLP-14																					
HLP-15																					
HLP-16																					
HLP-17		0.0005																			
HLP-18																					
HLP-19																					
HLP-20																					
HLP-21																					
HLP-22																					

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
DZr-CV-5																				
DZr-CV-6																				
DZr-CV-7																				
DZr-CV-8																				
DZr-CV-9																				
DZr-CV-10																				
DZr-CV-11																				
DZr-CV-12																				
DZr-CV-13																				
DZr-CV-14																				
DZr-CV-15																				
DZr-CV-16																				
DZr-CV-17																				
DZr-CV-18																				
DZr-CV-19																				
DZr-CV-20																				
DZr-CV-21																				
DZr-CV-22																				
DZr-CV-23																				
DZr-CV-24																				

HLP glasses (Vienna et al. 2001)

HLP-01										0.0300								0.0146		0.9777
HLP-02										0.0386								0.0188		0.9922
HLP-03										0.0289								0.0143		0.9927
HLP-04										0.0356								0.0174		1.0094
HLP-05										0.0317								0.0156		0.9734
HLP-06										0.0294								0.0142		0.9846
HLP-07										0.0315								0.0156		1.0351
HLP-08										0.0304								0.0146		0.9514
HLP-09										0.0287								0.0151		0.9473
HLP-10										0.0309								0.0149		0.9679
HLP-11										0.0283								0.0148		0.9459
HLP-12										0.0275								0.0145		0.9615
HLP-13										0.0295								0.0153		0.9688
HLP-14																		0.0155		0.9560
HLP-15										0.0591								0.0151		1.0006
HLP-16										0.0318										1.0287
HLP-17										0.0300								0.0396		1.0019
HLP-18										0.0318								0.0154		0.9622
HLP-19										0.0298								0.0150		1.0124
HLP-20										0.0320								0.0160		0.9912
HLP-21										0.0303								0.0168		0.9860
HLP-22										0.0327								0.0165		1.0280

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
DZr-CV-5					slight phase separation			
DZr-CV-6					amorphous Homo.			
DZr-CV-7					amorphous Homo.			
DZr-CV-8					massive phase separation			
DZr-CV-9					amorphous Homo.			
DZr-CV-10					amorphous Homo.			
DZr-CV-11					amorphous Homo.			
DZr-CV-12					amorphous Homo.			
DZr-CV-13					slight phase separation			
DZr-CV-14					amorphous Homo.			
DZr-CV-15					slight phase separation			
DZr-CV-16					amorphous Homo.			
DZr-CV-17					amorphous Homo.			
DZr-CV-18					moderate phase separation			
DZr-CV-19					amorphous Homo.			
DZr-CV-20					moderate phase separation			
DZr-CV-21					amorphous Homo.			
DZr-CV-22					amorphous Homo.			
DZr-CV-23					amorphous Homo.			
DZr-CV-24					amorphous Homo.			

HLP glasses (Vienna et al. 2001)

HLP-01								
HLP-02								
HLP-03								
HLP-04								
HLP-05								
HLP-06								
HLP-07								
HLP-08								
HLP-09								
HLP-10								
HLP-11								
HLP-12								
HLP-13								
HLP-14								
HLP-15								
HLP-16								
HLP-17								
HLP-18								
HLP-19								
HLP-20								
HLP-21								
HLP-22								

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
DZr-CV-5	crystallized phase separated		1.7 wt% fluorapatite		
DZr-CV-6	crystallized homogenous		no crystal		
DZr-CV-7	crystallized homogenous		no crystal		
DZr-CV-8	crystallized phase separated		0.3 wt% fluorapatite, 3.8 wt% fluorite		
DZr-CV-9	crystallized phase separated		2.1 wt% fluorapatite		
DZr-CV-10	crystallized homogenous		3.0 wt% cuspidine		
DZr-CV-11	crystallized homogenous		1.6 wt% cuspidine		
DZr-CV-12	crystallized phase separated		5.5 wt% apatite		
DZr-CV-13	crystallized phase separated		1.4 wt% fluorite, 6.2 wt% sodium calcium oxide fluoride phosphate		
DZr-CV-14	crystallized homogenous		no crystal		
DZr-CV-15	crystallized phase separated		2.4 wt% fluorite		
DZr-CV-16	crystallized phase separated		no crystal		
DZr-CV-17	crystallized homogenous		1.3 wt% cuspidine		
DZr-CV-18	crystallized phase separated		4.8 wt% fluorapatite		
DZr-CV-19	amorphous Homo.		no crystal		
DZr-CV-20	crystallized phase separated		8.7 wt% sodalite		
DZr-CV-21	crystallized phase separated		3.7 wt% cuspidine, 12.1 wt% nosean		
DZr-CV-22	crystallized phase separated		0.6 wt% fluorapatite, 0.6 wt% fluorite		
DZr-CV-23	crystallized phase separated		1.0 wt% cuspidine		
DZr-CV-24	crystallized phase separated		0.6 wt% fluorite, 15.3 wt% hiortdahlite		

HLP glasses (Vienna et al. 2001)

HLP-01					
HLP-02					
HLP-03					
HLP-04					
HLP-05					
HLP-06					
HLP-07					
HLP-08					
HLP-09					
HLP-10					
HLP-11					
HLP-12					
HLP-13					
HLP-14					
HLP-15					
HLP-16					
HLP-17					
HLP-18					
HLP-19					
HLP-20					
HLP-21					
HLP-22					

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
DZr-CV-5															
DZr-CV-6															
DZr-CV-7															
DZr-CV-8															
DZr-CV-9															
DZr-CV-10															
DZr-CV-11															
DZr-CV-12															
DZr-CV-13															
DZr-CV-14															
DZr-CV-15															
DZr-CV-16															
DZr-CV-17															
DZr-CV-18															
DZr-CV-19															
DZr-CV-20															
DZr-CV-21															
DZr-CV-22															
DZr-CV-23															
DZr-CV-24															

HLP glasses (Vienna et al. 2001)

HLP-01		2.6493													
HLP-02		2.7022													
HLP-03		2.6364													
HLP-04		2.6828													
HLP-05		2.6756													
HLP-06		2.5609													
HLP-07		2.6027													
HLP-08		2.6915													
HLP-09		2.6014													
HLP-10		2.6229													
HLP-11		2.563													
HLP-12		2.6819													
HLP-13		2.6074													
HLP-14		2.588													
HLP-15		2.6275													
HLP-16		2.5919													
HLP-17		2.6574													
HLP-18		2.5997													
HLP-19		2.6692													
HLP-20		2.6258													
HLP-21		2.6148													
HLP-22		2.59													

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
DZr-CV-5																					
DZr-CV-6																					
DZr-CV-7																					
DZr-CV-8																					
DZr-CV-9																					
DZr-CV-10																					
DZr-CV-11																					
DZr-CV-12																					
DZr-CV-13																					
DZr-CV-14																					
DZr-CV-15																					
DZr-CV-16																					
DZr-CV-17																					
DZr-CV-18																					
DZr-CV-19																					
DZr-CV-20																					
DZr-CV-21																					
DZr-CV-22																					
DZr-CV-23																					
DZr-CV-24																					

HLP glasses (Vienna et al. 2001)

HLP-01																					
HLP-02																					
HLP-03																					
HLP-04																					
HLP-05																					
HLP-06																					
HLP-07																					
HLP-08																					
HLP-09																					
HLP-10																					
HLP-11																					
HLP-12																					
HLP-13																					
HLP-14																					
HLP-15																					
HLP-16																					
HLP-17																					
HLP-18																					
HLP-19																					
HLP-20																					
HLP-21																					
HLP-22																					

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
DZr-CV-5					0.2097	0.2926	0.3211	0.0955		2.2434	0.6887	0.6005	0.1025			
DZr-CV-6					0.1305	0.2631	0.2634	0.0683		0.1766	0.2340	0.2425	0.0776			
DZr-CV-7					0.1723	0.2881	0.3004	0.0886		0.1253	0.2342	0.2373	0.0794			
DZr-CV-8					0.1834	0.2740	0.2939	0.0897		0.2330	0.4462	0.3178	0.1516			
DZr-CV-9					6.5610	0.2841	0.3376	0.0909		0.1636	0.2482	0.2855	0.0840			
DZr-CV-10					0.2151	0.3022	0.3367	0.0858		0.1558	0.2259	0.2634	0.0974			
DZr-CV-11					0.2062	0.2987	0.3366	0.0868		0.1345	0.0653	0.2512	0.0815			
DZr-CV-12					0.2062	0.3166	0.3194	0.0916		0.1056	0.2141	0.2435	0.0768			
DZr-CV-13					0.0978	0.2027	0.2134	0.0635		0.1178	0.2138	0.2157	0.0982			
DZr-CV-14					0.2368	0.3501	0.3963	0.1053		0.1818	0.3026	0.3274	0.0989			
DZr-CV-15					0.1022	0.1952	0.1640	0.0563		0.0959	0.1861	0.1430	0.0603			
DZr-CV-16					0.2170	0.3110	0.3982	0.0986		0.1514	0.2511	0.3221	0.0885			
DZr-CV-17					0.1099	0.2394	0.2611	0.0696		0.0766	0.1894	0.2281	0.0732			
DZr-CV-18					0.2360	0.3502	0.3750	0.1157		0.1777	0.2635	0.2692	0.0848			
DZr-CV-19					0.1249	0.2500	0.2657	0.0776		0.0959	0.2086	0.2189	0.0731			
DZr-CV-20					0.1529	0.2582	0.2897	0.0767		0.0568	0.1918	0.2391	0.0710			
DZr-CV-21					0.3099	0.4298	0.4835	0.1114		0.6589	0.2665	0.5741	0.2151			
DZr-CV-22					0.1180	0.2275	0.2340	0.0699		0.1048	0.2115	0.2039	0.0665			
DZr-CV-23					0.1396	0.2475	0.2883	0.0765		0.1260	0.2215	0.2550	0.0786			
DZr-CV-24					0.1415	0.2494	0.2509	0.0722		0.1303	0.2144	0.2182	0.1127			

HLP glasses (Vienna et al. 2001)

HLP-01					0.2700		0.3500	0.1700	10.3133							
HLP-02					2.9000		2.3100	0.3300	11.6800							
HLP-03					0.2800		0.3200	0.1800	10.2200							
HLP-04					1.9400		1.1700	0.3100	11.2933							
HLP-05					1.2800		0.8400	0.4200	10.3500							
HLP-06					0.3000		0.2800	0.1800	10.2733							
HLP-07					0.3000		0.3100	0.1800	10.2900							
HLP-08					0.3300		0.4400	0.2200	10.8400							
HLP-09					0.5000		0.4500	0.1600	10.2933							
HLP-10					0.3400		0.3700	0.2000	10.6033							
HLP-11					0.4400		0.4100	0.2000	10.5667							
HLP-12					0.4100		0.3400	0.2200	10.3200							
HLP-13					0.4500		0.4300	0.2000	10.5200							
HLP-14					0.6900		0.5400	0.1900	10.6367							
HLP-15					0.3400		0.3500	0.2200	10.4400							
HLP-16					0.3600		0.3600	0.2000	10.5500							
HLP-17					0.4400		0.4200	0.2000	10.4567							
HLP-18					0.5100		0.4500	0.2400	10.6133							
HLP-19					0.2700		0.3000	0.1600	10.5533							
HLP-20					0.3700		0.3300	0.2000	10.5367							
HLP-21					0.5800		0.4600	0.2300	10.5633							
HLP-22					0.2400		0.2300	0.1700	9.8033							

INEEL DZr-CV Glasses (Riley et al. 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
DZr-CV-5												
DZr-CV-6												
DZr-CV-7												
DZr-CV-8												
DZr-CV-9												
DZr-CV-10												
DZr-CV-11												
DZr-CV-12												
DZr-CV-13												
DZr-CV-14												
DZr-CV-15												
DZr-CV-16												
DZr-CV-17												
DZr-CV-18												
DZr-CV-19												
DZr-CV-20												
DZr-CV-21												
DZr-CV-22												
DZr-CV-23												
DZr-CV-24												

HLP glasses (Vienna et al. 2001)

HLP-01												
HLP-02												
HLP-03												
HLP-04												
HLP-05												
HLP-06												
HLP-07												
HLP-08												
HLP-09												
HLP-10												
HLP-11												
HLP-12												
HLP-13												
HLP-14												
HLP-15												
HLP-16												
HLP-17												
HLP-18												
HLP-19												
HLP-20												
HLP-21												
HLP-22												

HLP glasses (Vienna et al. 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
HLP-23	0.0672	0.0961	0.0001	0.0529		0.0047	0.0000	0.0144	0.2300		0.0006	0.4713	0.0144								
HLP-24	0.0718	0.1027	0.0001	0.0565		0.0037	0.0000	0.0154	0.1800		0.0005	0.5037	0.0154								
HLP-25	0.0700	0.1000	0.0001	0.0550		0.0041	0.0000	0.0150	0.2000		0.0006	0.4907	0.0150								
HLP-26	0.0700	0.1000	0.0001	0.0550		0.0041	0.0000	0.0150	0.2000		0.0006	0.4907	0.0150								
HLP-27	0.1194	0.1200	0.0001	0.0000		0.0047	0.0000	0.0000	0.2300		0.0006	0.5200	0.0000								
HLP-28	0.1194	0.1200	0.0001	0.0310		0.0033	0.0000	0.0084	0.1600		0.0004	0.5200	0.0084								
HLP-29	0.1194	0.0600	0.0001	0.0254		0.0047	0.0000	0.0069	0.2300		0.0006	0.5200	0.0069								
HLP-30	0.1194	0.0600	0.0001	0.0564		0.0033	0.0000	0.0154	0.1600		0.0004	0.5200	0.0154								
HLP-31	0.0400	0.1200	0.0001	0.0336		0.0047	0.0000	0.0092	0.2300		0.0006	0.5200	0.0092								
HLP-32	0.0400	0.1200	0.0001	0.0646		0.0033	0.0000	0.0176	0.1600		0.0004	0.5200	0.0176								
HLP-33	0.0400	0.0600	0.0001	0.0590		0.0047	0.0000	0.0161	0.2300		0.0006	0.5200	0.0161								
HLP-34	0.0400	0.0600	0.0001	0.0900		0.0033	0.0000	0.0245	0.1600		0.0004	0.5200	0.0245								
HLP-35	0.1194	0.1200	0.0001	0.0677		0.0047	0.0000	0.0185	0.2300		0.0006	0.3600	0.0185								
HLP-36	0.1194	0.1200	0.0001	0.0987		0.0033	0.0000	0.0269	0.1600		0.0004	0.3600	0.0269								
HLP-37	0.1194	0.0600	0.0001	0.0931		0.0047	0.0000	0.0254	0.2300		0.0006	0.3600	0.0254								
HLP-38	0.1194	0.0600	0.0001	0.1241		0.0033	0.0000	0.0338	0.1600		0.0004	0.3600	0.0338								
HLP-39	0.0400	0.1200	0.0001	0.1013		0.0047	0.0000	0.0276	0.2300		0.0006	0.3600	0.0276								
HLP-40	0.0400	0.1200	0.0001	0.1323		0.0033	0.0000	0.0361	0.1600		0.0004	0.3600	0.0361								
HLP-40Q	0.0400	0.1200	0.0001	0.1323		0.0033	0.0000	0.0361	0.1600		0.0004	0.3600	0.0361								
HLP-41	0.0400	0.0600	0.0001	0.1267		0.0047	0.0000	0.0345	0.2300		0.0006	0.3600	0.0345								
HLP-42	0.0400	0.0600	0.0001	0.1577		0.0033	0.0000	0.0430	0.1600		0.0004	0.3600	0.0430								
HLP-42Q	0.0400	0.0600	0.0001	0.1577		0.0033	0.0000	0.0430	0.1600		0.0004	0.3600	0.0430								
HLP-43	0.0700	0.1000	0.0001	0.0550		0.0041	0.0000	0.0150	0.2000		0.0006	0.4907	0.0150								
HLP-44	0.0700	0.1000	0.0001	0.0550		0.0041	0.0000	0.0150	0.2000		0.0006	0.4907	0.0150								
HLP-45	0.0700	0.1000	0.0001	0.0550		0.0041	0.0000	0.0150	0.2000		0.0006	0.4907	0.0150								
HLP-46	0.1200	0.0500	0.0400	0.0000		0.0146		0.0000	0.2000		0.0019	0.5591									
HLP-47	0.1000	0.0800	0.0050	0.0100		0.0150	0.0010	0.0010	0.2000	0.0010	0.0050	0.5437	0.0100			0.0001			0.0020		
HLP-48	0.1197	0.0885	0.0000	0.0577		0.0310	0.0000	0.0199	0.2000		0.0008	0.3825	0.0249								
HLP-49	0.0803	0.0807	0.0703	0.0803		0.0036	0.0408	0.0300	0.1000		0.0001	0.4393	0.0304								
HLP-51	0.1000	0.0925	0.0000	0.0250		0.0220	0.0000	0.0100	0.2000		0.0008	0.4189	0.0525								
HLP-52	0.1019	0.0000	0.0260	0.0254		0.0197	0.0000	0.0118	0.2874		0.0191	0.4464	0.0502								
HLP-53	0.0986	0.0423	0.0438	0.0730		0.0310	0.0204	0.0204	0.2000		0.0008	0.4015	0.0299								
HLP-53Q	0.0986	0.0423	0.0438	0.0730		0.0310	0.0204	0.0204	0.2000		0.0008	0.4015	0.0299								
HLP-54	0.1200	0.0900	0.0000	0.0000		0.0033	0.0000	0.0000	0.2000		0.0119	0.5678	0.0000								
HLP-55	0.0900	0.0900	0.0000	0.0000		0.0033	0.0000	0.0000	0.2000		0.0119	0.5978	0.0000								
HLP-56	0.0620	0.0890	0.0199	0.0698		0.0050	0.0000	0.0199	0.2000		0.0003	0.4455	0.0299								
HLP-58	0.0686	0.0980	0.0200	0.0539		0.0040	0.0000	0.0147	0.1960		0.0006	0.4809	0.0147								
HLP-59	0.0665	0.0950	0.0500	0.0523		0.0039	0.0000	0.0143	0.1900		0.0006	0.4662	0.0143								
HLP-60	0.1194	0.1257	0.0001	0.0171		0.0033	0.0000	0.0430	0.1600		0.0200	0.3600	0.0600								
HLP-61	0.0400	0.1257	0.0500	0.0000		0.0500	0.0000	0.0430	0.1600		0.0004	0.3965	0.0000								
HLP-62	0.0400	0.1257	0.0500	0.0000		0.0033	0.0000	0.0000	0.1600		0.0004	0.4692	0.0600								
HLP-63	0.0400	0.0600	0.0001	0.1504		0.0033	0.0000	0.0430	0.2514		0.0004	0.3600	0.0000								
HLP-64	0.0400	0.0600	0.0001	0.0000		0.0500	0.0000	0.0430	0.1600		0.0200	0.5200	0.0600								
HLP-65	0.0400	0.0600	0.0500	0.0982		0.0033	0.0000	0.0430	0.1600		0.0200	0.5200	0.0000								
HLP-66	0.0400	0.1257	0.0001	0.0536		0.0033	0.0000	0.0000	0.2514		0.0004	0.5200	0.0000								
HLP-67	0.0400	0.1257	0.0001	0.0443		0.0500	0.0000	0.0000	0.2514		0.0200	0.3600	0.0600								
HLP-68	0.0964	0.0600	0.0500	0.1577		0.0500	0.0000	0.0000	0.1600		0.0004	0.3600	0.0600								
HLP-69	0.1194	0.0600	0.0001	0.0024		0.0033	0.0000	0.0000	0.1600		0.0004	0.5200	0.0000								
HLP-70	0.1194	0.0600	0.0478	0.0000		0.0500	0.0000	0.0000	0.2514		0.0200	0.3600	0.0000								

HLP glasses (Vienna et al. 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
HLP-23	0.0032			0.0009				0.0001					0.0000				0.0000				
HLP-24	0.0025			0.0007				0.0001					0.0000				0.0000				
HLP-25	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-26	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-27	0.0032			0.0009				0.0001					0.0000				0.0000				
HLP-28	0.0022			0.0006				0.0001					0.0000				0.0000				
HLP-29	0.0032			0.0009				0.0001					0.0000				0.0000				
HLP-30	0.0022			0.0006				0.0001					0.0000				0.0000				
HLP-31	0.0032			0.0009				0.0001					0.0000				0.0000				
HLP-32	0.0022			0.0006				0.0001					0.0000				0.0000				
HLP-33	0.0032			0.0009				0.0001					0.0000				0.0000				
HLP-34	0.0022			0.0006				0.0001					0.0000				0.0000				
HLP-35	0.0032			0.0009				0.0001					0.0000				0.0000				
HLP-36	0.0022			0.0006				0.0001					0.0000				0.0000				
HLP-37	0.0032			0.0009				0.0001					0.0000				0.0000				
HLP-38	0.0022			0.0006				0.0001					0.0000				0.0000				
HLP-39	0.0032			0.0009				0.0001					0.0000				0.0000				
HLP-40	0.0022			0.0006				0.0001					0.0000				0.0000				
HLP-40Q	0.0022			0.0006				0.0001					0.0000				0.0000				
HLP-41	0.0032			0.0009				0.0001					0.0000				0.0000				
HLP-42	0.0022			0.0006				0.0001					0.0000				0.0000				
HLP-42Q	0.0022			0.0006				0.0001					0.0000				0.0000				
HLP-43	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-44	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-45	0.0028			0.0008				0.0001					0.0000				0.0000				
HLP-46	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
HLP-47	0.0080			0.0020				0.0100				0.0000	0.0001		0.0010		0.0000			0.0010	
HLP-48	0.0058			0.0002				0.0004					0.0000				0.0000				
HLP-49	0.0029			0.0010				0.0000					0.0000				0.0000				
HLP-51	0.0058			0.0002				0.0004					0.0200				0.0000				
HLP-52	0.0013			0.0008				0.0031					0.0000				0.0000				
HLP-53	0.0036			0.0001				0.0012					0.0000				0.0000				
HLP-53Q	0.0036			0.0001				0.0012					0.0000				0.0000				
HLP-54	0.0009			0.0004				0.0021					0.0001				0.0000				
HLP-55	0.0009			0.0004				0.0021					0.0001				0.0000				
HLP-56	0.0065			0.0002				0.0001					0.0000				0.0001				
HLP-58	0.0027			0.0008				0.0001					0.0000				0.0000				
HLP-59	0.0027			0.0008				0.0001					0.0000				0.0000				
HLP-60	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-61	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-62	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-63	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-64	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-65	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-66	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-67	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-68	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-69	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-70	0.0035			0.0009				0.0001					0.0000				0.0000				

HLP glasses (Vienna et al. 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
HLP-23					0.0001											0.0008					0.0288
HLP-24					0.0001											0.0007					0.0308
HLP-25					0.0001											0.0007					0.0300
HLP-26					0.0001											0.0007					0.0300
HLP-27					0.0001											0.0008					0.0000
HLP-28					0.0001											0.0006					0.0169
HLP-29					0.0001											0.0008					0.0138
HLP-30					0.0001											0.0006					0.0307
HLP-31					0.0001											0.0008					0.0183
HLP-32					0.0001											0.0006					0.0352
HLP-33					0.0001											0.0008					0.0321
HLP-34					0.0001											0.0006					0.0490
HLP-35					0.0001											0.0008					0.0369
HLP-36					0.0001											0.0006					0.0538
HLP-37					0.0001											0.0008					0.0507
HLP-38					0.0001											0.0006					0.0676
HLP-39					0.0001											0.0008					0.0552
HLP-40					0.0001											0.0006					0.0721
HLP-40Q					0.0001											0.0006					0.0721
HLP-41					0.0001											0.0008					0.0690
HLP-42					0.0001											0.0006					0.0859
HLP-42Q					0.0001											0.0006					0.0859
HLP-43					0.0001											0.0007					0.0300
HLP-44					0.0001											0.0007					0.0300
HLP-45					0.0001											0.0007					0.0300
HLP-46																0.0022	0.0011				
HLP-47					0.0000											0.0020					0.0010
HLP-48					0.0000											0.0010					0.0249
HLP-49					0.0000											0.0002					0.0000
HLP-51					0.0000											0.0010					0.0249
HLP-52					0.0000											0.0030					0.0038
HLP-53					0.0000											0.0004					0.0000
HLP-53Q					0.0000											0.0004					0.0000
HLP-54					0.0000											0.0032					0.0000
HLP-55					0.0000											0.0032					0.0000
HLP-56					0.0010											0.0010					0.0199
HLP-58					0.0001											0.0007					0.0294
HLP-59					0.0001											0.0007					0.0285
HLP-60					0.0001											0.0009					0.0859
HLP-61					0.0001											0.0009					0.0859
HLP-62					0.0001											0.0009					0.0859
HLP-63					0.0001											0.0009					0.0859
HLP-64					0.0001											0.0009					0.0000
HLP-65					0.0001											0.0009					0.0000
HLP-66					0.0001											0.0009					0.0000
HLP-67					0.0001											0.0009					0.0000
HLP-68					0.0001											0.0009					0.0000
HLP-69					0.0001											0.0009					0.0859
HLP-70					0.0001											0.0009					0.0859

HLP glasses (Vienna et al. 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
HLP-23								0.0144		1.0000	0.0692	0.0965		0.0591		0.0042		0.0147	0.2150		
HLP-24								0.0154		1.0001	0.0744	0.1000		0.0659		0.0040		0.0163	0.1720		
HLP-25								0.0150		1.0000	0.0676	0.1010	0.0001	0.0627		0.0041		0.0154	0.1850		
HLP-26								0.0150		1.0000	0.0668	0.0943		0.0597		0.0043		0.0145	0.1820		
HLP-27								0.0000		0.9999	0.1200	0.1230		0.0060		0.0044			0.2170		
HLP-28								0.0084		0.9999	0.1210	0.1300		0.0382				0.0080	0.1510		
HLP-29								0.0069		0.9998	0.1180	0.0651		0.0312		0.0042		0.0069	0.2150		
HLP-30								0.0154		1.0001	0.1220	0.0656		0.0638		0.0029		0.0150	0.1540		
HLP-31								0.0092		1.0000	0.0420	0.1230		0.0430		0.0040		0.0084	0.2200		
HLP-32								0.0176		1.0000	0.0421	0.1290		0.0705		0.0031		0.0166	0.1570		
HLP-33								0.0161		0.9999	0.0416	0.0644		0.0692		0.0045		0.0157	0.2200		
HLP-34								0.0245		0.9999	0.0397	0.0624		0.1020		0.0030		0.0210	0.1430		
HLP-35								0.0185		1.0000	0.1150	0.1210		0.0747		0.0050		0.0168	0.2160		
HLP-36								0.0269		1.0000	0.1200	0.1260		0.1030		0.0027		0.0241	0.1550		
HLP-37								0.0254		0.9999	0.1160	0.0678		0.0971		0.0040		0.0219	0.2180		
HLP-38								0.0338		0.9999	0.1200	0.0609		0.1260		0.0030		0.0315	0.1530		
HLP-39								0.0276		0.9998	0.0399	0.1260		0.1040		0.0045		0.0259	0.2150		
HLP-40								0.0361		1.0001	0.0426	0.1240		0.1340		0.0031		0.0365	0.1630		
HLP-40Q								0.0361		1.0001	0.0401	0.1270		0.1340		0.0031		0.0346	0.1540		
HLP-41								0.0345		0.9997	0.0391	0.0647		0.1300		0.0043		0.0320	0.2160		
HLP-42								0.0430		1.0000	0.0413	0.0646		0.1580		0.0042		0.0409	0.1560		
HLP-42Q								0.0430		1.0000	0.0409	0.0632		0.1680		0.0037		0.0405	0.1550		
HLP-43								0.0150		1.0000	0.0669	0.0985	0.0001	0.0623		0.0047		0.0133	0.1850		
HLP-44								0.0150		1.0000	0.0693	0.0997		0.0607		0.0035		0.0146	0.1860		
HLP-45								0.0150		1.0000	0.0710	0.1010		0.0606		0.0034		0.0155	0.1850		
HLP-46										1.0000	0.1170	0.0550	0.0392	0.0049		0.0028			0.1800		
HLP-47								0.0000		0.9989	0.0942	0.0764	0.0052	0.0204		0.0140	0.0012	0.0011	0.1890		
HLP-48								0.0427		1.0000	0.1150	0.0893		0.0637		0.0275		0.0183	0.1850		
HLP-49								0.0399		0.9998	0.0776	0.0874	0.0696	0.0871		0.0036	0.0411	0.0281	0.0965		
HLP-51								0.0260		1.0000	0.0968	0.0926		0.0294		0.0207		0.0092	0.1880		
HLP-52								0.0000		1.0000	0.0963	0.0010	0.0251	0.0300		0.0180		0.0108	0.2750		
HLP-53								0.0328		0.9998	0.0931	0.0546	0.0421	0.0767		0.0275	0.0229	0.0193	0.1860		
HLP-53Q								0.0328		0.9998	0.0979	0.0454	0.0433	0.0752		0.0308	0.0213	0.0184	0.2040		
HLP-54								0.0000		0.9997	0.1170	0.0876		0.0056		0.0028			0.1780		
HLP-55								0.0000		0.9997	0.0887	0.0892		0.0058		0.0032			0.1770		
HLP-56								0.0296		0.9997	0.0633	0.0931	0.0206	0.0705		0.0212		0.0204	0.1810		
HLP-58								0.0147		0.9999	0.0663	0.0998	0.0202	0.0545		0.0045	0.0013	0.0143	0.1903		0.0008
HLP-59								0.0143		1.0003	0.0659	0.0932	0.0468	0.0540		0.0045	0.0013	0.0138	0.1837		0.0005
HLP-60								0.0000		1.0000	0.1181	0.1225	0.0002	0.0185		0.0038	0.0013	0.0390	0.1569		0.0068
HLP-61								0.0430		1.0000	0.0408	0.1252	0.0474	0.0013		0.0478	0.0014	0.0387	0.1592		0.0007
HLP-62								0.0000		1.0000	0.0403	0.1278	0.0467	0.0019		0.0037	0.0012		0.1641		0.0007
HLP-63								0.0000		1.0000	0.0390	0.0600	0.0001	0.1452		0.0038	0.0011	0.0391	0.2565		0.0008
HLP-64								0.0414		1.0000	0.0404	0.0609		0.0016		0.0460	0.0011	0.0392	0.1599		0.0106
HLP-65								0.0000		1.0000	0.0399	0.0602	0.0466	0.0990		0.0037	0.0011	0.0398	0.1688		0.0198
HLP-66								0.0000		1.0000	0.0418	0.1257	0.0004	0.0544		0.0041	0.0013		0.2349		0.0004
HLP-67								0.0430		1.0000	0.0410	0.1232	0.0002	0.0443		0.0473	0.0013		0.2372		0.0055
HLP-68								0.0000		1.0000	0.0941	0.0624	0.0470	0.1590		0.0464	0.0012		0.1631		0.0006
HLP-69								0.0430		1.0000	0.1131	0.0611		0.0038		0.0038	0.0011		0.1694		0.0009
HLP-70								0.0000		1.0000	0.1179	0.0616	0.0456	0.0023		0.0497	0.0012		0.2431		0.0193

HLP glasses (Vienna et al. 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
HLP-23	0.4410	0.0138												0.0027							
HLP-24	0.4890	0.0151												0.0024							
HLP-25	0.4720	0.0148												0.0021							
HLP-26	0.4680	0.0150												0.0021							
HLP-27	0.5040													0.0026							
HLP-28	0.5180	0.0075												0.0022							
HLP-29	0.4950	0.0064												0.0025							
HLP-30	0.4730	0.0143												0.0023							
HLP-31	0.4890	0.0070												0.0024							
HLP-32	0.4600	0.0160												0.0025							
HLP-33	0.5230	0.0131												0.0030							
HLP-34	0.5100	0.0200												0.0020							
HLP-35	0.3600	0.0173												0.0022							
HLP-36	0.3560	0.0244												0.0017							
HLP-37	0.3560	0.0228												0.0019							
HLP-38	0.3540	0.0338												0.0017							
HLP-39	0.3440	0.0262												0.0023							
HLP-40	0.3510	0.0344												0.0018							
HLP-40Q	0.3410	0.0316												0.0020							
HLP-41	0.3500	0.0319												0.0022							
HLP-42	0.3420	0.0378												0.0017							
HLP-42Q	0.3510	0.0327												0.0019							
HLP-43	0.4840	0.0150												0.0023							
HLP-44	0.4830	0.0122												0.0021							
HLP-45	0.4860	0.0134												0.0022							
HLP-46	0.5770													0.0016							
HLP-47	0.5510	0.0094												0.0032							
HLP-48	0.3640	0.0204												0.0014							
HLP-49	0.4110	0.0273												0.0024							
HLP-51	0.4120	0.0390												0.0014							
HLP-52	0.4580	0.0254												0.0021							
HLP-53	0.3950	0.0276												0.0014							
HLP-53Q	0.4080	0.0282																			
HLP-54	0.5640	0.0007												0.0016							
HLP-55	0.6060													0.0017							
HLP-56	0.4690	0.0135												0.0002							
HLP-58	0.4822	0.0146									0.0027			0.0008				0.0005			
HLP-59	0.4482	0.0152									0.0031			0.0008				0.0005			
HLP-60	0.3531	0.0414									0.0031			0.0010				0.0011			
HLP-61	0.3945	0.0007									0.0032			0.0010				0.0005			
HLP-62	0.4839	0.0552									0.0032			0.0007				0.0015			
HLP-63	0.3696	0.0006									0.0036			0.0008				0.0005			
HLP-64	0.5296	0.0424									0.0033			0.0007				0.0005			
HLP-65	0.5340	0.0004									0.0032			0.0008				0.0005			
HLP-66	0.5151	0.0002									0.0034			0.0009				0.0005			
HLP-67	0.3526	0.0379									0.0035			0.0009				0.0005			
HLP-68	0.3778	0.0563									0.0029			0.0008				0.0005			
HLP-69	0.5389	0.0007									0.0030			0.0007				0.0005			
HLP-70	0.3799	0.0005									0.0037			0.0007				0.0005			

HLP glasses (Vienna et al. 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
HLP-23																					
HLP-24																					
HLP-25		0.0002																			
HLP-26																					
HLP-27																					
HLP-28																					
HLP-29																					
HLP-30																					
HLP-31																					
HLP-32																					
HLP-33																					
HLP-34																					
HLP-35																					
HLP-36																					
HLP-37																					
HLP-38																					
HLP-39																					
HLP-40																					
HLP-40Q																					
HLP-41																					
HLP-42																					
HLP-42Q		0.0010																			
HLP-43																					
HLP-44																					
HLP-45																					
HLP-46																					
HLP-47																					
HLP-48																					
HLP-49																					
HLP-51		0.0194																			
HLP-52																					
HLP-53																					
HLP-53Q																					
HLP-54																					
HLP-55																					
HLP-56																					
HLP-58		0.0001				0.0002															
HLP-59		0.0001				0.0002															
HLP-60		0.0001				0.0002															
HLP-61		0.0001				0.0002															
HLP-62		0.0001				0.0002															
HLP-63		0.0001				0.0002															
HLP-64		0.0001				0.0002															
HLP-65		0.0001				0.0002															
HLP-66		0.0001				0.0002															
HLP-67		0.0001				0.0002															
HLP-68		0.0001				0.0002															
HLP-69		0.0001				0.0002															
HLP-70		0.0001				0.0002															

HLP glasses (Vienna et al. 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
HLP-23										0.0290								0.0147		0.9599
HLP-24										0.0324								0.0160		0.9875
HLP-25										0.0266								0.0149		0.9665
HLP-26										0.0286								0.0140		0.9493
HLP-27																				0.9770
HLP-28										0.0174								0.0092		1.0025
HLP-29										0.0141								0.0073		0.9657
HLP-30										0.0320								0.0155		0.9604
HLP-31										0.0178								0.0094		0.9660
HLP-32										0.0357								0.0186		0.9511
HLP-33										0.0323								0.0167		1.0035
HLP-34										0.0470								0.0232		0.9733
HLP-35										0.0361								0.0183		0.9824
HLP-36										0.0549								0.0269		0.9947
HLP-37										0.0504								0.0246		0.9805
HLP-38										0.0688								0.0333		0.9860
HLP-39										0.0550								0.0272		0.9700
HLP-40										0.0765								0.0373		1.0042
HLP-40Q										0.0728								0.0362		0.9764
HLP-41										0.0678								0.0348		0.9728
HLP-42										0.0866								0.0417		0.9748
HLP-42Q										0.0831								0.0429		0.9839
HLP-43										0.0286								0.0140		0.9747
HLP-44										0.0312								0.0151		0.9774
HLP-45										0.0293								0.0146		0.9820
HLP-46																				0.9775
HLP-47										0.0009										0.9660
HLP-48										0.0245								0.0410		0.9501
HLP-49																		0.0393		0.9710
HLP-51										0.0237								0.0251		0.9573
HLP-52										0.0037										0.9454
HLP-53																		0.0309		0.9771
HLP-53Q																		0.0324		1.0049
HLP-54																				0.9573
HLP-55																				0.9716
HLP-56																		0.0409		0.9937
HLP-58					0.0009					0.0301								0.0143		0.9984
HLP-59					0.0009					0.0288								0.0143		0.9758
HLP-60					0.0009					0.0857								0.0002		0.9539
HLP-61					0.0013					0.0846								0.0399		0.9885
HLP-62					0.0013					0.0856										1.0181
HLP-63					0.0014					0.0883										1.0107
HLP-64					0.0004													0.0373		0.9742
HLP-65					0.0011															1.0192
HLP-66					0.0011					0.0004								0.0001		0.9850
HLP-67					0.0011					0.0001								0.0395		0.9364
HLP-68					0.0014															1.0138
HLP-69					0.0004					0.0879								0.0394		1.0250
HLP-70					0.0009					0.0843										1.0115

HLP glasses (Vienna et al. 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
HLP-23								
HLP-24								
HLP-25								
HLP-26								
HLP-27								
HLP-28								
HLP-29								
HLP-30								
HLP-31								
HLP-32								
HLP-33								
HLP-34								
HLP-35								
HLP-36								
HLP-37								
HLP-38								
HLP-39								
HLP-40								
HLP-40Q								
HLP-41								
HLP-42								
HLP-42Q								
HLP-43								
HLP-44								
HLP-45								
HLP-46								
HLP-47								
HLP-48								
HLP-49								
HLP-51								
HLP-52								
HLP-53								
HLP-53Q								
HLP-54								
HLP-55								
HLP-56								
HLP-58								
HLP-59								
HLP-60								
HLP-61								
HLP-62								
HLP-63								
HLP-64								
HLP-65								
HLP-66								
HLP-67								
HLP-68								
HLP-69								
HLP-70								

HLP glasses (Vienna et al. 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
HLP-23					
HLP-24					
HLP-25					
HLP-26					
HLP-27					
HLP-28					
HLP-29					
HLP-30					
HLP-31					
HLP-32					
HLP-33					
HLP-34					
HLP-35					
HLP-36					
HLP-37					
HLP-38					
HLP-39					
HLP-40					
HLP-40Q					
HLP-41					
HLP-42					
HLP-42Q					
HLP-43					
HLP-44					
HLP-45					
HLP-46					
HLP-47					
HLP-48					
HLP-49					
HLP-51					
HLP-52					
HLP-53					
HLP-53Q					
HLP-54					
HLP-55					
HLP-56					
HLP-58					
HLP-59					
HLP-60					
HLP-61					
HLP-62					
HLP-63					
HLP-64					
HLP-65					
HLP-66					
HLP-67					
HLP-68					
HLP-69					
HLP-70					

HLP glasses (Vienna et al. 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
HLP-23		2.6285													
HLP-24		2.6087													
HLP-25		2.6409													
HLP-26		2.6418													
HLP-27		2.5048													
HLP-28		2.5165													
HLP-29		2.5691													
HLP-30		2.599													
HLP-31		2.6244													
HLP-32		2.6249													
HLP-33		2.6351													
HLP-34		2.6729													
HLP-35		2.6437													
HLP-36	X														
HLP-37	X														
HLP-38	X														
HLP-39		2.7304													
HLP-40	X														
HLP-40Q															
HLP-41	X														
HLP-42	X														
HLP-42Q															
HLP-43		2.6354													
HLP-44		2.6391													
HLP-45		2.6572													
HLP-46		2.5389													
HLP-47		2.5233													
HLP-48		2.6872													
HLP-49	X														
HLP-51		2.6751													
HLP-52		2.6539													
HLP-53	X														
HLP-53Q		2.7258													
HLP-54		2.4897													
HLP-55		2.4545													
HLP-56		2.6804													
HLP-58		2.6217													
HLP-59		2.6452													
HLP-60	X														
HLP-61		2.6494													
HLP-62		2.6795													
HLP-63		2.7808													
HLP-64		2.6331													
HLP-65		2.6494													
HLP-66		2.5834													
HLP-67		2.7122													
HLP-68	X	2.7948													
HLP-69		2.6048													
HLP-70	X														

HLP glasses (Vienna et al. 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
HLP-23																					
HLP-24																					
HLP-25																					
HLP-26																					
HLP-27																					
HLP-28																					
HLP-29																					
HLP-30																					
HLP-31																					
HLP-32																					
HLP-33																					
HLP-34																					
HLP-35																					
HLP-36																					
HLP-37																					
HLP-38																					
HLP-39																					
HLP-40																					
HLP-40Q																					
HLP-41																					
HLP-42																					
HLP-42Q																					
HLP-43																					
HLP-44																					
HLP-45																					
HLP-46																					
HLP-47																					
HLP-48																					
HLP-49																					
HLP-51																					
HLP-52																					
HLP-53																					
HLP-53Q																					
HLP-54																					
HLP-55																					
HLP-56																					
HLP-58																					
HLP-59																					
HLP-60																					
HLP-61																					
HLP-62																					
HLP-63																					
HLP-64																					
HLP-65																					
HLP-66																					
HLP-67																					
HLP-68																					
HLP-69																					
HLP-70																					

HLP glasses (Vienna et al. 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
HLP-23					0.9600		0.7600	0.3000	11.1667							
HLP-24					0.3300		0.3500	0.1900	10.1367							
HLP-25					0.4300		0.4200	0.2000	10.5033							
HLP-26					0.5200		0.3800	0.2200	10.4533							
HLP-27					2.1700		1.5200	0.2300	11.3567							
HLP-28					0.2500		0.1900	0.1800	9.5867							
HLP-29					0.3800		0.5300	0.2600	11.0667							
HLP-30					0.1500		0.2400	0.1500	10.1733							
HLP-31					6.5400		4.6700	1.4800	11.4000							
HLP-32					0.4600		0.3400	0.1800	9.8400							
HLP-33					1.9200		1.6100	0.8100	11.3500							
HLP-34					0.3800		0.3600	0.1900	10.2033							
HLP-35					1.3200		1.0000	0.2100	11.1567							
HLP-36										0.4300		0.3500	0.1600	9.8700		
HLP-37					0.6300		0.7500	0.3000	11.4467							
HLP-38					0.4000		0.3700	0.1800	10.5833							
HLP-39					2.3100		1.4900	0.4000	11.4567							
HLP-40										0.9400		0.7300	0.2100	10.0533		
HLP-40Q					0.8100		0.6400	0.2100	10.0300							
HLP-41										6.9400		4.6600	1.1100	12.2033		
HLP-42										0.7400		0.5900	0.2600	10.8667		
HLP-42Q					0.9700		0.7100	0.2700	10.9900							
HLP-43					0.4000		0.3300	0.1800	10.4933							
HLP-44					0.4500		0.4000	0.1700	10.4800							
HLP-45					0.4200		0.3800	0.1700	10.4633							
HLP-46					0.0500		0.4700	0.1100	10.9033							
HLP-47					0.4900		0.4900	0.1400	10.9300							
HLP-48					0.6100		0.5200	0.1700	10.5667							
HLP-49										0.3100		0.2900	0.0900	10.8700		
HLP-51					0.3400		0.3800	0.1500	12.6800							
HLP-52							5.5700	0.6500	10.3300							
HLP-53																
HLP-53Q																
HLP-54					0.4300		0.4500	0.1900	10.3233							
HLP-55					0.1400		0.2500	0.1100	11.3633							
HLP-56																
HLP-58					0.2600		0.3100	0.1400	10.4633							
HLP-59					0.2900		0.3700	0.1500	10.7367							
HLP-60										0.0300		0.0400	0.0200			
HLP-61					0.9600		0.3300	0.2400	10.5733							
HLP-62					0.2500		0.2700	0.1200	9.9700							
HLP-63					1.2700		3.7300	0.9900	11.8600							
HLP-64					3.2000		2.4000	0.5800	11.1933							
HLP-65					0.4600		0.4900	0.2300	10.5700							
HLP-66					8.9200		6.5000	2.3400	11.5400							
HLP-67					7.6600		5.6200	0.9100	12.1967							
HLP-68										0.3200		0.4300	0.1100	11.1867		
HLP-69					0.2000		0.2100	0.1400	10.2967							
HLP-70										0.3100		0.1400	0.1300	12.2767		

HLP glasses (Vienna et al. 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
HLP-23												
HLP-24												
HLP-25												
HLP-26												
HLP-27												
HLP-28												
HLP-29												
HLP-30												
HLP-31												
HLP-32												
HLP-33												
HLP-34												
HLP-35												
HLP-36												
HLP-37												
HLP-38												
HLP-39												
HLP-40												
HLP-40Q												
HLP-41												
HLP-42												
HLP-42Q												
HLP-43												
HLP-44												
HLP-45												
HLP-46												
HLP-47												
HLP-48												
HLP-49												
HLP-51												
HLP-52												
HLP-53												
HLP-53Q												
HLP-54												
HLP-55												
HLP-56												
HLP-58												
HLP-59												
HLP-60												
HLP-61												
HLP-62												
HLP-63												
HLP-64												
HLP-65												
HLP-66												
HLP-67												
HLP-68												
HLP-69												
HLP-70												

HLP glasses (Vienna et al. 2001)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
HLP-71	0.1194	0.0600	0.0500	0.0040		0.0033	0.0000	0.0430	0.2514		0.0004	0.3600	0.0600								
HLP-72	0.0400	0.0600	0.0001	0.1577		0.0033	0.0000	0.0000	0.1600		0.0200	0.3645	0.0600								
HLP-73	0.1194	0.1257	0.0001	0.1359		0.0500	0.0000	0.0430	0.1600		0.0004	0.3600	0.0000								
HLP-74	0.1194	0.1257	0.0500	0.1131		0.0033	0.0000	0.0000	0.1600		0.0200	0.3600	0.0000								
HLP-75	0.0743	0.0893	0.0231	0.0554		0.0249	0.0000	0.0200	0.1984		0.0099	0.4155	0.0270								
HLP-76	0.1000	0.0800	0.0050	0.0100		0.0150	0.0010	0.0010	0.2000	0.0010	0.0050	0.5437	0.0100			0.0001			0.0020		
HLP-77	0.1000	0.0800	0.0050	0.0100		0.0150	0.0010	0.0010	0.2000	0.0010	0.0050	0.5437	0.0100			0.0001			0.0020		

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9	0.0900			0.0000		0.0033			0.2000		0.0119	0.6878	0.0000				0.0001				
L1-12	0.1200			0.0000		0.0033			0.2000		0.0119	0.6578	0.0000				0.0001				
L1-15	0.1500			0.0000		0.0033			0.2000		0.0119	0.6278	0.0000				0.0001				
L4-69	0.0900	0.0600		0.0000		0.0033			0.2000		0.0119	0.6278	0.0000				0.0001				
L4-612	0.1200	0.0600		0.0000		0.0033			0.2000		0.0119	0.5978	0.0000				0.0001				
L4-615	0.1500	0.0600		0.0000		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				
L4-96	0.0600	0.0900		0.0000		0.0033			0.2000		0.0119	0.6278	0.0000				0.0001				
L4-99	0.0900	0.0900		0.0000		0.0033			0.2000		0.0119	0.5978	0.0000				0.0001				
L4-912	0.1200	0.0900		0.0000		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				
L4-915	0.1500	0.0900		0.0000		0.0033			0.2000		0.0119	0.5378	0.0000				0.0001				
L4-129	0.0900	0.1200		0.0000		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				
L4-1212	0.1200	0.1200		0.0000		0.0033			0.2000		0.0119	0.5378	0.0000				0.0001				
L4-1215	0.1500	0.1200		0.0000		0.0033			0.2000		0.0119	0.5078	0.0000				0.0001				
L5-69	0.0900		0.0600	0.0000		0.0033			0.2000		0.0119	0.6278	0.0000				0.0001				
L5-612	0.1200		0.0600	0.0000		0.0033			0.2000		0.0119	0.5978	0.0000				0.0001				
L5-615	0.1500		0.0600	0.0000		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				
L5-96	0.0600		0.0900	0.0000		0.0033			0.2000		0.0119	0.6278	0.0000				0.0001				
L5-99	0.0900		0.0900	0.0000		0.0033			0.2000		0.0119	0.5978	0.0000				0.0001				
L5-912	0.1200		0.0900	0.0000		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				
L5-915	0.1500		0.0900	0.0000		0.0033			0.2000		0.0119	0.5378	0.0000				0.0001				
L5-129	0.0900		0.1200	0.0000		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				
L5-1212	0.1200		0.1200	0.0000		0.0033			0.2000		0.0119	0.5378	0.0000				0.0001				
L5-1215	0.1500		0.1200	0.0000		0.0033			0.2000		0.0119	0.5078	0.0000				0.0001				
L6-3312	0.1200	0.0300	0.0300	0.0000		0.0033			0.2000		0.0119	0.5978	0.0000				0.0001				
L6-546	0.0600	0.0500	0.0400	0.0000		0.0033			0.2000		0.0119	0.6278	0.0000				0.0001				
L6-549	0.0900	0.0500	0.0400	0.0000		0.0033			0.2000		0.0119	0.5978	0.0000				0.0001				
L6-5412	0.1200	0.0500	0.0400	0.0000		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				
L6-5415	0.1500	0.0500	0.0400	0.0000		0.0033			0.2000		0.0119	0.5378	0.0000				0.0001				
L6-669	0.0900	0.0600	0.0600	0.0000		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				
L6-6612	0.1200	0.0600	0.0600	0.0000		0.0033			0.2000		0.0119	0.5378	0.0000				0.0001				
L7-15	0.1245	0.0539	0.0431	0.0000		0.0025			0.1500		0.0089	0.6119	0.0000				0.0001				
L7-25	0.1155	0.0461	0.0369	0.0000		0.0041			0.2500		0.0148	0.5238	0.0001				0.0002				
L7-30	0.1110	0.0422	0.0338	0.0001		0.0049			0.3000		0.0178	0.4797	0.0001				0.0002				
L7-35	0.1065	0.0384	0.0307	0.0001		0.0057			0.3500		0.0208	0.4357	0.0001				0.0002				
L8-1	0.0900	0.0600		0.0000		0.0033			0.2000		0.0119	0.5678	0.0600				0.0001				
L8-2	0.0900		0.0600	0.0000		0.0033			0.2000		0.0119	0.5678	0.0600				0.0001				
L8-3	0.0900	0.0300	0.0300	0.0000		0.0033			0.2000		0.0119	0.5678	0.0600				0.0001				
L8-4	0.0900	0.0600		0.0600		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				
L8-5	0.0900		0.0600	0.0600		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				
L8-6	0.0900	0.0300	0.0300	0.0600		0.0033			0.2000		0.0119	0.5678	0.0000				0.0001				

HLP glasses (Vienna et al. 2001)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
HLP-71	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-72	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-73	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-74	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-75	0.0035			0.0009				0.0001					0.0000				0.0000				
HLP-76	0.0080			0.0020				0.0100				0.0000	0.0001		0.0010		0.0000			0.0010	
HLP-77	0.0080			0.0020				0.0100				0.0000	0.0001		0.0010		0.0000			0.0010	

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9	0.0009			0.0004				0.0021							0.0001				0.0001		
L1-12	0.0009			0.0004				0.0021							0.0001				0.0001		
L1-15	0.0009			0.0004				0.0021							0.0001				0.0001		
L4-69	0.0009			0.0004				0.0021							0.0001				0.0001		
L4-612	0.0009			0.0004				0.0021							0.0001				0.0001		
L4-615	0.0009			0.0004				0.0021							0.0001				0.0001		
L4-96	0.0009			0.0004				0.0021							0.0001				0.0001		
L4-99	0.0009			0.0004				0.0021							0.0001				0.0001		
L4-912	0.0009			0.0004				0.0021							0.0001				0.0001		
L4-915	0.0009			0.0004				0.0021							0.0001				0.0001		
L4-129	0.0009			0.0004				0.0021							0.0001				0.0001		
L4-1212	0.0009			0.0004				0.0021							0.0001				0.0001		
L4-1215	0.0009			0.0004				0.0021							0.0001				0.0001		
L5-69	0.0009			0.0004				0.0021							0.0001				0.0001		
L5-612	0.0009			0.0004				0.0021							0.0001				0.0001		
L5-615	0.0009			0.0004				0.0021							0.0001				0.0001		
L5-96	0.0009			0.0004				0.0021							0.0001				0.0001		
L5-99	0.0009			0.0004				0.0021							0.0001				0.0001		
L5-912	0.0009			0.0004				0.0021							0.0001				0.0001		
L5-915	0.0009			0.0004				0.0021							0.0001				0.0001		
L5-129	0.0009			0.0004				0.0021							0.0001				0.0001		
L5-1212	0.0009			0.0004				0.0021							0.0001				0.0001		
L5-1215	0.0009			0.0004				0.0021							0.0001				0.0001		
L6-3312	0.0009			0.0004				0.0021							0.0001				0.0001		
L6-546	0.0009			0.0004				0.0021							0.0001				0.0001		
L6-549	0.0009			0.0004				0.0021							0.0001				0.0001		
L6-5412	0.0009			0.0004				0.0021							0.0001				0.0001		
L6-5415	0.0009			0.0004				0.0021							0.0001				0.0001		
L6-669	0.0009			0.0004				0.0021							0.0001				0.0001		
L6-6612	0.0009			0.0004				0.0021							0.0001				0.0001		
L7-15	0.0007			0.0003				0.0016							0.0001				0.0001		
L7-25	0.0012			0.0004				0.0027							0.0001				0.0001		
L7-30	0.0014			0.0005				0.0032							0.0001				0.0002		
L7-35	0.0016			0.0006				0.0037							0.0001				0.0002		
L8-1	0.0009			0.0004				0.0021							0.0001				0.0001		
L8-2	0.0009			0.0004				0.0021							0.0001				0.0001		
L8-3	0.0009			0.0004				0.0021							0.0001				0.0001		
L8-4	0.0009			0.0004				0.0021							0.0001				0.0001		
L8-5	0.0009			0.0004				0.0021							0.0001				0.0001		
L8-6	0.0009			0.0004				0.0021							0.0001				0.0001		

HLP glasses (Vienna et al. 2001)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
HLP-71					0.0001											0.0009					0.0000
HLP-72					0.0001											0.0009					0.0859
HLP-73					0.0001											0.0009					0.0000
HLP-74					0.0001											0.0009					0.0000
HLP-75					0.0001											0.0009					0.0368
HLP-76					0.0000											0.0020					0.0010
HLP-77					0.0000											0.0020					0.0010

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9																0.0032					
L1-12																0.0032					
L1-15																0.0032					
L4-69																0.0032					
L4-612																0.0032					
L4-615																0.0032					
L4-96																0.0032					
L4-99																0.0032					
L4-912																0.0032					
L4-915																0.0032					
L4-129																0.0032					
L4-1212																0.0032					
L4-1215																0.0032					
L5-69																0.0032					
L5-612																0.0032					
L5-615																0.0032					
L5-96																0.0032					
L5-99																0.0032					
L5-912																0.0032					
L5-915																0.0032					
L5-129																0.0032					
L5-1212																0.0032					
L5-1215																0.0032					
L6-3312																0.0032					
L6-546																0.0032					
L6-549																0.0032					
L6-5412																0.0032					
L6-5415																0.0032					
L6-669																0.0032					
L6-6612																0.0032					
L7-15																0.0024					
L7-25																0.0040					
L7-30																0.0048					
L7-35																0.0056					
L8-1																0.0032					
L8-2																0.0032					
L8-3																0.0032					
L8-4																0.0032					
L8-5																0.0032					
L8-6																0.0032					

HLP glasses (Vienna et al. 2001)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
HLP-71								0.0430		1.0000	0.1184	0.0590	0.0465	0.0045		0.0037	0.0013	0.0391	0.2447		0.0004
HLP-72								0.0430		1.0000	0.0401	0.0615	0.0017	0.1533		0.0037	0.0015	0.0004	0.1642		0.0087
HLP-73								0.0000		1.0000	0.1181	0.1220	0.0004	0.1349		0.0478	0.0013	0.0391	0.1556		0.0005
HLP-74								0.0430		1.0000	0.1193	0.1245	0.0473	0.1108		0.0042	0.0014		0.1573		0.0201
HLP-75								0.0200		1.0001	0.0762	0.0943	0.0238	0.0585		0.0264	0.0028	0.0195	0.1925		0.0080
HLP-76								0.0000		0.9989	0.0997	0.0785	0.0054	0.0157		0.0164	0.0018	0.0009	0.1938		0.0052
HLP-77								0.0000		0.9989	0.0958	0.0790	0.0049	0.0167		0.0156	0.0019	0.0006	0.2029		0.0052

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9										1.0000											
L1-12										1.0000											
L1-15										1.0000											
L4-69										1.0000											
L4-612										1.0000											
L4-615										1.0000											
L4-96										1.0000											
L4-99										1.0000											
L4-912										1.0000											
L4-915										1.0000											
L4-129										1.0000											
L4-1212										1.0000											
L4-1215										1.0000											
L5-69										1.0000											
L5-612										1.0000											
L5-615										1.0000											
L5-96										1.0000											
L5-99										1.0000											
L5-912										1.0000											
L5-915										1.0000											
L5-129										1.0000											
L5-1212										1.0000											
L5-1215										1.0000											
L6-3312										1.0000											
L6-546										1.0000											
L6-549										1.0000											
L6-5412										1.0000											
L6-5415										1.0000											
L6-669										1.0000											
L6-6612										1.0000											
L7-15										1.0000											
L7-25										1.0000											
L7-30										1.0000											
L7-35										1.0001											
L8-1										0.9999											
L8-2										0.9999											
L8-3										0.9999											
L8-4										0.9999											
L8-5										0.9999											
L8-6										0.9999											

HLP glasses (Vienna et al. 2001)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
HLP-71	0.3579	0.0612									0.0036			0.0009				0.0005			
HLP-72	0.3701	0.0385									0.0033			0.0008				0.0005			
HLP-73	0.3532	0.0001									0.0032			0.0009				0.0005			
HLP-74	0.3584										0.0034			0.0008				0.0005			
HLP-75	0.4225	0.0253									0.0028			0.0009				0.0005			
HLP-76	0.5546	0.0111									0.0011			0.0019				0.0086			
HLP-77	0.5612	0.0101									0.0010			0.0018				0.0086			

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9																					
L1-12																					
L1-15																					
L4-69																					
L4-612																					
L4-615																					
L4-96																					
L4-99																					
L4-912																					
L4-915																					
L4-129																					
L4-1212																					
L4-1215																					
L5-69																					
L5-612																					
L5-615																					
L5-96																					
L5-99																					
L5-912																					
L5-915																					
L5-129																					
L5-1212																					
L5-1215																					
L6-3312																					
L6-546																					
L6-549																					
L6-5412																					
L6-5415																					
L6-669																					
L6-6612																					
L7-15																					
L7-25																					
L7-30																					
L7-35																					
L8-1																					
L8-2																					
L8-3																					
L8-4																					
L8-5																					
L8-6																					

HLP glasses (Vienna et al. 2001)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
HLP-71		0.0001				0.0002															
HLP-72		0.0001				0.0002															
HLP-73		0.0001				0.0002															
HLP-74		0.0001				0.0002															
HLP-75		0.0001				0.0002															
HLP-76		0.0001				0.0009															
HLP-77		0.0001				0.0008															

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9																					
L1-12																					
L1-15																					
L4-69																					
L4-612																					
L4-615																					
L4-96																					
L4-99																					
L4-912																					
L4-915																					
L4-129																					
L4-1212																					
L4-1215																					
L5-69																					
L5-612																					
L5-615																					
L5-96																					
L5-99																					
L5-912																					
L5-915																					
L5-129																					
L5-1212																					
L5-1215																					
L6-3312																					
L6-546																					
L6-549																					
L6-5412																					
L6-5415																					
L6-669																					
L6-6612																					
L7-15																					
L7-25																					
L7-30																					
L7-35																					
L8-1																					
L8-2																					
L8-3																					
L8-4																					
L8-5																					
L8-6																					

HLP glasses (Vienna et al. 2001)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
HLP-71					0.0012					0.0001								0.0393		0.9826
HLP-72					0.0014					0.0856								0.0386		0.9742
HLP-73					0.0014					0.0002								0.0001		0.9796
HLP-74					0.0010													0.0401		0.9894
HLP-75					0.0010					0.0366								0.0197		1.0116
HLP-76					0.0020					0.0013								0.0001		0.9991
HLP-77					0.0019					0.0008										1.0089

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9																				
L1-12																				
L1-15																				
L4-69																				
L4-612																				
L4-615																				
L4-96																				
L4-99																				
L4-912																				
L4-915																				
L4-129																				
L4-1212																				
L4-1215																				
L5-69																				
L5-612																				
L5-615																				
L5-96																				
L5-99																				
L5-912																				
L5-915																				
L5-129																				
L5-1212																				
L5-1215																				
L6-3312																				
L6-546																				
L6-549																				
L6-5412																				
L6-5415																				
L6-669																				
L6-6612																				
L7-15																				
L7-25																				
L7-30																				
L7-35																				
L8-1																				
L8-2																				
L8-3																				
L8-4																				
L8-5																				
L8-6																				

HLP glasses (Vienna et al. 2001)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
HLP-71								
HLP-72								
HLP-73								
HLP-74								
HLP-75								
HLP-76								
HLP-77								

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9								
L1-12								
L1-15								
L4-69								
L4-612								
L4-615								
L4-96								
L4-99								
L4-912								
L4-915								
L4-129								
L4-1212								
L4-1215								
L5-69								
L5-612								
L5-615								
L5-96								
L5-99								
L5-912								
L5-915								
L5-129								
L5-1212								
L5-1215								
L6-3312								
L6-546								
L6-549								
L6-5412								
L6-5415								
L6-669								
L6-6612								
L7-15								
L7-25								
L7-30								
L7-35								
L8-1								
L8-2								
L8-3								
L8-4								
L8-5								
L8-6								

HLP glasses (Vienna et al. 2001)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
HLP-71					
HLP-72					
HLP-73					
HLP-74					
HLP-75					
HLP-76					
HLP-77					

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9					
L1-12					
L1-15					
L4-69					
L4-612					
L4-615					
L4-96					
L4-99					
L4-912					
L4-915					
L4-129					
L4-1212					
L4-1215					
L5-69					
L5-612					
L5-615					
L5-96					
L5-99					
L5-912					
L5-915					
L5-129					
L5-1212					
L5-1215					
L6-3312					
L6-546					
L6-549					
L6-5412					
L6-5415					
L6-669					
L6-6612					
L7-15					
L7-25					
L7-30					
L7-35					
L8-1					
L8-2					
L8-3					
L8-4					
L8-5					
L8-6					

HLP glasses (Vienna et al. 2001)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
HLP-71	X	2.7159													
HLP-72	X														
HLP-73	X														
HLP-74	X														
HLP-75		2.6806													
HLP-76		2.5537													
HLP-77		2.5613													

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9															
L1-12															
L1-15															
L4-69															
L4-612															
L4-615							-10.107	21514.4	150.21				1214	79.1	1264
L4-96							-9.925	19184.6	35.05				1139	40.8	1189
L4-99															
L4-912							-9.443	19143.8	55.15				1140	66.5	1189
L4-915															
L4-129							-9.629	18093.3	21.89				1089	41.6	1139
L4-1212															
L4-1215							-9.373	18494.4	37.48				1140	43.9	1189
L5-69															
L5-612															
L5-615															
L5-96							-10.576	20941.0	62.81				1139	74.5	1189
L5-99															
L5-912															
L5-915															
L5-129							-11.479	21915.7	50.50				1089	108.8	1139
L5-1212															
L5-1215							-11.864	22949.3	71.05				1139	85.2	1189
L6-3312							-9.784	20688.7	116.14				1188	86.9	1238
L6-546							-9.898	19289.6	38.77				1089	78.6	1138
L6-549							-9.858	19476.5	46.01				1089	95.2	1138
L6-5412							-9.845	19820.9	59.38				1139	71.3	1188
L6-5415							-9.945	20303.5	75.42				1138	89.4	1188
L6-669							-10.126	19064.5	26.35				1090	50.7	1140
L6-6612							-10.057	19249.1	32.14				1089	62.8	1138
L7-15							-10.227	22267.0	226.08				1188	154.5	1237
L7-25							-9.774	18172.2	20.01				1089	36.4	1138
L7-30							-10.088	17489.3	9.05				990	43.7	1040
L7-35							-10.863	17430.6	4.00				891	63.7	941
L8-1							-11.168	22495.8	103.62				1189	72.5	1239
L8-2							-12.425	24879.3	157.39				1186	108.9	1236
L8-3							-11.713	23496.3	121.36				1189	83.1	1239
L8-4							-12.650	23160.4	37.55				1094	77.3	1145
L8-5							-10.915	21611.1	71.67				1091	143.3	1141
L8-6							-9.611	19309.7	52.39				1142	60	1192

HLP glasses (Vienna et al. 2001)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
HLP-71																					
HLP-72																					
HLP-73																					
HLP-74																					
HLP-75																					
HLP-76																					
HLP-77																					

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9																					
L1-12																					
L1-15																					
L4-69																					
L4-612																					
L4-615	50.1	1314	32.9	1363	18.9	1412	13.9	1413	13.5	1462	9.5	1462	10.1	1464	11.1	(1516)	(9.7)				
L4-96	25.5	1239	16.4	1288	9.5	1337	6.8	1337	6.9	1387	4.8	1387	5	1388	5.6	1437	3.7	1488	2.9		
L4-99																					
L4-912	40.6	1239	26.4	1289	14.3	1338	10.2	1338	10.4	1388	7.2	1388	7.6	1388	8.9	1438	6	1489	5		
L4-915																					
L4-129	24.9	1189	15.8	1238	9.5	1287	6.6	1287	6.7	1336	4.7	1337	4.9	1338	5.3	1387	3.7	1437	2.9		
L4-1212																					
L4-1215	27.6	1239	18.4	1288	10.5	1337	7.3	1338	7.6	1387	5.2	1388	5.8	1388	6.6	1437	4.4	1488	3.5		
L5-69																					
L5-612																					
L5-615																					
L5-96	43	1238	26	1287	16.5	1287	16.6	1336	11.2	1337	11.2	1338	11.4	1387	7.6	1437	5.5	1487	3.9		
L5-99																					
L5-912																					
L5-915																					
L5-129	58	1189	32	1238	19.5	1238	19.7	1287	12.8	1287	12.9	1288	12.9	1337	8.4	1387	5.8	1438	4		
L5-1212																					
L5-1215	46.6	1238	27.1	1287	16.5	1287	16.5	1336	10.8	1337	10.8	1338	10.8	1387	7.3	1437	4.9	1487	3.3		
L6-3312	53.2	1287	29.8	1336	19.9	1336	20.3	1386	13.6	1386	14.4	1388	15.5	1436	10.1	1487	7.4	1538	5.6		
L6-546	45.1	1188	25.6	1237	16.7	1238	16.4	1286	11.5	1287	11	1287	12.2	1337	8	1387	5.9	1437	4.3		
L6-549	55	1187	29.5	1236	19.6	1237	19	1286	12.8	1286	13.6	1287	14.8	1336	9.4	1386	6.9	1436	5.1		
L6-5412	43.1	1238	24.6	1287	16	1287	16.5	1337	10.9	1337	11.7	1337	12.6	1387	8.4	1437	6.2				
L6-5415	53.2	1237	31.7	1287	20.5	1287	21	1336	13.6	1336	14.5	1337	15	1386	10	1437	7.3				
L6-669	29.4	1189	17.2	1239	11.5	1239	11.6	1288	7.7	1288	8	1289	8.3	1338	5.6	1388	4.1				
L6-6612	36.2	1188	21.3	1238	14.2	1238	14.3	1287	9.4	1287	9.7	1287	9.9	1337	6.9	1387	4.9				
L7-15	91.3	1287	56.3	1336	35.8	1386	23.6	1386	25	1436	15.7	1436	17.7	1436	16.7						
L7-25	22.6	1188	13.8	1237	9.4	1237	9.5	1286	6.4	1286	6.6	1287	6.7	1336	4.6	1387	3.3				
L7-30	25.4	1090	15.4	1139	9.7	1188	6.5	1189	6.5	1238	4.4	1238	4.4	1239	4.5	1288	3.1				
L7-35	32.4	991	18.3	1040	11	1089	6.8	1089	6.8	1139	4.4	1139	4.4	1140	4.4	1189	3				
L8-1	42.1	1288	26.1	1338	14.4	1388	10	1389	9.7	1438	6.9	1438	7.5	1438	7.7	1488	5.7				
L8-2	60.1	1286	32.6	1336	19.8	1336	20	1386	12.9	1386	12.9	1386	13.1	1436	8.4	1486	5.7	1536	4		
L8-3	47.7	1288	26.7	1338	16.5	1338	17	1388	10.5	1388	11.3	1388	11.9	1438	7.8	1488	5.5				
L8-4	39.7	1194	21.8	1244	13.3	1244	13.4	1294	8.1	1294	8.4	1294	8.5	1344	5.4	1344	5.7				
L8-5	78.6	1191	45.6	1241	28.2	1291	17.8	1341	12	1391	8.2										
L8-6	35.8	1242	21.9	1292	14.9	1292	14.6	1342	10	1342	10.4	1343	10.7	1392	7.3	1443	5.5				

HLP glasses (Vienna et al. 2001)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
HLP-71										42.6800		11.0100	0.4300	12.4667		
HLP-72										0.2900		0.3000	0.1200	9.8933		
HLP-73										2.0600		1.2400	0.1400	10.2667		
HLP-74										0.2500		0.2900	0.1000	10.1833		
HLP-75					0.3300		0.4300	0.1700	10.9667							
HLP-76					0.2300		0.3000	0.1300	10.7967							
HLP-77					0.2200		0.3000	0.1300	10.7600							

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9							6.085	0.935	12.735							
L1-12							2.62	0.4	12.3367							
L1-15							0.86	0.21	11.63							
L4-69					0.47		0.53	0.22	10.88							
L4-612					0.155		0.27	0.13	10.705							
L4-615					0.145		0.235	0.13	10.615							
L4-96					2.975		2.29	0.785	10.62							
L4-99					0.775		0.595	0.21	10.51							
L4-912					0.28		0.3	0.13	10.53							
L4-915					0.2		0.225	0.12	10.335							
L4-129					1.65		1.13	0.245	10.385							
L4-1212					1.08		0.695	0.13	10.39							
L4-1215					0.64		0.41	0.115	10.075							
L5-69							1.905	0.35	12.165							
L5-612							1.01	0.155	11.94							
L5-615							0.54	0.12	11.635							
L5-96							2.235	0.5	12.22							
L5-99							1.675	0.335	12.165							
L5-912							0.945	0.18	11.955							
L5-915							0.64	0.11	11.8							
L5-129							1.403	0.29	12.09							
L5-1212							1.05	0.21	11.97							
L5-1215							0.6	0.095	11.795							
L6-3312					0.165		0.575	0.155	11.635							
L6-546					0.235		0.94	0.22	11.9							
L6-549					0.17		0.595	0.155	11.65							
L6-5412					0.13		0.395	0.12	11.4							
L6-5415					0.11		0.305	0.1	11.24							
L6-669					0.14		0.49	0.13	11.365							
L6-6612					0.115		0.38	0.105	11.465							
L7-15					0.07		0.15	0.06	10.4							
L7-25					0.39		1.505	0.37	12.22							
L7-30					1.19		6.02	0.955	12.89							
L7-35					44.385		35.52	16.605	13.355							
L8-1					0.17		0.345	0.12	11							
L8-2							1.03	0.185	11.865							
L8-3					0.24		0.67	0.155	11.58							
L8-4					1.29		1.015	0.43	10.705							
L8-5							1.16	0.215	11.935							
L8-6					0.24		0.615	0.19	11.47							

HLP glasses (Vienna et al. 2001)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
HLP-71												
HLP-72												
HLP-73												
HLP-74												
HLP-75												
HLP-76												
HLP-77												

Hanford LLW Glass Formulation (Feng et al. 1996)

L1-9												
L1-12												
L1-15												
L4-69												
L4-612												
L4-615												
L4-96												
L4-99												
L4-912												
L4-915												
L4-129												
L4-1212												
L4-1215												
L5-69												
L5-612												
L5-615												
L5-96												
L5-99												
L5-912												
L5-915												
L5-129												
L5-1212												
L5-1215												
L6-3312												
L6-546												
L6-549												
L6-5412												
L6-5415												
L6-669												
L6-6612												
L7-15												
L7-25												
L7-30												
L7-35												
L8-1												
L8-2												
L8-3												
L8-4												
L8-5												
L8-6												

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
L8-7	0.0900	0.0600		0.0300		0.0033			0.2000		0.0119	0.5678	0.0300				0.0001				
L8-8	0.0900	0.0500		0.0000		0.0033		0.0400	0.2000		0.0119	0.5979	0.0000				0.0001				
LD4-912	0.1200	0.0900		0.0000		0.0146		0.0000	0.2000		0.0019	0.5591									
LD5-912	0.1200		0.0900	0.0000		0.0146		0.0000	0.2000		0.0019	0.5591									
LD6-5314	0.1400	0.0500	0.0300	0.0000		0.0146		0.0000	0.2000		0.0019	0.5491									
LD6-5412	0.1200	0.0500	0.0400	0.0000		0.0146		0.0000	0.2000		0.0019	0.5591									
LD6-5510	0.1000	0.0500	0.0500	0.0000		0.0146		0.0000	0.2000		0.0019	0.5691									
LDM-912	0.1200		0.0900			0.0143			0.2000		0.0019	0.5514									
LDM-1	0.1200	0.0200	0.0200	0.0600		0.0143			0.2000		0.0019	0.5014	0.0400								
LDM-2	0.1200		0.0600	0.0600		0.0143			0.2000		0.0019	0.5214									
LDM-3	0.1200	0.0600				0.0143			0.2000		0.0019	0.5214	0.0600								
LDM-4	0.1000	0.0600	0.0600	0.0600		0.0143			0.2000		0.0019	0.4414	0.0400								
LDM-5412	0.1200	0.0500	0.0400			0.0143			0.2000		0.0019	0.5514									
LDMS-1	0.1200	0.0200	0.0200	0.0600		0.0143			0.2000		0.0019	0.5014	0.0400								
LRM-912	0.1200		0.0900			0.0003			0.2000		0.0252	0.5454									
LRM-1	0.1200	0.0200	0.0200	0.0600		0.0003	0.0100		0.2000		0.0252	0.4854	0.0400								
LRM-2	0.1200		0.0600	0.0600		0.0003			0.2000		0.0252	0.5154									
LRM-3	0.1200	0.0600				0.0003			0.2000		0.0252	0.5154	0.0600								
LRM-4	0.1000	0.0600	0.0600	0.0600		0.0003	0.0050		0.2000		0.0252	0.4304	0.0400								
LRM-5412	0.1200	0.0500	0.0400			0.0003			0.2000		0.0252	0.5454									
LRMS-1	0.1200	0.0200	0.0200	0.0600		0.0003	0.0100		0.2000		0.0252	0.4854	0.0400								
SSHTM-3	0.1200	0.0500	0.0400	0.0000		0.0146		0.0000	0.2000		0.0019	0.5591									
B1G9-0IIC4	0.1000	0.0500	0.0500	0.0000		0.0146		0.0000	0.2000		0.0019	0.5691									
B1G9-013C5	0.1000	0.0500	0.0500	0.0000		0.0146		0.0000	0.2000		0.0019	0.5691									
B1G9-014C	0.1000	0.0500	0.0500	0.0000		0.0146		0.0000	0.2000		0.0019	0.5691									
D1G4-022P2	0.0614	0.0615	0.0780	0.0750		0.0368		0.0000	0.1882		0.0018	0.4223	0.0509								
D1G4-023P3	0.0614	0.0615	0.0780	0.0750		0.0368		0.0000	0.1882		0.0018	0.4223	0.0509								
Duratek	0.0614	0.0615	0.0780	0.0750		0.0368		0.0000	0.1882		0.0018	0.4223	0.0509								
PEI	0.0600		0.0973	0.0100		0.0150		0.0013	0.1882		0.0019	0.5922	0.0200								
M1G1-008P	0.1000	0.0500	0.0500	0.0000		0.0146		0.0000	0.2000		0.0019	0.5691									
M1G1-011P	0.1000	0.0500	0.0500	0.0000		0.0146		0.0000	0.2000		0.0019	0.5691									
V1M2 6 32 011 P1	0.1000	0.0800	0.0290	0.0100		0.0146		0.0210	0.2000		0.0019	0.5290									
V1M2 6 32 040 P2	0.1000	0.0800	0.0290	0.0100		0.0146		0.0210	0.2000		0.0019	0.5290									
V1M3 6 32 059 P1	0.1000	0.0800	0.0290	0.0100		0.0146		0.0210	0.2000		0.0019	0.5290									
V1M3 6 32 075 P2	0.1000	0.0800	0.0290	0.0100		0.0146		0.0210	0.2000		0.0019	0.5290									
V1M4 6 32 088 P1	0.1000	0.0800	0.0290	0.0100		0.0146		0.0210	0.2000		0.0019	0.5290									
V1M4 6 32 096 P2	0.1000	0.0800	0.0290	0.0100		0.0146		0.0210	0.2000		0.0019	0.5290									
Vectra	0.1000	0.0800	0.0290	0.0100		0.0146		0.0210	0.2000		0.0019	0.5290									
WSTC	0.1822	0.0945	0.0465	0.0000		0.0144	0.0083	0.0000	0.1882		0.0019	0.4290	0.0210								

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01	0.1003	0.0900	0.0218	0.0412		0.0278	0.0200	0.0000	0.1772	0.0008	0.0122	0.4548	0.0120			0.0200			0.0020		
SBW1-02	0.0980	0.0900	0.0218	0.0608		0.0278	0.0300	0.0000	0.1408	0.0008	0.0084	0.4650	0.0120			0.0200			0.0030		
SBW1-03	0.0980	0.0900	0.0218	0.0412		0.0278	0.0200	0.0000	0.1408	0.0008	0.0084	0.5029	0.0080			0.0200			0.0020		
SBW1-04	0.0980	0.1100	0.0218	0.0412		0.0362	0.0300	0.0000	0.1450	0.0008	0.0122	0.4548	0.0080			0.0200			0.0020		

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
L8-7	0.0009			0.0004				0.0021							0.0001				0.0001		
L8-8	0.0009			0.0004				0.0021							0.0001				0.0001		
LD4-912	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
LD5-912	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
LD6-5314	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
LD6-5412	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
LD6-5510	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
LDM-912	0.0064			0.0004	0.0014			0.0082				0.0013					0.0015				
LDM-1	0.0064			0.0004	0.0014			0.0082				0.0013					0.0015				
LDM-2	0.0064			0.0004	0.0014			0.0082				0.0013					0.0015				
LDM-3	0.0064			0.0004	0.0014			0.0082				0.0013					0.0015				
LDM-4	0.0064			0.0004	0.0014			0.0082				0.0013					0.0015				
LDM-5412	0.0064			0.0004	0.0014			0.0082				0.0013					0.0015				
LDMS-1	0.0064			0.0004	0.0014			0.0082				0.0013					0.0014				
LRM-912	0.0004			0.0004	0.0015			0.0026				0.0014			0.0001		0.0015				
LRM-1	0.0004			0.0004	0.0015			0.0026				0.0014			0.0001		0.0015				
LRM-2	0.0004			0.0004	0.0015			0.0026				0.0014			0.0001		0.0015				
LRM-3	0.0004			0.0004	0.0015			0.0026				0.0014			0.0001		0.0015				
LRM-4	0.0004			0.0004	0.0015			0.0026				0.0014			0.0001		0.0015				
LRM-5412	0.0004			0.0004	0.0015			0.0026				0.0014			0.0001		0.0015				
LRMS-1	0.0004			0.0004	0.0015			0.0026				0.0014			0.0001		0.0015				
SSHTM-3	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
B1G9-0IIC4	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
B1G9-013C5	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
B1G9-014C	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
D1G4-022P2	0.0033			0.0004	0.0014			0.0028				0.0012			0.0000		0.0014				
D1G4-023P3	0.0033			0.0004	0.0014			0.0028				0.0012			0.0000		0.0014				
Duratek	0.0033			0.0004	0.0014			0.0028				0.0012			0.0000		0.0014				
PEI	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
M1G1-008P	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
M1G1-011P	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
V1M2 6 32 011 P1	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
V1M2 6 32 040 P2	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
V1M3 6 32 059 P1	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
V1M3 6 32 075 P2	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
V1M4 6 32 088 P1	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
V1M4 6 32 096 P2	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
Vectra	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				
WSTC	0.0035			0.0004	0.0015			0.0029				0.0013			0.0000		0.0015				

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01	0.0015			0.0013				0.0058				0.0001	0.0003		0.0049		0.0002			0.0007	
SBW1-02	0.0015			0.0013				0.0058				0.0001	0.0003		0.0066		0.0002			0.0007	
SBW1-03	0.0015			0.0013				0.0042				0.0001	0.0003		0.0049		0.0002			0.0007	
SBW1-04	0.0015			0.0013				0.0042				0.0001	0.0003		0.0066		0.0002			0.0007	

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
L8-7																0.0032					
L8-8																0.0032					
LD4-912																0.0022	0.0011				
LD5-912																0.0022	0.0011				
LD6-5314																0.0022	0.0011				
LD6-5412																0.0022	0.0011				
LD6-5510																0.0022	0.0011				
LDM-912																0.0021	0.0010				
LDM-1																0.0021	0.0010				
LDM-2																0.0021	0.0010				
LDM-3																0.0021	0.0010				
LDM-4																0.0021	0.0010				
LDM-5412																0.0021	0.0010				
LDMS-1																0.0021	0.0010				
LRM-912																0.0101	0.0011				
LRM-1																0.0101	0.0011				
LRM-2																0.0101	0.0011				
LRM-3																0.0101	0.0011				
LRM-4																0.0101	0.0011				
LRM-5412																0.0101	0.0011				
LRMS-1																0.0101	0.0011				
SSHTM-3																0.0022	0.0011				
B1G9-0IIC4																0.0022	0.0011				
B1G9-013C5																0.0022	0.0011				
B1G9-014C																0.0022	0.0011				
D1G4-022P2																0.0020	0.0010				0.0100
D1G4-023P3																0.0020	0.0010				0.0100
Duratek																0.0020	0.0010				0.0100
PEI																0.0021	0.0010				
M1G1-008P																0.0022	0.0011				
M1G1-011P																0.0022	0.0011				
V1M2 6 32 011 P1																0.0022	0.0011				
V1M2 6 32 040 P2																0.0022	0.0011				
V1M3 6 32 059 P1																0.0022	0.0011				
V1M3 6 32 075 P2																0.0022	0.0011				
V1M4 6 32 088 P1																0.0022	0.0011				
V1M4 6 32 096 P2																0.0022	0.0011				
Vectra																0.0022	0.0011				
WSTC																0.0022	0.0011				

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01									0.0000							0.0050					
SBW1-02									0.0000							0.0050					
SBW1-03									0.0000							0.0050					
SBW1-04									0.0000							0.0050					

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
L8-7										0.9999											
L8-8										1.0001											
LD4-912										1.0000											
LD5-912										1.0000											
LD6-5314										1.0000											
LD6-5412										1.0000	0.1217	0.0505	0.0412	0.0011		0.0166	0.0001		0.2041	0.0003	0.0022
LD6-5510										1.0000											
LDM-912										0.9999	0.1222		0.0960	0.0006		0.0167		0.0010	0.1992		0.0024
LDM-1										0.9999	0.1217	0.0201	0.0178	0.0621		0.0146			0.2105		0.0046
LDM-2										0.9999	0.1208		0.0624	0.0619		0.0179			0.2030		0.0028
LDM-3										0.9999	0.1244	0.0631	0.0012	0.0005		0.0230			0.1885	0.0005	0.0028
LDM-4										0.9999	0.1006	0.0625	0.0648	0.0614		0.0202			0.2036	0.0003	0.0027
LDM-5412										0.9999	0.1205	0.0501	0.0394	0.0006		0.0213		0.0015	0.2122		0.0062
LDMS-1										0.9998	0.1213	0.0203	0.0205	0.0607		0.0250	0.0001	0.0011	0.2083	0.0002	0.0028
LRM-912										1.0000	0.1179	0.0003	0.0941	0.0005		0.0070		0.0012	0.2042		0.0267
LRM-1										1.0000	0.1219	0.0202	0.0182	0.0624			0.0102		0.2123		0.0272
LRM-2										1.0000	0.1141		0.0613	0.0587				0.0011	0.2213		0.0252
LRM-3										1.0000	0.1262	0.0638	0.0019	0.0005		0.0044			0.1811		0.0282
LRM-4										1.0000	0.0977	0.0601	0.0619	0.0598		0.0146	0.0049	0.0011	0.2022	0.0002	0.0262
LRM-5412										1.0000	0.1186	0.0509	0.0423	0.0005		0.0092			0.2027	0.0003	0.0267
LRMS-1										1.0000	0.1191	0.0201	0.0220	0.0598		0.0176	0.0101	0.0011		0.0002	0.0257
SSHTM-3										1.0000	0.1163	0.0609	0.0414	0.0002		0.0104	0.0002		0.2255	0.0003	0.0031
B1G9-0IIC4										1.0000	0.1215	0.0141	0.0516	0.0044		0.0371		0.0025	0.1205	0.0004	
B1G9-013C5										1.0000	0.1294	0.0139	0.0514	0.0066		0.0315		0.0023	0.1250	0.0004	
B1G9-014C										1.0000	0.1260	0.0162	0.0522	0.0058		0.0284		0.0024	0.1337	0.0004	
D1G4-022P2										0.9994	0.0670	0.0736	0.0869	0.0777		0.0246		0.0061	0.1800	0.0006	0.0006
D1G4-023P3										0.9994	0.0641	0.0710	0.0857	0.0776		0.0302		0.0053	0.1824	0.0007	0.0004
Duratek										0.9994											
PEI										1.0002											
M1G1-008P										1.0000	0.1498	0.0181	0.0950	0.0106				0.0039	0.1321		
M1G1-011P										1.0000	0.1335	0.0253	0.0675	0.0116				0.0030	0.1524		
V1M2 6 32 011 P1										0.9999	0.1028	0.0701	0.0299	0.0104		0.0123		0.0214	0.1622	0.0004	
V1M2 6 32 040 P2										0.9999	0.1042	0.0718	0.0306	0.0102		0.0226		0.0221	0.1553	0.0004	
V1M3 6 32 059 P1										0.9999	0.1062	0.0729	0.0333	0.0104		0.0200		0.0221	0.1597	0.0004	
V1M3 6 32 075 P2										0.9999	0.1098	0.0761	0.0351	0.0114		0.0181	0.0001	0.0228	0.1267	0.0004	
V1M4 6 32 088 P1										0.9999	0.1059	0.0733	0.0335	0.0120		0.0202	0.0003	0.0213	0.1680	0.0004	
V1M4 6 32 096 P2										0.9999	0.1087	0.0752	0.0299	0.0099		0.0212		0.0215	0.1654	0.0003	
Vectra										0.9999	0.0945	0.0820	0.0290	0.0110		0.0091		0.0187	0.2082	0.0003	0.0040
WSTC										1.0004											

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01										1.0000	0.1007	0.0874	0.0220	0.0414		0.0268	0.0192		0.1712	0.0009	0.0111
SBW1-02										1.0000	0.0991	0.0863	0.0219	0.0597		0.0269	0.0285		0.1403	0.0009	0.0082
SBW1-03										1.0000	0.1041	0.0922	0.0228	0.0416		0.0278	0.0200		0.1441	0.0009	0.0085
SBW1-04										1.0000	0.0998	0.1058	0.0224	0.0413		0.0353	0.0289		0.1452	0.0009	0.0112

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
L8-7																					
L8-8																					
LD4-912																					
LD5-912																					
LD6-5314																					
LD6-5412	0.5544	0.0008												0.0005							
LD6-5510																					
LDM-912	0.5530									0.0006											
LDM-1	0.5006	0.0402								0.0005				0.0005							
LDM-2	0.5187	0.0001												0.0005							
LDM-3	0.5350	0.0527								0.0008				0.0005							
LDM-4	0.4370	0.0382												0.0005							
LDM-5412	0.5356													0.0005							
LDMS-1	0.4803	0.0405								0.0005				0.0003							
LRM-912	0.5319									0.0005				0.0004							
LRM-1	0.4742	0.0399												0.0004							
LRM-2	0.4820													0.0004							
LRM-3	0.5529	0.0507												0.0004							
LRM-4	0.4174	0.0382								0.0006				0.0004							
LRM-5412	0.5341									0.0005				0.0004							
LRMS-1	0.4717									0.0005				0.0003							
SSHTM-3	0.5281	0.0034												0.0016							
B1G9-0IIC4	0.6387	0.0008			0.0001									0.0005							
B1G9-013C5	0.6300	0.0006			0.0001									0.0005							
B1G9-014C	0.6256	0.0006			0.0001									0.0005							
D1G4-022P2	0.4247	0.0362			0.0004					0.0007				0.0021							
D1G4-023P3	0.4227	0.0382			0.0004					0.0004				0.0019							
Duratek																					
PEI																					
M1G1-008P	0.4782																				
M1G1-011P	0.5053																				
V1M2 6 32 011 P1	0.5809	0.0006												0.0031							
V1M2 6 32 040 P2	0.5735	0.0004								0.0001				0.0029							
V1M3 6 32 059 P1	0.5669	0.0005								0.0006				0.0027							
V1M3 6 32 075 P2	0.5908	0.0003			0.0001					0.0006				0.0029							
V1M4 6 32 088 P1	0.5563	0.0004			0.0001					0.0005				0.0031							
V1M4 6 32 096 P2	0.5597	0.0004												0.0030							
Vectra	0.5331	0.0002												0.0004							
WSTC																					

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01	0.4343	0.0118			0.0201			0.0024			0.0013			0.0011				0.0049			
SBW1-02	0.4429	0.0115			0.0203			0.0036			0.0015			0.0011				0.0052			
SBW1-03	0.5092	0.0080			0.0206			0.0024			0.0014			0.0011				0.0038			
SBW1-04	0.4363	0.0074			0.0205			0.0023			0.0012			0.0011				0.0038			

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
L8-7																					
L8-8																					
LD4-912																					
LD5-912																					
LD6-5314																					
LD6-5412				0.0001		0.0013		0.0006													
LD6-5510																					
LDM-912						0.0016															
LDM-1				0.0001		0.0015		0.0005													
LDM-2						0.0015		0.0006													
LDM-3						0.0016		0.0007													
LDM-4				0.0001		0.0015		0.0008													
LDM-5412						0.0016		0.0006													
LDMS-1				0.0001		0.0013		0.0008													
LRM-912				0.0001		0.0016		0.0009													
LRM-1				0.0002		0.0015															
LRM-2				0.0002		0.0016		0.0003													
LRM-3				0.0001		0.0017		0.0004													
LRM-4				0.0002		0.0015		0.0009													
LRM-5412				0.0001		0.0016		0.0008													
LRMS-1				0.0001		0.0015		0.0010													
SSHTM-3				0.0001		0.0014		0.0002													
B1G9-0IIC4				0.0002		0.0006		0.0008													
B1G9-013C5				0.0002		0.0006		0.0011													
B1G9-014C				0.0002		0.0007		0.0013													
D1G4-022P2				0.0002		0.0015		0.0005													
D1G4-023P3				0.0002		0.0015		0.0003													
Duratek																					
PEI																					
M1G1-008P						0.0007															
M1G1-011P						0.0009															
V1M2 6 32 011 P1				0.0001		0.0022		0.0002													
V1M2 6 32 040 P2				0.0001		0.0019		0.0004													
V1M3 6 32 059 P1				0.0001		0.0016		0.0010													
V1M3 6 32 075 P2				0.0002		0.0016		0.0009													
V1M4 6 32 088 P1				0.0003		0.0013		0.0009													
V1M4 6 32 096 P2				0.0001		0.0013		0.0006													
Vectra						0.0015		0.0003													
WSTC																					

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01				0.0035																	
SBW1-02				0.0047																	
SBW1-03				0.0035																	
SBW1-04				0.0047																	

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
L8-7																				
L8-8																				
LD4-912																				
LD5-912																				
LD6-5314																				
LD6-5412					0.0018	0.0009				0.0002								0.0014		0.9998
LD6-5510																				
LDM-912					0.0026	0.0012														0.9971
LDM-1					0.0022	0.0010				0.0001								0.0011		0.9997
LDM-2					0.0023	0.0011												0.0006		0.9942
LDM-3					0.0021	0.0012				0.0001								0.0008		0.9995
LDM-4					0.0026	0.0012												0.0014		0.9994
LDM-5412					0.0069	0.0011				0.0001								0.0016		0.9998
LDMS-1					0.0026	0.0009				0.0002								0.0006		0.9884
LRM-912					0.0101	0.0013												0.0010		0.9997
LRM-1					0.0076	0.0012				0.0002								0.0021		0.9997
LRM-2					0.0074	0.0012				0.0001								0.0018		0.9767
LRM-3					0.0059	0.0013				0.0001								0.0024		1.0220
LRM-4					0.0093	0.0012				0.0001								0.0009		0.9994
LRM-5412					0.0087	0.0013												0.0011		0.9998
LRMS-1					0.0101	0.0011				0.0002								0.0006		0.7628
SSHTM-3					0.0029	0.0007				0.0007								0.0026		1.0000
B1G9-0IIC4						0.0010				0.0019								0.0014		0.9981
B1G9-013C5						0.0010				0.0017								0.0012		0.9975
B1G9-014C						0.0010				0.0017								0.0019		0.9987
D1G4-022P2					0.0021	0.0010				0.0089								0.0021		0.9975
D1G4-023P3					0.0021	0.0010				0.0091								0.0027		0.9979
Duratek																				
PEI																				
M1G1-008P										0.0068										0.8952
M1G1-011P										0.0035										0.9030
V1M2 6 32 011 P1						0.0006				0.0001								0.0008		0.9981
V1M2 6 32 040 P2						0.0006				0.0001								0.0006		0.9978
V1M3 6 32 059 P1						0.0008				0.0001								0.0007		1.0000
V1M3 6 32 075 P2						0.0008				0.0002								0.0008		0.9997
V1M4 6 32 088 P1						0.0009				0.0002								0.0008		0.9997
V1M4 6 32 096 P2						0.0008				0.0001										0.9981
Vectra					0.0022	0.0011												0.0028		0.9984
WSTC																				

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01					0.0056															0.9656
SBW1-02					0.0066															0.9693
SBW1-03					0.0055															1.0174
SBW1-04					0.0054															0.9735

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
L8-7								
L8-8								
LD4-912								
LD5-912								
LD6-5314								
LD6-5412								
LD6-5510								
LDM-912								
LDM-1								
LDM-2								
LDM-3								
LDM-4								
LDM-5412								
LDMS-1								
LRM-912								
LRM-1								
LRM-2								
LRM-3								
LRM-4								
LRM-5412								
LRMS-1								
SSHTM-3								
B1G9-0IIC4								
B1G9-013C5								
B1G9-014C								
D1G4-022P2								
D1G4-023P3								
Duratek								
PEI								
M1G1-008P								
M1G1-011P								
V1M2 6 32 011 P1								
V1M2 6 32 040 P2								
V1M3 6 32 059 P1								
V1M3 6 32 075 P2								
V1M4 6 32 088 P1								
V1M4 6 32 096 P2								
Vectra								
WSTC								

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01	1150		793	Ca5(PO4)3F	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-02	1150		783	Ca5(PO4)3F	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-03	1150		848	(Na,K)(Si3Al)O8	Clear dark brown glass with black specks and air bubbles, avg. viscosity		Amorphous	Single-phase
SBW1-04	1150		783	Ca5(PO4)3F	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
L8-7					
L8-8					
LD4-912					
LD5-912					
LD6-5314					
LD6-5412					
LD6-5510					
LDM-912					
LDM-1					
LDM-2					
LDM-3					
LDM-4					
LDM-5412					
LDMS-1					
LRM-912					
LRM-1					
LRM-2					
LRM-3					
LRM-4					
LRM-5412					
LRMS-1					
SSHTM-3					
B1G9-0IIC4					
B1G9-013C5					
B1G9-014C					
D1G4-022P2					
D1G4-023P3					
Duratek					
PEI					
M1G1-008P					
M1G1-011P					
V1M2 6 32 011 P1					
V1M2 6 32 040 P2					
V1M3 6 32 059 P1					
V1M3 6 32 075 P2					
V1M4 6 32 088 P1					
V1M4 6 32 096 P2					
Vectra					
WSTC					

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01	Clear dark brown glass, with few air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-02	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-03	Clear dark reddish brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-04	Clear dark brown glass, few air bubbles and black specks (expected to be Ru).		Amorphous		

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
L8-7							-10.390	20691.6	63.49				1141	76.3	1191
L8-8							-9.780	20032.8	73.54				1190	54.5	1239
LD4-912							-10.096	19838.1	46.76				1045	153.4	1144
LD5-912							-11.888	23324.3	90.28				1095	179.9	1145
LD6-5314							-10.564	21253.2	79.16				1070	198.3	1119
LD6-5412							-10.879	21013.7	48.82				1046	161	1145
LD6-5510							-11.161	21110.3	39.41				997	244.2	1096
LDM-912							-10.759	21165.8	61.26				1138	76.8	1186
LDM-1							-11.786	23083.2	84.40				1092	179.3	1142
LDM-2							-11.119	21720.8	63.12				1091	133.5	1141
LDM-3							-11.395	22585.1	87.92				1138	111.1	1187
LDM-4							-12.435	21132.1	11.19				941	158.7	992
LDM-5412							-8.601	17292.2	34.85				(1088)	(78.7)	1138
LDMS-1							-11.648	22995.7	91.10				1143	108.1	1193
LRM-912							-10.848	21757.9	84.96				1187	59.9	1237
LRM-1							-11.491	22167.2	59.55				1142	67.3	1192
LRM-2							-10.836	21715.1	83.43				1191	54.9	1241
LRM-3							-11.854	23833.9	133.62				1187	90.3	1237
LRM-4							-13.327	22476.2	11.80				940	203.9	990
LRM-5412							-8.839	18144.8	50.00				1188	40.8	1237
LRMS-1							-11.130	21635.2	58.79				1142	67.3	1192
SSHTM-3							-12.900	24419.0	70.83				1195	46.9	1245
B1G9-0IIC4															
B1G9-013C5															
B1G9-014C															
D1G4-022P2															
D1G4-023P3															
Duratek							-12.584	20386.2	5.71				941	76.5	992
PEI							-11.457	22008.1	55.09				1090	116.8	1140
M1G1-008P															
M1G1-011P															
V1M2 6 32 011 P1															
V1M2 6 32 040 P2															
V1M3 6 32 059 P1															
V1M3 6 32 075 P2															
V1M4 6 32 088 P1															
V1M4 6 32 096 P2															
Vectra							-9.500	17677.5	18.59				1090	33.4	1144
WSTC							-9.980	18288.5	17.67				1040	54.7	1090

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01		2.6045					-9.866	16504.0	5.65	1290		1083	1155.4	5.2593	1079.5
SBW1-02		2.6102					-10.105	16909.0	5.92	1293		1090	1157.1	5.5161	1081.3
SBW1-03		2.5754					-9.996	17892.0	13.16	1401		1182	1155.8	12.149	1080
SBW1-04		2.5891					-9.904	16145.0	4.23	1250		1050	1157	3.9018	1081.6

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
L8-7	45.3	1240	24.1	1290	15.7	1290	15.9	1340	10.6	1340	11.2	1341	12.4	1390	7.9	1442	6				
L8-8	33.1	1289	19.6	1339	13.3	1339	13.4	1388	9.3	1389	9	1390	10.2	1439	7.1	1489	5.4				
LD4-912	48.5	1243	19.4	1342	7.4	1343	9.2	1392	5.8	1442	4.4	1492	3.7								
LD5-912	94.6	1244	32.2	1343	12.3	1343	12.6	1393	8.2	1443	5.8										
LD6-5314	109.4	1220	39.6	1318	14.4	1319	16.9	1368	10.6	1418	8.1										
LD6-5412	49.7	1244	19.1	1342	8.7																
LD6-5510	69.4	1195	23.7	1294	9.6	1294	10.3	1344	7.1												
LDM-912	40.9	1236	24.8	1236	25.9	1285	15.6	1285	16.5	1286	17.1	1336	11.2	1385	7.6	1436	5.3				
LDM-1	96.1	1191	50.8	1241	29.8	1241	31.1	1290	17.9	1290	19.3	1292	19.8	1343	13	1392	8.6				
LDM-2	72.7	1190	38.6	1239	24.7	1240	23.7	1289	15.7	1290	14.9	1290	16.1	1340	10.8	1392	7.8				
LDM-3	62.8	1236	31.8	1286	20	1286	20.8	1336	12.5	1336	13.9	1336	15	1386	9.7	1436	6.9				
LDM-4	72.6	1041	35.9	1090	20.1	1091	20.1	1140	12.2	1141	11.9	1141	12.4	1190	7.5	1240	5.2				
LDM-5412	40	1187	24.9	1187	25.9	1236	15.8	1237	17	1237	18.8	1286	12	1336	8.6	1386	6.3				
LDMS-1	60.3	1243	30.1	1292	19.9	1293	18.8	1342	12.2	1342	13.4	1344	14.4	1393	8.8	1444	6.3				
LRM-912	35.3	1286	21.8	1336	14	1336	14.2	1386	9.6	1386	9.7	1386	9.7	1436	6.6	1487	4.7				
LRM-1	38.3	1242	22.6	1291	14.2	1292	14	1341	9.2	1341	9.5	1342	9.5	1392	6.3	1442	4.3				
LRM-2	33	1291	20.9	1291	21	1340	13.7	1340	13.9	1342	13.6	1392	9.4	1441	6.2	1492	4.3				
LRM-3	51.9	1286	31.3	1336	17.9	1386	11.7	1386	12.2	1435	7.6	1436	8.2	1436	8.5	1485	6				
LRM-4	89.4	1040	41.9	1089	22.4	1090	21.3	1139	12.7	1140	12.8	1140	13.1	1189	7.9	1240	5.4				
LRM-5412	23.6	1286	15.8	1287	15.3	1336	10.3	1336	11.1	1337	11.9	1386	8	1437	5.9	1488	4.8				
LRMS-1	38.5	1243	22.5	1292	14.1	1293	14	1341	9.4	1342	9.6	1343	9.8	1392	6.6	1443	4.6				
SSHTM-3	22.4	1294	14.2	1295	13.7	1344	8.6	1345	9.1	1345	9	1395	5.8	1446	3.9						
B1G9-0IIC4																					
B1G9-013C5																					
B1G9-014C																					
D1G4-022P2																					
D1G4-023P3																					
Duratek	35	1041	17.3	1091	9.8	1091	9.9	1140	6	1141	5.9	1141	6.2	1190	3.9	1241	2.9				
PEI	64.7	1188	35	1238	21.3	1238	21.4	1287	13.6	1287	13.7	1288	13.9	1337	9.1	1387	6.3	1438	4.4		
M1G1-008P																					
M1G1-011P																					
V1M2 6 32 011 P1																					
V1M2 6 32 040 P2																					
V1M3 6 32 059 P1																					
V1M3 6 32 075 P2																					
V1M4 6 32 088 P1																					
V1M4 6 32 096 P2																					
Vectra	20.6	1190	12.6	1240	8.4	1240	8.4	1289	5.9	1290	6	1291	6.4	1344	4.4	1390	3.2				
WSTC	30.8	1090	31.3	1139	18.6	1139	18.8	1140	20.1	1188	12.1	1237	8.2	1238	8.6	1287	5.8	1337	4.1		

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01	9.9147	1004.2	20.96	954.51	37.227	1252.6	2.6951	1153.2	5.528												
SBW1-02	10.474	1006.4	22.059	956.85	39.293	1255	2.6643	1155.9	5.6532												
SBW1-03	24.098	1004.6	54.205	954.81	101.35	1253.7	5.8842	1153.9	12.574												
SBW1-04	7.1934	1006.8	14.83	957.17	25.998	1255.3	2.012	1156.1	4.0156												

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
L8-7					0.185		0.35	0.14	10.985							
L8-8					1.435		1.285	0.4	11.285							
LD4-912					0.3515		0.3155	0.127	10.545							
LD5-912							1.2285	0.224	12.03							
LD6-5314					0.0985		0.2565	0.09	11.05							
LD6-5412					0.112		0.376	0.1045	11.385							
LD6-5510					0.1323333		0.5176667	0.1196667	11.475							
LDM-912							1.197	0.2185	11.815							
LDM-1					0.1725		0.365	0.131	11.12							
LDM-2							0.8445	0.1425	10.665							
LDM-3					0.1655		0.2875	0.111	10.665							
LDM-4					0.2815		0.463	0.129	10.945							
LDM-5412					0.126		0.4045	0.109	10.945							
LDMS-1					0.154		0.3055	0.1255	10.905							
LRM-912							1.0295	0.1845	11.73							
LRM-1					0.2045	0.105	0.462	0.154	11.225							
LRM-2							0.7615	0.185	11.495							
LRM-3					0.1635		0.3585	0.118	10.855							
LRM-4					0.2865	0.134	0.47	0.1485	11.19							
LRM-5412					0.1535		0.3905	0.1335	10.975							
LRMS-1					0.205	0.096	0.4445	0.159	11.23							
SSHTM-3					0.1735		0.4385	0.1185	11.325							
B1G9-0IIC4					0.049		0.125	0.05	10.365							
B1G9-013C5					0.0645		0.1575	0.0515	10.62							
B1G9-014C					0.045		0.124	0.049	10.445							
D1G4-022P2					0.538		0.62	0.1675	11.455							
D1G4-023P3					0.501		0.608	0.1665	11.455							
Duratek																
PEI							1.696	0.2575	12.14							
M1G1-008P					0.08		0.22	0.06	10.535							
M1G1-011P					0.1		0.32	0.08	11.06							
V1M2 6 32 011 P1					0.1335		0.213	0.094	10.295							
V1M2 6 32 040 P2					0.129		0.1895	0.087	10.215							
V1M3 6 32 059 P1					0.1465		0.223	0.096	10.34							
V1M3 6 32 075 P2					0.13		0.262	0.0875	10.315							
V1M4 6 32 088 P1					0.1415		0.2115	0.0935	10.375							
V1M4 6 32 096 P2					0.148		0.2185	0.096	10.37							
Vectra					0.4605		0.5485	0.1845	11.115							
WSTC					0.1513333	0.0793333	0.244	0.0846667	10.815							

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01					0.630	0.409	0.591	0.165	11.01							
SBW1-02					0.361	0.353	0.528	0.154	10.51							
SBW1-03					0.247	0.262	0.307	0.122	10.24							
SBW1-04					1.139	0.938	1.007	0.199	11.23							

Hanford LLW Glass Formulation (Feng et al. 1996)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
L8-7												
L8-8												
LD4-912												
LD5-912												
LD6-5314												
LD6-5412												
LD6-5510												
LDM-912												
LDM-1												
LDM-2												
LDM-3												
LDM-4												
LDM-5412												
LDMS-1												
LRM-912												
LRM-1												
LRM-2												
LRM-3												
LRM-4												
LRM-5412												
LRMS-1												
SSHTM-3												
B1G9-0IIC4												
B1G9-013C5												
B1G9-014C												
D1G4-022P2												
D1G4-023P3												
Duratek												
PEI												
M1G1-008P												
M1G1-011P												
V1M2 6 32 011 P1												
V1M2 6 32 040 P2												
V1M3 6 32 059 P1												
V1M3 6 32 075 P2												
V1M4 6 32 088 P1												
V1M4 6 32 096 P2												
Vectra												
WSTC												

SBW CVS Phase 1 (Scholes et al. 2002)

SBW1-01												
SBW1-02												
SBW1-03												
SBW1-04												

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
SBW1-05	0.1270	0.0900	0.0218	0.0412		0.0278	0.0300	0.0000	0.1408	0.0008	0.0084	0.4548	0.0080			0.0258			0.0020		
SBW1-06	0.1171	0.0900	0.0218	0.0608		0.0362	0.0200	0.0000	0.1408	0.0008	0.0084	0.4548	0.0080			0.0200			0.0030		
SBW1-07	0.0980	0.0900	0.0218	0.0608		0.0362	0.0200	0.0000	0.1432	0.0008	0.0122	0.4548	0.0120			0.0282			0.0020		
SBW1-08	0.1270	0.0904	0.0300	0.0412		0.0278	0.0200	0.0000	0.1408	0.0008	0.0122	0.4548	0.0120			0.0200			0.0030		
SBW1-09	0.0980	0.1100	0.0218	0.0412		0.0278	0.0300	0.0000	0.1408	0.0008	0.0122	0.4559	0.0120			0.0282			0.0030		
SBW1-10	0.0980	0.0900	0.0300	0.0412		0.0362	0.0300	0.0000	0.1583	0.0008	0.0084	0.4548	0.0120			0.0200			0.0020		
SBW1-11	0.1029	0.1100	0.0218	0.0412		0.0362	0.0200	0.0000	0.1408	0.0008	0.0084	0.4548	0.0120			0.0282			0.0030		
SBW1-12	0.0980	0.0900	0.0300	0.0412		0.0362	0.0200	0.0000	0.1408	0.0008	0.0122	0.4782	0.0080			0.0200			0.0030		
SBW1-13	0.0980	0.0900	0.0218	0.0608		0.0278	0.0300	0.0000	0.1447	0.0008	0.0122	0.4548	0.0080			0.0282			0.0030		
SBW1-14	0.0980	0.0908	0.0218	0.0412		0.0278	0.0200	0.0000	0.1772	0.0008	0.0084	0.4548	0.0080			0.0282			0.0030		
SBW1-15	0.0980	0.1100	0.0300	0.0595		0.0278	0.0200	0.0000	0.1408	0.0008	0.0084	0.4548	0.0080			0.0200			0.0020		
SBW1-16	0.0690	0.1300	0.0124	0.0216		0.0194	0.0400	0.0000	0.1044	0.0008	0.0045	0.5550	0.0040			0.0100			0.0040		
SBW1-17	0.0690	0.0700	0.0400	0.0804		0.0194	0.0400	0.0000	0.1044	0.0008	0.0161	0.5299	0.0040			0.0100			0.0010		
SBW1-18	0.1560	0.0700	0.0400	0.0804		0.0446	0.0400	0.0000	0.1044	0.0008	0.0045	0.4215	0.0040			0.0100			0.0040		
SBW1-19	0.0690	0.0700	0.0124	0.0216		0.0446	0.0100	0.0000	0.1954	0.0008	0.0161	0.5253	0.0040			0.0100			0.0010		
SBW1-20	0.0690	0.0700	0.0400	0.0804		0.0194	0.0170	0.0000	0.2136	0.0008	0.0045	0.4304	0.0160			0.0100			0.0040		
SBW1-21	0.1560	0.0700	0.0124	0.0804		0.0194	0.0400	0.0000	0.1276	0.0008	0.0161	0.4254	0.0160			0.0100			0.0010		
SBW1-22	0.1560	0.0700	0.0124	0.0216		0.0446	0.0400	0.0000	0.1484	0.0008	0.0045	0.4567	0.0160			0.0100			0.0040		
SBW1-23	0.1110	0.0700	0.0124	0.0216		0.0194	0.0400	0.0000	0.1906	0.0008	0.0161	0.4524	0.0040			0.0376			0.0040		

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
SBW1-05	0.0015			0.0013				0.0058				0.0001	0.0003		0.0066		0.0002			0.0007	
SBW1-06	0.0015			0.0013				0.0042				0.0001	0.0003		0.0049		0.0002			0.0007	
SBW1-07	0.0015			0.0013				0.0042				0.0001	0.0003		0.0066		0.0002			0.0007	
SBW1-08	0.0015			0.0013				0.0042				0.0001	0.0003		0.0066		0.0002			0.0007	
SBW1-09	0.0015			0.0013				0.0042				0.0001	0.0003		0.0049		0.0002			0.0007	
SBW1-10	0.0015			0.0013				0.0042				0.0001	0.0003		0.0049		0.0002			0.0007	
SBW1-11	0.0015			0.0013				0.0058				0.0001	0.0003		0.0049		0.0002			0.0007	
SBW1-12	0.0015			0.0013				0.0058				0.0001	0.0003		0.0066		0.0002			0.0007	
SBW1-13	0.0015			0.0013				0.0058				0.0001	0.0003		0.0049		0.0002			0.0007	
SBW1-14	0.0015			0.0013				0.0042				0.0001	0.0003		0.0066		0.0002			0.0007	
SBW1-15	0.0015			0.0013				0.0058				0.0001	0.0003		0.0049		0.0002			0.0007	
SBW1-16	0.0015			0.0013				0.0074				0.0001	0.0003		0.0083		0.0002			0.0007	
SBW1-17	0.0015			0.0013				0.0026				0.0001	0.0003		0.0032		0.0002			0.0007	
SBW1-18	0.0015			0.0013				0.0074				0.0001	0.0003		0.0032		0.0002			0.0007	
SBW1-19	0.0015			0.0013				0.0074				0.0001	0.0003		0.0032		0.0002			0.0007	
SBW1-20	0.0015			0.0013				0.0074				0.0001	0.0003		0.0083		0.0002			0.0007	
SBW1-21	0.0015			0.0013				0.0074				0.0001	0.0003		0.0083		0.0002			0.0007	
SBW1-22	0.0015			0.0013				0.0026				0.0001	0.0003		0.0032		0.0002			0.0007	
SBW1-23	0.0015			0.0013				0.0026				0.0001	0.0003		0.0083		0.0002			0.0007	

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
SBW1-05									0.0000							0.0050					
SBW1-06									0.0000							0.0050					
SBW1-07									0.0000							0.0050					
SBW1-08									0.0000							0.0050					
SBW1-09									0.0000							0.0050					
SBW1-10									0.0000							0.0050					
SBW1-11									0.0000							0.0050					
SBW1-12									0.0000							0.0050					
SBW1-13									0.0000							0.0050					
SBW1-14									0.0000							0.0050					
SBW1-15									0.0000							0.0050					
SBW1-16									0.0000							0.0050					
SBW1-17									0.0000							0.0050					
SBW1-18									0.0000							0.0050					
SBW1-19									0.0000							0.0050					
SBW1-20									0.0000							0.0050					
SBW1-21									0.0000							0.0050					
SBW1-22									0.0000							0.0050					
SBW1-23									0.0000							0.0050					

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
SBW1-05										1.0000	0.1293	0.0868	0.0226	0.0420		0.0277	0.0289		0.1421	0.0009	0.0071
SBW1-06										1.0000	0.1181	0.0895	0.0220	0.0617		0.0357	0.0193		0.1409	0.0009	0.0079
SBW1-07										1.0000	0.0976	0.0906	0.0219	0.0602		0.0353	0.0194		0.1449	0.0009	0.0108
SBW1-08										1.0000	0.1299	0.0873	0.0306	0.0415		0.0273	0.0190		0.1439	0.0011	0.0103
SBW1-09										1.0000	0.1013	0.1092	0.0222	0.0418		0.0281	0.0295		0.1432	0.0009	0.0112
SBW1-10										1.0000	0.0991	0.0878	0.0297	0.0411		0.0349	0.0287		0.1555	0.0009	0.0081
SBW1-11										1.0000	0.1093	0.1120	0.0230	0.0426		0.0366	0.0202		0.1440	0.0009	0.0082
SBW1-12										1.0000	0.0993	0.0901	0.0300	0.0415		0.0351	0.0196		0.1400	0.0009	0.0099
SBW1-13										1.0000	0.1018	0.0905	0.0222	0.0611		0.0273	0.0293		0.1467	0.0009	0.0108
SBW1-14										1.0000	0.1004	0.0887	0.0222	0.0422		0.0272	0.0194		0.1760	0.0009	0.0081
SBW1-15										1.0000	0.0986	0.1087	0.0300	0.0591		0.0266	0.0194		0.1383	0.0009	0.0082
SBW1-16										1.0000	0.0719	0.1262	0.0128	0.0218		0.0191	0.0387		0.1052	0.0009	0.0046
SBW1-17										1.0000	0.0725	0.0688	0.0407	0.0796		0.0191	0.0392		0.1060	0.0009	0.0163
SBW1-18										1.0000	0.1602	0.0712	0.0396	0.0792		0.0437	0.0391		0.1055	0.0008	0.0044
SBW1-19										1.0000	0.0703	0.0695	0.0124	0.0219		0.0435	0.0096		0.1927	0.0008	0.0146
SBW1-20										1.0000	0.0727	0.0696	0.0402	0.0795		0.0191	0.0166		0.2186	0.0010	0.0048
SBW1-21										1.0000	0.1579	0.0691	0.0129	0.0793		0.0188	0.0386		0.1259	0.0011	0.0143
SBW1-22										1.0000	0.1593	0.0682	0.0130	0.0219		0.0433	0.0376		0.1491	0.0009	0.0048
SBW1-23										1.0000	0.1139	0.0717	0.0128	0.0221		0.0193	0.0396		0.1923	0.0009	0.0151

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
SBW1-05	0.4427	0.0082			0.0268			0.0024			0.0013			0.0011				0.0048			
SBW1-06	0.4515	0.0073			0.0206			0.0035			0.0012			0.0011				0.0038			
SBW1-07	0.4867	0.0112			0.0285			0.0023			0.0014			0.0011				0.0036			
SBW1-08	0.4340	0.0112			0.0203			0.0036			0.0014			0.0011				0.0036			
SBW1-09	0.4512	0.0112			0.0286			0.0035			0.0014			0.0011				0.0037			
SBW1-10	0.4396	0.0116			0.0199			0.0023			0.0012			0.0011				0.0037			
SBW1-11	0.4621	0.0116			0.0293			0.0035			0.0013			0.0011				0.0051			
SBW1-12	0.4672	0.0082			0.0202			0.0035			0.0007			0.0011				0.0065			
SBW1-13	0.4479	0.0061			0.0287			0.0036			0.0013			0.0011				0.0050			
SBW1-14	0.4406	0.0072			0.0293			0.0036			0.0012			0.0011				0.0038			
SBW1-15	0.4444	0.0082			0.0200			0.0024			0.0013			0.0011				0.0048			
SBW1-16	0.5334	0.0041			0.0104			0.0047			0.0015			0.0011				0.0062			
SBW1-17	0.5132	0.0038			0.0104			0.0012			0.0014			0.0011				0.0029			
SBW1-18	0.4206	0.0038			0.0104			0.0046			0.0012			0.0011				0.0063			
SBW1-19	0.5199	0.0037			0.0102			0.0012			0.0012			0.0010				0.0064			
SBW1-20	0.4305	0.0166			0.0102			0.0047			0.0012			0.0011				0.0062			
SBW1-21	0.4137	0.0156			0.0105			0.0013			0.0011			0.0011				0.0061			
SBW1-22	0.4305	0.0163			0.0102			0.0048			0.0011			0.0011				0.0025			
SBW1-23	0.4576	0.0039			0.0387			0.0047			0.0013			0.0010				0.0026			

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
SBW1-05				0.0047																	
SBW1-06				0.0035																	
SBW1-07				0.0046																	
SBW1-08				0.0047																	
SBW1-09				0.0035																	
SBW1-10				0.0035																	
SBW1-11				0.0036																	
SBW1-12				0.0048																	
SBW1-13				0.0036																	
SBW1-14				0.0047																	
SBW1-15				0.0035																	
SBW1-16				0.0059																	
SBW1-17				0.0023																	
SBW1-18				0.0022																	
SBW1-19				0.0023																	
SBW1-20				0.0061																	
SBW1-21				0.0059																	
SBW1-22				0.0023																	
SBW1-23				0.0061																	

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
SBW1-05					0.0055															0.9849
SBW1-06					0.0054															0.9939
SBW1-07					0.0054															1.0261
SBW1-08					0.0051															0.9759
SBW1-09					0.0056															0.9971
SBW1-10					0.0056															0.9744
SBW1-11					0.0054															1.0198
SBW1-12					0.0049															0.9833
SBW1-13					0.0055															0.9935
SBW1-14					0.0056															0.9823
SBW1-15					0.0055															0.9809
SBW1-16					0.0053															0.9740
SBW1-17					0.0057															0.9851
SBW1-18					0.0053															0.9992
SBW1-19					0.0054															0.9865
SBW1-20					0.0057															1.0044
SBW1-21					0.0053															0.9785
SBW1-22					0.0054															0.9724
SBW1-23					0.0055															1.0091

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
SBW1-05	1150		808	Na6(AlSiO4)6	Clear dark reddish brown glass with a few black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-06	1150		848	Ca5(PO4)3F	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-07	1150		828	Ca5(PO4)3F	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-08	1150		908	Ca5(PO4)3F	Clear very dark brown glass with a few black specks and lots of air bubbles, avg. viscosity		Amorphous	Single-phase
SBW1-09	1150		793	Ca5(PO4)3F	Clear dark brown glass with a few black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-10	1150		743	Na6(AlSiO4)6	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-11	1150		828	K(Si3Al)O8	Clear dark brown glass with a few black specks and lots of air bubbles, low viscosity		Amorphous	Single-phase
SBW1-12	1150		878	Ca5(PO4)3F	Clear dark brown glass with a few black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-13	1150		783	Ca5(PO4)3F	Clear dark brown glass with a few black specks and lots of air bubbles, low viscosity		Amorphous	Single-phase
SBW1-14	1150		773	Na6(AlSiO4)6	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-15	1150		866	Ca5(PO4)3F	Clear dark brown glass with black specks and a few air bubbles, low viscosity		Amorphous	Single-phase
SBW1-16	1150		783	NaAlSi3O8	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-17	1150		931	Ca5(PO4)3F	Clear brown glass with black specks and air bubbles, avg. viscosity		Amorphous	Single-phase
SBW1-18	1150		948	NaAlSiO4	Clear reddish brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-19	1150		801	Na3PO4	Clear brown glass with few black specks and lots of air bubbles, low viscosity		Amorphous	Single-phase
SBW1-20	1150		801	Na6(AlSiO4)6	Clear dark reddish brown glass with a few black specks and very few air bubbles, low viscosity		Amorphous	Single-phase
SBW1-21	1150		938	Fe2O3	Clear dark brown glass with a few black specks and lots of air bubbles, avg. viscosity		Amorphous	Single-phase
SBW1-22	1150		908	NaAlSiO4	Clear brown glass with a few black specks and lots of air bubbles, avg. viscosity		Amorphous	Single-phase
SBW1-23	1150		828	Na6(AlSiO4)6	Clear dark reddish brown glass with a few black specks and a few air bubbles, low viscosity		Amorphous	Single-phase

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
SBW1-05	Clear very dark brown glass, with air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-06	Clear brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-07	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-08	Clear dark brown glass with clear needles around outside edges, some sheet-type crystals on top surface, some dark cubic clusters, and other clear crystal clusters around the blacl specks (expected to be Ru).		Fe2O3, LiOH, NaHF2, and Na2Ca(SiO4) (0.19 vol% crystallinity)		
SBW1-09	Clear dark brown glass, with few air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-10	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-11	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		NaMn3F7 and ZrO2 (0.00 vol% crystallinity)		
SBW1-12	Clear dark brown glass with some sheet-type crystals on top surface, air bubbles and black specks (expected to be Ru).		NaMn3F7 (0.05 vol% crystallinity)		
SBW1-13	Clear brown glass, with few air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-14	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Ca5Si6O16(OH)2 (0.03 vol% crystallinity)		
SBW1-15	Clear brown glass with one surface crystal and some dark crystal clusters, air bubbles and black specks (expected to be Ru).		Ca5Si6O16(OH)2 (0.11 vol% crystallinity)		
SBW1-16	Clear dark purplish glass, few air bubbles and a few black specks (expected to be Ru).		Amorphous		
SBW1-17	Clear greenish brown glass with clusters of thin rod-type crystals forming on top and along the crucible walls, air bubbles and black specks (expected to be Ru).		Ca5(PO4)3F (0.20 vol% crystallinity)		
SBW1-18	Clear brown glass, few air bubbles and clusters of crystals around each black speck (expected to be Ru).		Amorphous		
SBW1-19	Clear dark purplish glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-20	Clear dark reddish brown glass, a few black specks (expected to be Ru) but no air bubbles.		Amorphous		
SBW1-21	Clear dark brown glass, with clusters of fuzzy sphere crystals throughout.		LiAlO2 (0.15 vol% crystallinity)		
SBW1-22	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-23	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
SBW1-05		2.5925					-9.649	16730.0	8.23	1344		1127	1155.7	7.5633	1079.9
SBW1-06		2.5997					-9.904	17477.0	10.78	1376		1159	1155.8	10.009	1080.3
SBW1-07		2.6258					-10.333	17591.0	7.61	1322		1119	1160.2	6.961	1083.1
SBW1-08		2.5841					-10.365	18249.0	11.70	1377		1167	1156.5	10.768	1081.1
SBW1-09		2.6066					-9.967	16451.0	4.92	1270		1068	1153.7	4.661	1079.3
SBW1-10		2.6066					-9.985	16250.0	4.20	1249		1049	1156.6	3.9068	1080.9
SBW1-11		2.6016					-10.200	17229.0	6.74	1308		1105	1156.7	6.1792	1081.1
SBW1-12		2.5945					-10.243	17669.0	8.79	1343		1135	1159.8	7.8889	1082.8
SBW1-13		2.6261					-9.824	16351.0	5.29	1282		1075	1154.1	5.0109	1078.8
SBW1-14		2.6178					-9.899	16323.0	4.82	1268		1065	1155.1	4.5201	1079.7
SBW1-15		2.6103					-10.262	17277.0	6.55	1304		1102	1156	6.0766	1079.7
SBW1-16		2.5127					-10.055	17309.0	8.24	1337		1128	1155.3	7.488	1079.6
SBW1-17		2.5929					-10.418	18108.0	10.05	1357		1150	1156.2	9.6228	1080.5
SBW1-18		2.6045					-10.585	18071.0	8.28	1329		1129	1155.1	7.9986	1079.6
SBW1-19		2.5464					-9.707	16981.0	9.26	1360		1141	1155.8	8.4691	1079.9
SBW1-20		2.6735					-10.229	15879.0	2.53	1181		994	1156.2	2.3822	1080.4
SBW1-21		2.5936					-10.728	18683.0	11.04	1363		1161	1153.6	10.838	1078.3
SBW1-22		2.5479					-9.799	17272.0	10.37	1373		1154	1156.5	9.64	1080.6
SBW1-23		2.6065					-9.222	15119.0	4.06	1252		1039	1155.3	3.8327	1080

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
SBW1-05	14.474	1004.6	30.953	954.96	55.569	1252.9	3.9229	1153.6	7.9369												
SBW1-06	19.455	1005.3	42.664	955.53	78.332	1253.6	4.9056	1154.2	10.225												
SBW1-07	13.227	1007.4	29.087	960.75	53.407	1254.6	3.3452	1158.4	7.1193												
SBW1-08	21.495	1006.3	48.807	956.58	91.116	1255.2	5.0299	1155.5	11.07												
SBW1-09	8.6702	1003.7	18.265	954.07	32.449	1252	2.378	1152.6	4.7617												
SBW1-10	7.2541	1006.1	14.942	956.48	26.176	1253.3	1.9994	1154.3	4.0525												
SBW1-11	11.872	1006	25.908	956.18	47.447	1255.2	3.0595	1156.3	6.387												
SBW1-12	15.535	1007.8	34.267	958.22	63.416	1255.9	3.8793	1156.7	8.2315												
SBW1-13	9.3391	1004.1	19.445	954.5	34.062	1252.6	2.528	1153.3	5.1395												
SBW1-14	8.3932	1005.4	17.439	955.29	30.69	1253.6	2.2901	1154.2	4.6615												
SBW1-15	11.736	1004.9	25.575	955.26	46.874	1253.7	2.9998	1154.2	6.2825												
SBW1-16	14.619	1004.4	32.419	954.57	60.602	1253.2	3.9059	1153.8	7.8332												
SBW1-17	18.767	1005.3	41.6	955.61	76.681	1154.8	9.6888														
SBW1-18	15.742	1004.7	34.64	954.91	63.118	1154.2	7.995														
SBW1-19	16.231	1004.6	35.452	954.91	64.729	1252.8	4.3656	1153.6	9.033												
SBW1-20	4.3905	1005.4	8.8737	955.83	15.098	1253	1.2207	1153.5	2.4559												
SBW1-21	21.817	1003.5	49.043	953.91	91.267	1202.7	6.9506	1152.9	10.587												
SBW1-22	18.791	1005.5	40.469	955.87	72.09	1254	4.6425	1154.5	9.9693												
SBW1-23	6.8778	1005	13.455	955.25	22.393	1253.7	2.0227	1154.2	3.9427												

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
SBW1-05					0.292	0.309	0.330	0.142	10.44							
SBW1-06					0.238	0.257	0.254	0.111	10.285							
SBW1-07					0.338	0.324	0.383	0.125	10.63							
SBW1-08					0.182	0.209	0.325	0.100	10.005							
SBW1-09					0.738	0.622	0.598	0.164	10.67							
SBW1-10					0.663	0.567	0.770	0.187	11.22							
SBW1-11					0.667	0.526	0.665	0.133	10.22							
SBW1-12					0.315	0.316	0.469	0.135	10.57							
SBW1-13					0.374	0.353	0.411	0.156	10.635							
SBW1-14					0.852	0.578	0.902	0.207	11.37							
SBW1-15					0.442	0.379	0.380	0.138	10.19							
SBW1-16					1.490	1.355	0.950	0.267	9.905							
SBW1-17					0.243	0.389	0.277	0.136	10.165							
SBW1-18					0.180	0.290	0.175	0.099	10.25							
SBW1-19					3.514	2.529	2.952	0.957	11.595							
SBW1-20					1.197	0.804	1.424	0.370	11.695							
SBW1-21					0.229	0.309	0.215	0.161	10.215							
SBW1-22					0.357	0.368	0.613	0.173	10.77							
SBW1-23					1.139	0.832	1.372	0.372	11.575							

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
SBW1-05												
SBW1-06												
SBW1-07												
SBW1-08												
SBW1-09												
SBW1-10												
SBW1-11												
SBW1-12												
SBW1-13												
SBW1-14												
SBW1-15												
SBW1-16												
SBW1-17												
SBW1-18												
SBW1-19												
SBW1-20												
SBW1-21												
SBW1-22												
SBW1-23												

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
SBW1-24	0.1560	0.1300	0.0124	0.0804		0.0446	0.0100	0.0000	0.1059	0.0008	0.0161	0.4057	0.0040			0.0100			0.0040		
SBW1-25	0.0690	0.1300	0.0400	0.0216		0.0194	0.0100	0.0000	0.1293	0.0008	0.0161	0.5188	0.0160			0.0100			0.0040		
SBW1-26	0.0690	0.0700	0.0124	0.0804		0.0446	0.0244	0.0000	0.1044	0.0008	0.0045	0.5148	0.0160			0.0376			0.0010		
SBW1-27	0.1560	0.1300	0.0124	0.0216		0.0194	0.0100	0.0000	0.1301	0.0008	0.0045	0.4408	0.0160			0.0376			0.0010		
SBW1-28	0.0938	0.1300	0.0124	0.0804		0.0446	0.0400	0.0000	0.1044	0.0008	0.0161	0.4024	0.0160			0.0353			0.0040		
SBW1-29	0.1155	0.1300	0.0400	0.0216		0.0446	0.0400	0.0000	0.1419	0.0008	0.0161	0.4024	0.0160			0.0100			0.0010		
SBW1-30	0.0727	0.1300	0.0124	0.0804		0.0194	0.0100	0.0000	0.2123	0.0008	0.0045	0.4275	0.0040			0.0100			0.0010		
SBW1-31D	0.1617	0.1354	0.0085	0.0854		0.0173	0.0428	0.0000	0.0917	0.0008	0.0171	0.4066	0.0030			0.0058			0.0043		
SBW1-32	0.0400	0.1500	0.0030	0.0020		0.0530	0.0500	0.0000	0.0680	0.0008	0.0006	0.6044									
SBW1-33A	0.0400	0.1500	0.0500	0.1000		0.0530		0.0000	0.0680	0.0008	0.0200	0.4780	0.0200								
SBW1-34	0.0400	0.1289	0.0030	0.0020		0.0110	0.0500	0.0000	0.0680	0.0008	0.0006	0.6120	0.0200			0.0470			0.0050		
SBW1-35	0.1799	0.1500	0.0500	0.0020		0.0530		0.0000	0.1970	0.0008	0.0006	0.3500							0.0050		
SBW1-36	0.1850	0.0500	0.0030	0.0020		0.0110		0.0000	0.2390	0.0008	0.0006	0.4334				0.0470					
SBW1-37	0.0400	0.0500	0.0030	0.1000		0.0110		0.0000	0.2163	0.0008	0.0200	0.5142	0.0200						0.0050		
SBW1-38B	0.1617	0.1354	0.0085	0.0854		0.0173	0.0078	0.0000	0.1127	0.0008	0.0035	0.4010	0.0030			0.0387			0.0043		
SBW1-39B	0.1592	0.0586	0.0048	0.0951		0.0509	0.0026	0.0000	0.1920	0.0008	0.0016	0.3886	0.0190			0.0019			0.0048		
SBW1-40	0.1523	0.1356	0.0030	0.1000		0.0530	0.0500	0.0000	0.0680	0.0008	0.0006	0.3500	0.0200			0.0470					
SBW1-41	0.0400	0.1500	0.0030	0.1000		0.0110		0.0000	0.2280	0.0008	0.0006	0.4549									
SBW1-42	0.0400	0.1500	0.0500	0.1000		0.0110	0.0500	0.0000	0.0798	0.0008	0.0006	0.4646	0.0200						0.0050		
SBW1-43	0.1650	0.1500	0.0030	0.0020		0.0110	0.0500	0.0000	0.1781	0.0008	0.0200	0.3799	0.0200								

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
SBW1-24	0.0015			0.0013				0.0026				0.0001	0.0003		0.0083		0.0002			0.0007	
SBW1-25	0.0015			0.0013				0.0026				0.0001	0.0003		0.0032		0.0002			0.0007	
SBW1-26	0.0015			0.0013				0.0026				0.0001	0.0003		0.0083		0.0002			0.0007	
SBW1-27	0.0015			0.0013				0.0074				0.0001	0.0003		0.0032		0.0002			0.0007	
SBW1-28	0.0015			0.0013				0.0074				0.0001	0.0003		0.0032		0.0002			0.0007	
SBW1-29	0.0015			0.0013				0.0026				0.0001	0.0003		0.0083		0.0002			0.0007	
SBW1-30	0.0015			0.0013				0.0026				0.0001	0.0003		0.0032		0.0002			0.0007	
SBW1-31D	0.0015			0.0013				0.0078				0.0001	0.0003		0.0028		0.0002			0.0007	
SBW1-32	0.0015			0.0013				0.0090				0.0001	0.0003		0.0100		0.0002			0.0007	
SBW1-33A	0.0015			0.0013				0.0010				0.0001	0.0003		0.0100		0.0002			0.0007	
SBW1-34	0.0015			0.0013				0.0010				0.0001	0.0003		0.0015		0.0002			0.0007	
SBW1-35	0.0015			0.0013				0.0010				0.0001	0.0003		0.0015		0.0002			0.0007	
SBW1-36	0.0015			0.0013				0.0090				0.0001	0.0003		0.0100		0.0002			0.0007	
SBW1-37	0.0015			0.0013				0.0090				0.0001	0.0003		0.0015		0.0002			0.0007	
SBW1-38B	0.0015			0.0013				0.0022				0.0001	0.0003		0.0087		0.0002			0.0007	
SBW1-39B	0.0015			0.0013				0.0014				0.0001	0.0003		0.0096		0.0002			0.0007	
SBW1-40	0.0015			0.0013				0.0090				0.0001	0.0003		0.0015		0.0002			0.0007	
SBW1-41	0.0015			0.0013				0.0010				0.0001	0.0003		0.0015		0.0002			0.0007	
SBW1-42	0.0015			0.0013				0.0090				0.0001	0.0003		0.0100		0.0002			0.0007	
SBW1-43	0.0015			0.0013				0.0010				0.0001	0.0003		0.0100		0.0002			0.0007	

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
SBW1-24									0.0000							0.0050					
SBW1-25									0.0000							0.0050					
SBW1-26									0.0000							0.0050					
SBW1-27									0.0000							0.0050					
SBW1-28									0.0000							0.0050					
SBW1-29									0.0000							0.0050					
SBW1-30									0.0000							0.0050					
SBW1-31D									0.0000							0.0050					
SBW1-32									0.0000							0.0050					
SBW1-33A									0.0000							0.0050					
SBW1-34									0.0000							0.0050					
SBW1-35									0.0000							0.0050					
SBW1-36									0.0000							0.0050					
SBW1-37									0.0000							0.0050					
SBW1-38B									0.0000							0.0050					
SBW1-39B									0.0000							0.0050					
SBW1-40									0.0000							0.0050					
SBW1-41									0.0000							0.0050					
SBW1-42									0.0000							0.0050					
SBW1-43									0.0000							0.0050					

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
SBW1-24										1.0000	0.1589	0.1251	0.0129	0.0802		0.0428	0.0096		0.1058	0.0009	0.0136
SBW1-25										1.0000	0.0628	0.1266	0.0406	0.0224		0.0188	0.0097		0.1277	0.0009	0.0140
SBW1-26										1.0000	0.0699	0.0720	0.0125	0.0797		0.0430	0.0244		0.1042	0.0009	0.0049
SBW1-27										1.0000	0.1565	0.1282	0.0125	0.0215		0.0188	0.0098		0.1288	0.0009	0.0047
SBW1-28										1.0000	0.0955	0.1281	0.0127	0.0804		0.0441	0.0385		0.1063	0.0009	0.0141
SBW1-29										1.0000	0.1161	0.1313	0.0396	0.0218		0.0431	0.0397		0.1401	0.0009	0.0140
SBW1-30										1.0000	0.0731	0.1259	0.0129	0.0798		0.0191	0.0096		0.2107	0.0009	0.0046
SBW1-31D										1.0000	0.1690	0.1386	0.0090	0.0854		0.0177	0.0421		0.0942	0.0010	0.0161
SBW1-32										1.0000	0.0369	0.1494	0.0032	0.0026		0.0506	0.0491		0.0675	0.0011	0.0003
SBW1-33A										1.0000	0.0387	0.1502	0.0473	0.0993		0.0514	0.0000		0.0681	0.0009	0.0158
SBW1-34										1.0000	0.0008	0.1481	0.0032	0.0021		0.0111	0.0488		0.0693	0.0009	0.0003
SBW1-35										1.0000	0.1648	0.1483	0.0506	0.0026		0.0518	0.0000		0.1980	0.0009	0.0004
SBW1-36										1.0000	0.1732	0.0492	0.0033	0.0024		0.0103	0.0000		0.2341	0.0008	0.0004
SBW1-37										1.0000	0.0428	0.0510	0.0034	0.1004		0.0112	0.0000		0.2196	0.0009	0.0195
SBW1-38B										1.0000	0.1664	0.1392	0.0090	0.0866		0.0173	0.0077		0.1151	0.0009	0.0038
SBW1-39B										1.0000	0.1610	0.0596	0.0051	0.0957		0.0485	0.0026		0.1928	0.0008	0.0028
SBW1-40										1.0000	0.1528	0.1381	0.0034	0.0995		0.0534	0.0488		0.0701	0.0010	0.0004
SBW1-41										1.0000	0.0411	0.1444	0.0031	0.0987		0.0109	0.0000		0.2232	0.0009	0.0004
SBW1-42										1.0000	0.0465	0.1451	0.0521	0.0986		0.0138	0.0440		0.0790	0.0009	0.0041
SBW1-43										1.0000	0.1586	0.1455	0.0033	0.0024		0.0108	0.0476		0.1762	0.0009	0.0169

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
SBW1-24	0.3878	0.0039			0.0103			0.0047			0.0014			0.0011				0.0018			
SBW1-25	0.5032	0.0132			0.0105			0.0046			0.0013			0.0011				0.0024			
SBW1-26	0.5208	0.0164			0.0396			0.0012			0.0014			0.0011				0.0026			
SBW1-27	0.4298	0.0164			0.0367			0.0012			0.0012			0.0011				0.0060			
SBW1-28	0.3937	0.0146			0.0362			0.0048			0.0013			0.0011				0.0047			
SBW1-29	0.3987	0.0129			0.0103			0.0012			0.0013			0.0010				0.0026			
SBW1-30	0.4211	0.0041			0.0101			0.0012			0.0013			0.0011				0.0023			
SBW1-31D	0.4084	0.0029			0.0062			0.0050			0.0013			0.0011				0.0063			
SBW1-32	0.5946	0.0001			0.0003			0.0000			0.0013			0.0011				0.0075			
SBW1-33A	0.4721	0.0174			0.0003			0.0000			0.0013			0.0011				0.0011			
SBW1-34	0.5930	0.0393			0.0480			0.0060			0.0013			0.0010				0.0015			
SBW1-35	0.3409	0.0000			0.0000			0.0058			0.0020			0.0011				0.0009			
SBW1-36	0.4202	0.0000			0.0460			0.0000			0.0012			0.0010				0.0076			
SBW1-37	0.5158	0.0194			0.0001			0.0059			0.0014			0.0011				0.0081			
SBW1-38B	0.4073	0.0028			0.0391			0.0050			0.0010			0.0011				0.0020			
SBW1-39B	0.3842	0.0180			0.0023			0.0053			0.0007			0.0010				0.0014			
SBW1-40	0.3653	0.0209			0.0467			0.0000			0.0011			0.0011				0.0056			
SBW1-41	0.4505	0.0001			0.0001			0.0000			0.0015			0.0011				0.0012			
SBW1-42	0.4580	0.0209			0.0003			0.0054			0.0012			0.0011				0.0048			
SBW1-43	0.3704	0.0140			0.0002			0.0000			0.0013			0.0010				0.0012			

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
SBW1-24				0.0060																	
SBW1-25				0.0022																	
SBW1-26				0.0060																	
SBW1-27				0.0023																	
SBW1-28				0.0024																	
SBW1-29				0.0059																	
SBW1-30				0.0023																	
SBW1-31D				0.0021																	
SBW1-32				0.0071																	
SBW1-33A				0.0071																	
SBW1-34				0.0011																	
SBW1-35				0.0011																	
SBW1-36				0.0070																	
SBW1-37				0.0012																	
SBW1-38B				0.0065																	
SBW1-39B				0.0069																	
SBW1-40				0.0011																	
SBW1-41				0.0011																	
SBW1-42				0.0072																	
SBW1-43				0.0071																	

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
SBW1-24					0.0037															0.9705
SBW1-25					0.0052															0.9673
SBW1-26					0.0054															1.0059
SBW1-27					0.0048															0.9812
SBW1-28					0.0056															0.9848
SBW1-29					0.0055															0.9861
SBW1-30					0.0058															0.9857
SBW1-31D					0.0050															1.0115
SBW1-32					0.0051															0.9778
SBW1-33A					0.0048															0.9767
SBW1-34					0.0049															0.9807
SBW1-35					0.0053															0.9747
SBW1-36					0.0054															0.9621
SBW1-37					0.0059															1.0077
SBW1-38B					0.0028															1.0137
SBW1-39B					0.0043															0.9928
SBW1-40					0.0053															1.0144
SBW1-41					0.0057															0.9839
SBW1-42					0.0050															0.9880
SBW1-43					0.0055															0.9628

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
SBW1-24	1150		1038	Ca4P2O9	Clear dark brown glass with black specks and air bubbles, high viscosity		Ca5(PO4)3(OH)	Single-phase
SBW1-25	1150		1031	Ca5(PO4)3F	Clear dark brown glass with black specks and air bubbles, avg. viscosity		Na3Ca6(PO4)5	Single-phase
SBW1-26	1150		866	K(Si3Al)O8	Clear dark brown glass with black specks and air bubbles, avg. viscosity		Amorphous	Single-phase
SBW1-27	1150		943	Ca5(PO4)3F	Clear dark brown glass with black specks and lots of air bubbles, high viscosity		Amorphous	Single-phase
SBW1-28	1150		878	NaAlSiO4	Clear brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-29	1150		793	Ca5(PO4)3F	Clear very dark brown glass with black specks and few air bubbles, low viscosity		Amorphous	Single-phase
SBW1-30	1150		756	NaAlSiO4	Clear dark brown glass with few black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-31D	1150		1028	Fe2O3	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-32	1150		773	SiO2	Clear very dark reddish brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-33A	1250				Opaque brownish green glass with multi-phases and thin clear layer of glass on bottom, avg. viscosity		Ca5(PO4)3F	Multi-phase, opaque
SBW1-34	1150		978	SiO2	Clear brown glass with some black specks and lots of air bubbles, low viscosity		Amorphous	Single-phase
SBW1-35	1150		908	Na6(AlSiO4)6	Clear light brown glass with few black specks and lots of air bubbles, low viscosity		Amorphous	Single-phase
SBW1-36	1150		1123	Na6(AlSiO4)6	Clear dark reddish brown glass with air bubbles mostly on top of melt, high viscosity		Amorphous	Single-phase
SBW1-37	1150		916	Na2CaSiO4	Clear brown glass with black specks and air bubbles, avg. viscosity		Amorphous	Single-phase
SBW1-38B	1350		1131	Fe3O4	Clear very dark black shiny glass foamed out of crucible, avg. viscosity		Amorphous	Single-phase
SBW1-39B	1350		1073	NaAlSiO4	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-40	1150		1038	LiFe2O3F	Clear dark brown glass with air bubbles, low viscosity		Amorphous	Single-phase
SBW1-41	1150		736	(K,Na)(Si3Al)O8	Clear brown glass with a few black specks and some air bubbles, low viscosity		Amorphous	Single-phase
SBW1-42	1150		838	(Na,Ca)FeSi2O6	Clear dark brown glass with black specks and few air bubbles, low viscosity		Amorphous	Single-phase
SBW1-43	1150		858	Na6(AlSiO4)6	Clear dark black glass with some black specks and very few air bubbles, low viscosity		Amorphous	Single-phase

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
SBW1-24	Reddish brown and completely devitrified with very small crystalline specks with some clusters of dark red crystals.		Ca5(PO4)3F and Fe3O4 (0.76 vol% crystallinity)		
SBW1-25	Light reddish brown and phase-separated making the glass cloudy also some long flaky crystals near the surface.		Ca5(PO4)3F and CaF2 (0.42 vol% crystallinity)		
SBW1-26	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-27	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-28	Clear brown glass with some clear crystilline needle clusters, air bubbles and a few black specks (expected to be Ru).		BaZr(BO3)2 and AlFe(PO3)6 (0.04 vol% crystallinity)		
SBW1-29	Clear dark brown glass, with few air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-30	Clear brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-31D	Reddish brown and completely devitrified with small red and white clusters of crystals.		Fe2O3 (0.88 vol% crystallinity)		
SBW1-32	Clear dark purplish glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-33A	Very dark reddish brown and phase separated with a few clusters of clear crystals.		Ca5(PO4)3(OH) (0.40 vol% crystallinity)		
SBW1-34	Clear reddish brown glass with clusters of white crystals scattered throughout and completely covering the walls of the crucible.		SiO2 (0.13 vol% crystallinity)		
SBW1-35	Clear brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-36	Clear purplish brown glass, few small clusters of very small crystals near edges, also air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-37	Clear brown glass with clear cubic crystals and a slight cloudy or opaque appearance, air bubbles and black specks (expected to be Ru).		Ca2AlSiO7		
SBW1-38B	Opaque dark brown and phase separated with very small crystals.		Fe3O4, KFeO2, Ba2FeF6, and Mn3O4 (0.34 vol% crystallinity)		
SBW1-39B	Clear brown glass with some spots that appear cloudy, also some clear cubic crystals and flaky crystals.		Amorphous		
SBW1-40	Clear reddish brown glass with clusters of white crystals throughout.		Fe2O3 (0.53 vol% crystallinity)		
SBW1-41	Clear brown glass, few air bubbles and a few black specks (expected to be Ru).		Amorphous		
SBW1-42	Clear dark reddish brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-43	Clear dark reddish brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
SBW1-24		2.5222					-11.127	20624.0	28.97	1472		1263	1154.2	28.332	1079.4
SBW1-25		2.557					-11.565	20246.0	14.33	1378		1187	1156.9	12.822	1081
SBW1-26		2.6375					-10.730	19202.0	15.86	1408		1200	1160.1	14.707	1084.3
SBW1-27		2.5432					-10.614	19604.0	23.63	1461		1245	1157	21.673	1081.8
SBW1-28		2.6379					-10.100	15749.0	2.63	1186		997	1159.7	2.3927	1083.6
SBW1-29		2.5757					-9.941	15261.0	2.19	1162		973	1154.7	2.0715	1078.8
SBW1-30		2.6163					-9.866	15126.0	2.15	1159		970	1156.8	1.9862	1081.9
SBW1-31D		2.5317					-10.249	17603.0	8.34	1336		1129	1155.4	7.8874	1080.1
SBW1-32		2.4424					-10.601	17980.0	7.65	1319		1120	1155.3	6.9677	1079.8
SBW1-33A		2.5511													
SBW1-34															
SBW1-35		2.516					-9.882	16043.0	4.02	1244		1044	1156.6	3.7113	1080.3
SBW1-36		2.4982					-9.945	18745.0	25.23	1489		1257	1157	23.67	1081.2
SBW1-37		2.6297					-10.942	19060.0	11.61	1365		1166	1161.7	10.183	1085.8
SBW1-38B		2.5806					-10.922	20392.0	30.21	1482		1269	1254.8	11.102	1180.3
SBW1-39B		2.6269					-11.160	20554.0	26.69	1461		1254	1260	9.1749	1184.3
SBW1-40		2.6405					-10.230	16274.0	3.34	1217		1025	1157.4	3.0624	1082.5
SBW1-41		2.6055					-10.452	15888.0	2.04	1152		973	1158.9	1.8486	1083.2
SBW1-42		2.6517					-10.780	16302.0	1.97	1148		973	1155.9	1.8362	1079.7
SBW1-43		2.5045					-9.563	14877.0	2.44	1177		981	1157.3	2.2767	1082.6

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
SBW1-24	60.128	1004.7	147.76	954.81	295.87																
SBW1-25	27.433	1005.8	69.184	955.95	146.33	1254.4	5.896	1154.7	13.347												
SBW1-26	29.521	1009.2	68.16	959.4	130.85	1157.7	14.777														
SBW1-27	45.233	1005.9	110.3	956.34	215.53	1254.9	9.665	1155.3	21.849												
SBW1-28	4.3675	1008.4	8.7955	958.76	15.138	1255.4	1.2615	1157.6	2.4861												
SBW1-29	3.7258	1003.4	7.4194	953.65	12.537	1251.9	1.102	1152.8	2.1406												
SBW1-30	3.508	1007.2	6.9017	957.55	11.77	1255.8	1.0706	1156.9	2.0318												
SBW1-31D	15.421	1004.9	33.644	955.2	60.362	1204.5	5.4093	1154.1	8.005												
SBW1-32	13.866	1004.7	31.626	954.97	60.165	1253.7	3.4653	1154.4	7.2826												
SBW1-33A																					
SBW1-34																					
SBW1-35	6.8909	1004.8	14.234	955.04	25.045	1253.2	1.9498	1153.9	3.9126												
SBW1-36	47.48	1006.3	108.7	956.63	206.68	1254.7	10.423	1155.4	23.974												
SBW1-37	20.74	1010.8	48.913	961.18	93.577	1258.1	4.6471	1159.9	10.734												
SBW1-38B	22.073	1106	47.537	1055.7	85.116	1351.9	5.2433	1253	11.325												
SBW1-39B	18.575	1109.9	40.422	1060.3	71.429	1356.9	4.3304	1258	9.8112												
SBW1-40	5.7409	1007.4	11.826	957.69	20.491	1256.5	1.5553	1157.2	3.1584												
SBW1-41	3.3358	1007.8	6.8682	958.01	12.332	1255.6	0.9989	1156.9	1.9118												
SBW1-42	3.3996	1004.9	7.099	954.76	12.75	1254.2	0.9471	1153.8	1.8764												
SBW1-43	4.001	1007.6	7.7022	957.99	12.768	1255.4	1.2152	1157.1	2.3107												

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
SBW1-24					0.409	0.451	0.395	0.120	9.2							
SBW1-25					0.907	0.791	0.815	0.160	9.63							
SBW1-26					0.224	0.333	0.251	0.114	10.33							
SBW1-27					0.339	0.333	0.377	0.099	8.89							
SBW1-28					1.445	1.218	0.949	0.146	10.605							
SBW1-29					1.643	1.428	1.275	0.220	11.235							
SBW1-30					4.192	2.990	3.040	0.412	11.795							
SBW1-31D					0.392	0.514	0.073	0.186	9.34							
SBW1-32					4.141	3.722	3.342	0.695	10.045							
SBW1-33A					1.143		0.761	0.147	8.885							
SBW1-34																
SBW1-35					1.386		1.256	0.173	11.09							
SBW1-36					0.413		0.674	0.215	11.42							
SBW1-37					1.466		1.366	0.505	11.305							
SBW1-38B					0.116	0.241	0.093	0.044	8.795							
SBW1-39B					0.412	0.172	0.631	0.217	10.945							
SBW1-40					0.799	0.761	0.372	0.122	9.99							
SBW1-41					6.724		5.099	0.917	11.295							
SBW1-42					1.478	1.398	1.066	0.263	9.88							
SBW1-43					3.631	2.568	2.192	0.239	11.715							

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
SBW1-24												
SBW1-25												
SBW1-26												
SBW1-27												
SBW1-28												
SBW1-29												
SBW1-30												
SBW1-31D												
SBW1-32												
SBW1-33A												
SBW1-34												
SBW1-35												
SBW1-36												
SBW1-37												
SBW1-38B												
SBW1-39B												
SBW1-40												
SBW1-41												
SBW1-42												
SBW1-43												

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
SBW1-44B	0.0602	0.0654	0.0085	0.0854		0.0467	0.0428	0.0000	0.1400	0.0008	0.0171	0.4672	0.0030			0.0387			0.0043		
SBW1-45	0.0400	0.1500	0.0030	0.0020		0.0530		0.0000	0.1867	0.0008	0.0200	0.4443	0.0200			0.0470			0.0050		
SBW1-46	0.1072	0.1014	0.0214	0.0513		0.0320	0.0259	0.0000	0.1471	0.0008	0.0102	0.4512	0.0099			0.0192			0.0025		
SBW1-47	0.1072	0.1014	0.0214	0.0513		0.0320	0.0259	0.0000	0.1471	0.0008	0.0102	0.4512	0.0099			0.0192			0.0025		
SBW1-48	0.0904	0.1236	0.0103	0.0894		0.0270	0.0057	0.0000	0.1422	0.0005	0.0064	0.4866	0.0029						0.0015		
SBW1-49	0.0904	0.1236	0.0103	0.0054		0.0270	0.0412	0.0000	0.1422	0.0005	0.0064	0.5001	0.0029			0.0350			0.0015		
SBW1-50	0.0904	0.1198	0.0453	0.0894		0.0270	0.0412	0.0000	0.1422	0.0005	0.0064	0.4199	0.0029						0.0015		
SBW1-51	0.0904	0.0700	0.0103	0.0894		0.0270	0.0136	0.0000	0.1422	0.0005	0.0064	0.4973	0.0029			0.0350			0.0015		
SBW1-52	0.0904	0.1236	0.0453	0.0367		0.0270	0.0061	0.0000	0.1422	0.0005	0.0064	0.5039	0.0029						0.0015		
SBW1-53	0.0904	0.0700	0.0112	0.0894		0.0270	0.0412	0.0000	0.1422	0.0005	0.0064	0.5038	0.0029						0.0015		
SBW1-54	0.0725	0.1125	0.0461	0.0795		0.0224	0.0375	0.0000	0.1169	0.0006	0.0052	0.4873	0.0047						0.0012		
SBW1-55	0.0870	0.1050	0.0453	0.0754		0.0269	0.0350	0.0000	0.1403	0.0007	0.0062	0.4549	0.0056						0.0014		
SBW1-56	0.1014	0.0975	0.0445	0.0713		0.0314	0.0325	0.0000	0.1637	0.0009	0.0073	0.4224	0.0065						0.0017		
SBW1-57	0.0725	0.1125	0.0086	0.0795		0.0224	0.0375	0.0000	0.1169	0.0006	0.0052	0.4873	0.0047			0.0375			0.0012		
SBW1-58	0.0870	0.1050	0.0103	0.0754		0.0269	0.0350	0.0000	0.1403	0.0007	0.0062	0.4549	0.0056			0.0350			0.0014		
SBW1-59	0.1014	0.0975	0.0120	0.0713		0.0314	0.0325	0.0000	0.1637	0.0009	0.0073	0.4224	0.0065			0.0325			0.0017		
SBW1-60	0.0725	0.1125	0.0273	0.0795		0.0224	0.0375	0.0000	0.1169	0.0006	0.0052	0.4873	0.0047			0.0188			0.0012		
SBW1-61	0.0870	0.1050	0.0278	0.0754		0.0269	0.0350	0.0000	0.1403	0.0007	0.0062	0.4549	0.0056			0.0175			0.0014		
SBW1-62	0.1014	0.0975	0.0282	0.0713		0.0314	0.0325	0.0000	0.1637	0.0009	0.0073	0.4224	0.0065			0.0163			0.0017		
SBW1-63	0.1501	0.1501	0.0008	0.0005			0.0845		0.0500			0.5307	0.0301			0.0000					
SBW1-64	0.0375	0.1250	0.0009	0.0005		0.0250	0.0631		0.0875		0.0125	0.5391	0.1050			0.0000					

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
SBW1-44B	0.0015			0.0013				0.0022				0.0001	0.0003		0.0087		0.0002			0.0007	
SBW1-45	0.0015			0.0013				0.0090				0.0001	0.0003		0.0100		0.0002			0.0007	
SBW1-46	0.0015			0.0013				0.0050				0.0001	0.0003		0.0057		0.0002			0.0007	
SBW1-47	0.0015			0.0013				0.0050				0.0001	0.0003		0.0057		0.0002			0.0007	
SBW1-48	0.0009			0.0008				0.0037				0.0001	0.0002		0.0044		0.0001			0.0004	
SBW1-49	0.0009			0.0008				0.0037				0.0001	0.0002		0.0044		0.0001			0.0004	
SBW1-50	0.0009			0.0008				0.0037				0.0001	0.0002		0.0044		0.0001			0.0004	
SBW1-51	0.0009			0.0008				0.0037				0.0001	0.0002		0.0044		0.0001			0.0004	
SBW1-52	0.0009			0.0008				0.0037				0.0001	0.0002		0.0044		0.0001			0.0004	
SBW1-53	0.0009			0.0008				0.0037				0.0001	0.0002		0.0044		0.0001			0.0004	
SBW1-54	0.0011			0.0010				0.0031				0.0001	0.0002		0.0036		0.0001			0.0005	
SBW1-55	0.0014			0.0012				0.0037				0.0001	0.0003		0.0043		0.0002			0.0006	
SBW1-56	0.0016			0.0014				0.0043				0.0001	0.0003		0.0050		0.0002			0.0007	
SBW1-57	0.0011			0.0010				0.0031				0.0001	0.0002		0.0036		0.0001			0.0005	
SBW1-58	0.0014			0.0012				0.0037				0.0001	0.0003		0.0043		0.0002			0.0006	
SBW1-59	0.0016			0.0014				0.0043				0.0001	0.0003		0.0050		0.0002			0.0007	
SBW1-60	0.0011			0.0010				0.0031				0.0001	0.0002		0.0036		0.0001			0.0005	
SBW1-61	0.0014			0.0012				0.0037				0.0001	0.0003		0.0043		0.0002			0.0006	
SBW1-62	0.0016			0.0014				0.0043				0.0001	0.0003		0.0050		0.0002			0.0007	
SBW1-63					0.0009	0.0007				0.0007							0.0001			0.0000	
SBW1-64					0.0010	0.0007		0.0005		0.0007							0.0001			0.0000	

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
SBW1-44B									0.0000							0.0050					
SBW1-45									0.0000							0.0050					
SBW1-46									0.0000							0.0050					
SBW1-47									0.0000							0.0050					
SBW1-48									0.0000							0.0030					
SBW1-49									0.0000							0.0030					
SBW1-50									0.0000							0.0030					
SBW1-51									0.0000							0.0030					
SBW1-52									0.0000							0.0030					
SBW1-53									0.0000							0.0030					
SBW1-54									0.0000							0.0038					
SBW1-55									0.0000							0.0045					
SBW1-56									0.0000							0.0053					
SBW1-57									0.0000							0.0038					
SBW1-58									0.0000							0.0045					
SBW1-59									0.0000							0.0053					
SBW1-60									0.0000							0.0038					
SBW1-61									0.0000							0.0045					
SBW1-62									0.0000							0.0053					
SBW1-63																	0.0002				
SBW1-64																	0.0002				

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
SBW1-44B										1.0000	0.0593	0.0653	0.0087	0.0854		0.0451	0.0411		0.1404	0.0009	0.0161
SBW1-45										1.0000	0.0434	0.1483	0.0033	0.0025		0.0536	0.0001		0.1923	0.0009	0.0177
SBW1-46										1.0000	0.1082	0.1009	0.0216	0.0506		0.0311	0.0251		0.1455	0.0010	0.0093
SBW1-47										1.0000	0.1087	0.1015	0.0213	0.0509		0.0314	0.0255		0.1464	0.0009	0.0095
SBW1-48										1.0000	0.0869	0.1196	0.0105	0.0884		0.0261	0.0055		0.1406	0.0006	0.0066
SBW1-49										1.0000	0.0926	0.1214	0.0107	0.0057		0.0262	0.0398		0.1415	0.0006	0.0066
SBW1-50										1.0000	0.0810	0.1189	0.0461	0.0886		0.0259	0.0395		0.1407	0.0006	0.0064
SBW1-51										1.0000	0.0922	0.0702	0.0106	0.0912		0.0261	0.0131		0.1391	0.0005	0.0063
SBW1-52										1.0000	0.0922	0.1220	0.0458	0.0368		0.0262	0.0060		0.1400	0.0006	0.0064
SBW1-53										1.0000	0.0852	0.0706	0.0115	0.0899		0.0265	0.0399		0.1416	0.0006	0.0062
SBW1-54										1.0000	0.0742	0.1074	0.0465	0.0783		0.0217	0.0357		0.1162	0.0007	0.0055
SBW1-55										1.0000	0.0923	0.1083	0.0481	0.0764		0.0268	0.0356		0.1434	0.0008	0.0064
SBW1-56										1.0000	0.1057	0.0979	0.0462	0.0726		0.0311	0.0324		0.1660	0.0010	0.0070
SBW1-57										1.0000	0.0746	0.1085	0.0088	0.0791		0.0217	0.0359		0.1150	0.0007	0.0059
SBW1-58										1.0000	0.0832	0.1031	0.0108	0.0761		0.0256	0.0340		0.1379	0.0008	0.0062
SBW1-59										1.0000	0.1056	0.0986	0.0127	0.0709		0.0313	0.0326		0.1665	0.0009	0.0075
SBW1-60										1.0000	0.0744	0.1108	0.0274	0.0797		0.0224	0.0366		0.1191	0.0007	0.0054
SBW1-61										1.0000	0.0896	0.1026	0.0282	0.0744		0.0259	0.0339		0.1399	0.0008	0.0063
SBW1-62										1.0000	0.1067	0.0979	0.0300	0.0718		0.0306	0.0315		0.1695	0.0009	0.0074
SBW1-63			0.0006							1.0000	0.1496	0.1474	0.0010	0.0009		0.0002	0.0811		0.0503	0.0003	0.0001
SBW1-64			0.0007							1.0000	0.0389	0.1260	0.0012	0.0008		0.0241	0.0619		0.0881	0.0001	0.0107

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
SBW1-44B	0.4546	0.0028			0.0398			0.0050			0.0013			0.0011				0.0021			
SBW1-45	0.4332	0.0191			0.0488			0.0060			0.0015			0.0011				0.0075			
SBW1-46	0.4455	0.0087			0.0194			0.0030			0.0011			0.0011				0.0042			
SBW1-47	0.4417	0.0096			0.0192			0.0030			0.0011			0.0011				0.0042			
SBW1-48	0.4738	0.0030			0.0001			0.0018			0.0009			0.0007				0.0033			
SBW1-49	0.4843	0.0029			0.0353			0.0018			0.0009			0.0007				0.0038			
SBW1-50	0.4119	0.0029			0.0001			0.0017			0.0012			0.0006				0.0033			
SBW1-51	0.4945	0.0028			0.0359			0.0018			0.0008			0.0007				0.0033			
SBW1-52	0.4903	0.0030			0.0001			0.0018			0.0008			0.0007				0.0032			
SBW1-53	0.4945	0.0028			0.0001			0.0018			0.0011			0.0007				0.0034			
SBW1-54	0.4600	0.0047			0.0001			0.0014			0.0010			0.0008				0.0030			
SBW1-55	0.4622	0.0057			0.0001			0.0017			0.0009			0.0010				0.0033			
SBW1-56	0.4220	0.0067			0.0002			0.0021			0.0014			0.0011				0.0036			
SBW1-57	0.4716	0.0049			0.0376			0.0014			0.0009			0.0009				0.0032			
SBW1-58	0.4444	0.0057			0.0360			0.0017			0.0012			0.0010				0.0032			
SBW1-59	0.4248	0.0066			0.0335			0.0020			0.0014			0.0011				0.0040			
SBW1-60	0.4794	0.0048			0.0194			0.0014			0.0009			0.0008				0.0021			
SBW1-61	0.4371	0.0055			0.0174			0.0016			0.0013			0.0010				0.0035			
SBW1-62	0.4290	0.0069			0.0167			0.0021			0.0012			0.0011				0.0039			
SBW1-63	0.5181	0.0315			0.0001			0.0000			0.0002			0.0001				0.0003			
SBW1-64	0.5323	0.0911			0.0001			0.0000			0.0001			0.0001				0.0006			

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
SBW1-44B				0.0062																	
SBW1-45				0.0072																	
SBW1-46				0.0041																	
SBW1-47				0.0041																	
SBW1-48				0.0031																	
SBW1-49				0.0032																	
SBW1-50				0.0031																	
SBW1-51				0.0032																	
SBW1-52				0.0032																	
SBW1-53				0.0032																	
SBW1-54				0.0026																	
SBW1-55				0.0032																	
SBW1-56				0.0037																	
SBW1-57				0.0026																	
SBW1-58				0.0031																	
SBW1-59				0.0037																	
SBW1-60				0.0026																	
SBW1-61				0.0031																	
SBW1-62				0.0038																	
SBW1-63				0.0000																	
SBW1-64				0.0000																	

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
SBW1-44B					0.0056															0.9806
SBW1-45					0.0057															0.9919
SBW1-46					0.0054															0.9858
SBW1-47					0.0055															0.9855
SBW1-48					0.0034															0.9748
SBW1-49					0.0035															0.9815
SBW1-50					0.0037															0.9762
SBW1-51					0.0037															0.9957
SBW1-52					0.0037															0.9827
SBW1-53					0.0037															0.9834
SBW1-54					0.0038															0.9638
SBW1-55					0.0051															1.0215
SBW1-56					0.0060															1.0068
SBW1-57					0.0047															0.9779
SBW1-58					0.0049															0.9789
SBW1-59					0.0059															1.0096
SBW1-60					0.0047															0.9927
SBW1-61					0.0050															0.9772
SBW1-62					0.0058															1.0171
SBW1-63					0.0001															0.9813
SBW1-64					0.0001															0.9763

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
SBW1-44B	1150		736	K(Si3Al)O8	Clear dark brown glass with black specks and few air bubbles, low viscosity		Amorphous	Single-phase
SBW1-45	1150		801	NaBaPO4	Clear very dark purplish brown glass with black specks and a few air bubbles, low viscosity		Amorphous	Single-phase
SBW1-46	1150		808	Ca5(PO4)3F	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-47	1150		798	Ca5(PO4)3F	Clear dark brown glass with few black specks and lots of air bubbles, low viscosity		Amorphous	Single-phase
SBW1-48	1150		868	Ca5(PO4)3F	Clear brown glass with few black specks and lots of air bubbles, avg. viscosity		Amorphous	Single-phase
SBW1-49	1150		766	(K,Na)(Si3Al)O8	Clear reddish brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-50	1150				Clear brown glass with black specks and a few air bubbles, low viscosity		Amorphous	Single-phase
SBW1-51	1151		788	(K,Na)(Si3Al)O8	Clear brown glass with black specks and a few air bubbles, avg. viscosity		Amorphous	Single-phase
SBW1-52	1150		971	Ca5(PO4)3F	Clear brown glass with black specks and lots of tiny air bubbles, avg. viscosity		Amorphous	Single-phase
SBW1-53	1150		783	(K,Ba,Na)(Si,Al)4O8	Clear brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-54	1150		828	Ca5(PO4)3F	Clear light brown glass with very few black specks and lots of air bubbles, low viscosity		Amorphous	Single-phase
SBW1-55	1150		828	NaAlSiO4	Clear brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-56	1150		828	Na6(AlSiO4)6	Clear dark brown glass with black specks and a few air bubbles, low viscosity		Amorphous	Single-phase
SBW1-57	1150		756	(Na,K)(Si3Al)O8	Clear light brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-58	1150		748	K(Si3Al)O8	Clear brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-59	1150		793	Na6(AlSiO4)6	Clear dark brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-60	1150		773	(Na,K)(Si3Al)O8	Clear brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-61	1150		766	K(Si3Al)O8	Clear brown glass with black specks and air bubbles, low viscosity		Amorphous	Single-phase
SBW1-62	1150		828	Na6(AlSiO4)6	Clear dark brown glass with black specks and a few air bubbles, low viscosity		Amorphous	Single-phase
SBW1-63	1150		878	LiAlSi2O6	Clear blue glass with lots of air bubbles, avg.viscosity		Amorphous	Single-phase
SBW1-64	1150		888	NaLiZrSi6O15	Clear blue glass with lots of air bubbles, high viscosity		Amorphous	Single-phase

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
SBW1-44B	Clear dark brown glass, with very few air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-45	Clear dark purplish glass, a few black specks (expected to be Ru) and no air bubbles.		Amorphous		
SBW1-46	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-47	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-48	Clear brown glass, with air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-49	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-50	Clear brown glass, with black specks (expected to be Ru) but no air bubbles .		Amorphous		
SBW1-51	Clear brown glass, with black specks (expected to be Ru) but no air bubbles .		Amorphous		
SBW1-52	Clear brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-53	Clear brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-54	Clear brown glass, with air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-55	Clear brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-56	Clear dark brown glass, with very few air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-57	Clear brown glass, with few air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-58	Clear brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-59	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-60	Clear brown glass, few air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-61	Clear dark brown glass, air bubbles and black specks (expected to be Ru).		Amorphous		
SBW1-62	Clear brown glass with few black specks (expected to be Ru), no air bubbles.		Amorphous		
SBW1-63	Clear blue glass, lots air bubbles.		Amorphous		
SBW1-64	Clear blue glass, lots air bubbles.		Amorphous		

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
SBW1-44B		2.6652					-9.389	15058.0	3.30	1220		1015	1154.7	3.1362	1079.3
SBW1-45		2.6397					-11.520	17589.0	2.32	1167		999	1154	2.1289	1078.9
SBW1-46		2.6003					-10.014	16789.0	5.96	1295		1090	1156.1	5.5615	1080.2
SBW1-47		2.5972					-10.041	16785.0	5.78	1291		1087	1159.1	5.2659	1083.4
SBW1-48		2.5422					-10.838	19308.0	15.34	1401		1196	1154.6	14.841	1078.8
SBW1-49		2.5573					-9.582	15609.0	4.00	1246		1040	1155.5	3.7271	1080.1
SBW1-50		2.6139					-9.684	14557.0	1.73	1130		941	1155.9	1.6515	1079.8
SBW1-51		2.6386					-10.371	18767.0	16.73	1423		1208	1155.6	16.027	1079.6
SBW1-52		2.5406					-11.090	19320.0	12.02	1366		1169	1157.9	10.749	1082.1
SBW1-53		2.583					-9.384	16003.0	6.43	1315		1096	1154.5	6.1183	1079
SBW1-54		2.5967					-10.144	16445.0	4.11	1244		1048	1155.6	3.8889	1079.8
SBW1-55		2.6049					-10.031	15968.0	3.29	1216		1022	1157.5	3.0212	1082.8
SBW1-56		2.609					-9.767	15266.0	2.61	1186		992	1154	2.5424	1078
SBW1-57		2.6291					-9.859	16260.0	4.80	1268		1064	1156.5	4.4991	1080.8
SBW1-58		2.6365					-9.647	15607.0	3.75	1236		1033	1156.8	3.4718	1081.2
SBW1-59		2.6385					-9.504	15071.0	2.97	1205		1003	1155.4	2.7929	1080.5
SBW1-60		2.6101					-10.036	16410.0	4.46	1256		1057	1157.5	4.1374	1082.4
SBW1-61		2.6179					-9.804	15716.0	3.46	1224		1025	1155.4	3.2467	1080.1
SBW1-62		2.6238					-9.638	15230.0	2.90	1201		1002	1155.2	2.777	1079.4
SBW1-63		2.4303					-10.113	17680.0	10.09	1363		1151	1157.6	9.1859	1082.6
SBW1-64		2.5697					-12.395	20569.0	7.84	1298		1126	1157.5	7.0288	1082.6

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
SBW1-44B	5.6044	1004.3	10.914	954.63	18.154	1252.8	1.6543	1153.1	3.2108												
SBW1-45	4.1231	1004.3	9.271	954.75	17.731	1252.2	1.0906	1152.9	2.2532												
SBW1-46	10.54	1004.7	22.376	954.82	40.335	1253.3	2.7835	1154	5.7004												
SBW1-47	9.9564	1008.2	20.983	958.65	37.278	1254.7	2.6491	1156.9	5.465												
SBW1-48	30.158	1004	70.681	954.3	137.76	1202.4	9.7138	1152.9	14.683												
SBW1-49	6.7468	1005.5	13.589	955.79	23.674	1254.1	1.9868	1154.6	3.8339												
SBW1-50	2.8677	1004.7	5.4465	954.64	9.022	1252.9	0.8853	1153.5	1.6652												
SBW1-51	32.506	1004.5	73.526	954.49	139.39	1154	16.241														
SBW1-52	22.229	1007	53.628	957.28	107.86	1255.4	5.1018	1155.5	11.092												
SBW1-53	11.287	1004.1	23.071	954.55	39.494	1252.8	3.0958	1153.7	6.2195												
SBW1-54	7.2362	1004.8	15.102	955.18	26.445	1253.6	1.937	1154	3.905												
SBW1-55	5.5325	1008	11.238	958.67	19.487	1256.4	1.5659	1157.2	3.0906												
SBW1-56	4.5076	1003.1	8.8429	953.45	14.944	1251.9	1.2959	1152.7	2.5423												
SBW1-57	8.3111	1005.2	17.207	955.67	30.249	1253.4	2.2878	1153.9	4.5871												
SBW1-58	6.3131	1006.4	12.649	956.73	21.739	1254.6	1.8362	1155.3	3.569												
SBW1-59	4.9721	1005.9	9.6696	956.29	16.142	1254.3	1.4747	1155.2	2.8609												
SBW1-60	7.6618	1007.5	15.92	957.82	27.952	1255.9	2.0912	1156.5	4.1465												
SBW1-61	5.893	1005.1	11.93	955.45	20.586	1254.4	1.6884	1155.5	3.2839												
SBW1-62	4.9358	1004.5	9.7052	954.89	16.273	1252.8	1.4419	1153.4	2.8005												
SBW1-63	17.959	1007.7	39.496	958.04	72.978	1256.1	4.4612	1157.1	9.3947												
SBW1-64	15.251	1007.7	38.414	958.09	78.728	1256	3.0691	1156.4	7.2017												

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
SBW1-44B					0.908	0.998	1.078	0.360	11.39							
SBW1-45					15.272		14.267	1.701	10.71							
SBW1-46					0.520	0.422	0.461	0.162	10.525							
SBW1-47					0.516	0.435	0.478	0.131	10.765							
SBW1-48					0.602	0.462	0.392	0.131	9.33							
SBW1-49					2.587	2.233	2.028	0.418	11.36							
SBW1-50					0.961	0.899	0.893	0.240	10.935							
SBW1-51					0.191	0.234	0.289	0.114	10.23							
SBW1-52					0.461	0.508	0.325	0.105	9.89							
SBW1-53					0.402	0.435	0.469	0.222	10.78							
SBW1-54					0.449	0.491	0.389	0.166	10.34							
SBW1-55					0.455	0.461	0.583	0.168	10.88							
SBW1-56					0.569	0.492	0.597	0.203	10.905							
SBW1-57					0.661	0.616	0.458	0.173	10.385							
SBW1-58					0.859	0.715	0.810	0.203	10.99							
SBW1-59					1.295	0.983	1.158	0.263	11.48							
SBW1-60					0.415	0.434	0.319	0.149	10.335							
SBW1-61					0.604	0.538	0.660	0.184	10.56							
SBW1-62					1.033	0.768	1.019	0.253	11.24							
SBW1-63					0.576	0.646	0.165	0.355	9.845							
SBW1-64					1.868	1.618	0.891	0.340	10.395							

SBW CVS Phase 1 (Scholes et al. 2002)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
SBW1-44B												
SBW1-45												
SBW1-46												
SBW1-47												
SBW1-48												
SBW1-49												
SBW1-50												
SBW1-51												
SBW1-52												
SBW1-53												
SBW1-54												
SBW1-55												
SBW1-56												
SBW1-57												
SBW1-58												
SBW1-59												
SBW1-60												
SBW1-61												
SBW1-62												
SBW1-63												
SBW1-64												

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	Al2O3 -t	B2O3 -t	CaO -t	Fe2O3 -t	FeO -t	K2O -t	Li2O -t	MgO -t	Na2O -t	NiO -t	P2O5 -t	SiO2 -t	ZrO2 -t	Ag2O -t	As2O3 -t	BaO -t	Bi2O3 -t	Br -t	CdO -t	Ce2O3 -t	CeO2 -t
SBW-11-18.5	0.0510	0.0997	0.0449	0.0150		0.0140	0.0498	0.0150	0.1117	0.0002	0.0015	0.5235	0.0199			0.0000			0.0001		
SBW-11-30	0.0827	0.0861	0.0416	0.0149		0.0226	0.0428	0.0134	0.1693	0.0003	0.0024	0.4496	0.0171			0.0000			0.0002		
SBW-12-18.5	0.0510	0.0498	0.0449	0.0150		0.0140	0.0498	0.0150	0.1531	0.0002	0.0015	0.5320	0.0199			0.0000			0.0001		
SBW-13-18.5	0.0510	0.0997	0.0040	0.0150		0.0804	0.0498	0.0007	0.1117	0.0002	0.0015	0.5122	0.0199			0.0000			0.0001		
SBW-14-18.5	0.0510	0.1184	0.0449	0.0150		0.0140	0.0498	0.0150	0.1117	0.0002	0.0015	0.5445	0.0199			0.0000			0.0001		
SBW-15-18.5	0.0510	0.0577	0.0692	0.0678		0.0140	0.0489	0.0007	0.1532	0.0002	0.0015	0.5216	0.0000			0.0000			0.0001		
SBW-16-18.5	0.0510	0.0498	0.0449	0.0150		0.0140	0.0498	0.0150	0.1312	0.0002	0.0015	0.5538	0.0199			0.0000			0.0001		
SBW-17-18.5	0.0510	0.0984	0.0203	0.1004		0.0140	0.0326	0.0007	0.0962	0.0002	0.0015	0.5705	0.0000			0.0000			0.0001		
SBW-18-18.5	0.0510	0.0984	0.0203	0.1004		0.0140	0.0245	0.0007	0.1288	0.0002	0.0015	0.5216	0.0082			0.0000			0.0001		
SBW-19-18.5	0.0510	0.0984	0.0203	0.1004		0.0140	0.0245	0.0007	0.1288	0.0002	0.0015	0.5053	0.0082			0.0000			0.0001		
SBW-20-18.5	0.0510	0.0984	0.0366	0.1004		0.0140	0.0245	0.0007	0.1288	0.0002	0.0015	0.4890	0.0082			0.0000			0.0001		
SBW-21-18.5	0.0510	0.0821	0.0366	0.1004		0.0140	0.0245	0.0007	0.1288	0.0002	0.0015	0.5053	0.0082			0.0000			0.0001		
SBW-22-15	0.0414	0.0518	0.0459	0.0150		0.0113	0.0519	0.0155	0.1145	0.0001	0.0012	0.5776	0.0208			0.0000			0.0001		
SBW-22-18.5	0.0510	0.0498	0.0449	0.0150		0.0140	0.0498	0.0150	0.1312	0.0002	0.0015	0.5538	0.0199			0.0000			0.0001		
SBW-22-20	0.0551	0.0490	0.0445	0.0150		0.0151	0.0489	0.0148	0.1384	0.0002	0.0016	0.5436	0.0195			0.0000			0.0002		
SBW-22-25	0.0689	0.0461	0.0430	0.0149		0.0189	0.0458	0.0141	0.1622	0.0002	0.0020	0.5096	0.0183			0.0000			0.0002		
SBW-23-15	0.0414	0.1038	0.0032	0.0150		0.0480	0.0519	0.0006	0.0941	0.0001	0.0012	0.5668	0.0208			0.0000			0.0001		
SBW-23-18.5	0.0510	0.0997	0.0040	0.0150		0.0492	0.0498	0.0007	0.1117	0.0002	0.0015	0.5435	0.0199			0.0000			0.0001		
SBW-23-20	0.0551	0.0979	0.0043	0.0150		0.0496	0.0489	0.0008	0.1192	0.0002	0.0016	0.5335	0.0195			0.0000			0.0002		
SBW-23-25	0.0689	0.0920	0.0054	0.0149		0.0512	0.0458	0.0010	0.1442	0.0002	0.0020	0.5001	0.0183			0.0000			0.0002		
SBW-24-18.5	0.0510	0.0911	0.0449	0.0150		0.0140	0.0498	0.0150	0.1117	0.0002	0.0015	0.5718	0.0199			0.0000			0.0001		
SBW-25-15	0.0414	0.1038	0.0459	0.1041		0.0113	0.0292	0.0155	0.0780	0.0001	0.0012	0.4958	0.0208			0.0000			0.0001		
SBW-25-18.5	0.0510	0.0997	0.0449	0.1004		0.0140	0.0280	0.0150	0.0962	0.0002	0.0015	0.4753	0.0199			0.0000			0.0001		
SBW-25-20	0.0551	0.0979	0.0445	0.0988		0.0151	0.0275	0.0148	0.1040	0.0002	0.0016	0.4666	0.0195			0.0000			0.0002		
SBW-25-25	0.0689	0.0920	0.0430	0.0935		0.0189	0.0258	0.0141	0.1300	0.0002	0.0020	0.4374	0.0183			0.0000			0.0002		
SBW-26-18.5	0.0510	0.0498	0.1196	0.0150		0.0140	0.0287	0.0150	0.1117	0.0002	0.0015	0.5197	0.0199			0.0000			0.0001		
SBW-27-18.5	0.0510	0.0498	0.0997	0.0150		0.0140	0.0333	0.0150	0.1117	0.0002	0.0015	0.5152	0.0199			0.0000			0.0001		

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	Cl -t	CoO -t	Co2O3 -t	Cr2O3 -t	Cs2O -t	CuO -t	Eu2O3 -t	F -t	Ga2O3 -t	Gd2O3 -t	HgO -t	I -t	La2O3 -t	MnO2 -t	MnO -t	MoO -t	MoO3 -t	Nb2O5 -t	Nd2O3 -t	PbO -t	PdO2 -t
SBW-11-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-11-30	0.0026			0.0006		0.0002		0.0022		0.0001					0.0024		0.0001			0.0007	
SBW-12-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-13-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-14-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-15-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-16-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-17-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-18-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-19-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-20-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-21-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-22-15	0.0013			0.0003		0.0001		0.0011		0.0000					0.0012		0.0000			0.0004	
SBW-22-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-22-20	0.0017			0.0004		0.0001		0.0015		0.0001					0.0016		0.0000			0.0005	
SBW-22-25	0.0022			0.0005		0.0001		0.0018		0.0001					0.0020		0.0001			0.0006	
SBW-23-15	0.0013			0.0003		0.0001		0.0011		0.0000					0.0012		0.0000			0.0004	
SBW-23-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-23-20	0.0017			0.0004		0.0001		0.0015		0.0001					0.0016		0.0000			0.0005	
SBW-23-25	0.0022			0.0005		0.0001		0.0018		0.0001					0.0020		0.0001			0.0006	
SBW-24-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-25-15	0.0013			0.0003		0.0001		0.0011		0.0000					0.0012		0.0000			0.0004	
SBW-25-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-25-20	0.0017			0.0004		0.0001		0.0015		0.0001					0.0016		0.0000			0.0005	
SBW-25-25	0.0022			0.0005		0.0001		0.0018		0.0001					0.0020		0.0001			0.0006	
SBW-26-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	
SBW-27-18.5	0.0016			0.0004		0.0001		0.0014		0.0001					0.0015		0.0000			0.0004	

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	PdO -t	Pr2O3 -t	Pr6O11 -t	Rb2O -t	ReO -t	ReO2 -t	Rh2O3 -t	RhO2 -t	RuO2 -t	Sb2O3 -t	Sb2O5 -t	SeO2 -t	Sm2O3 -t	SnO -t	SnO2 -t	SO3 -t	SrO -t	Tc2O7 -t	TeO2 -t	ThO2 -t	TiO2 -t
SBW-11-18.5																0.0084					
SBW-11-30																0.0137					
SBW-12-18.5																0.0084					
SBW-13-18.5																0.0084					
SBW-14-18.5																0.0084					
SBW-15-18.5																0.0084					
SBW-16-18.5																0.0084					
SBW-17-18.5																0.0084					
SBW-18-18.5																0.0084					
SBW-19-18.5																0.0084					
SBW-20-18.5																0.0084					
SBW-21-18.5																0.0084					
SBW-22-15																0.0068					
SBW-22-18.5																0.0084					
SBW-22-20																0.0091					
SBW-22-25																0.0114					
SBW-23-15																0.0068					
SBW-23-18.5																0.0084					
SBW-23-20																0.0091					
SBW-23-25																0.0114					
SBW-24-18.5																0.0084					
SBW-25-15																0.0068					
SBW-25-18.5																0.0084					
SBW-25-20																0.0091					
SBW-25-25																0.0114					
SBW-26-18.5																0.0084					
SBW-27-18.5																0.0084					

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	Tl2O3 -t	U3O8 -t	UO2 -t	UO3 -t	V2O5 -t	WO3 -t	Y2O3 -t	ZnO -t	Others -t	Sum -t	Al2O3 -a	B2O3 -a	CaO -a	Fe2O3 -a	FeO -a	K2O -a	Li2O -a	MgO -a	Na2O -a	NiO -a	P2O5 -a
SBW-11-18.5					0.0399			0.0000		1.0000	0.0533	0.1060	0.0465	0.0163		0.0121	0.0527	0.0159	0.1100		
SBW-11-30					0.0344			0.0000		1.0000											
SBW-12-18.5					0.0399			0.0000		1.0000	0.0516	0.0486	0.0456	0.0150		0.0148	0.0488	0.0150	0.1540	0.0003	
SBW-13-18.5					0.0399			0.0000		1.0000	0.0505	0.0921	0.0039	0.0144		0.0822	0.0475	0.0005	0.1110	0.0002	
SBW-14-18.5					0.0001			0.0000		1.0000	0.0512	0.1130	0.0456	0.0150		0.0149	0.0486	0.0150	0.1120	0.0002	
SBW-15-18.5					0.0001			0.0000		1.0000	0.0508	0.0554	0.0701	0.0683		0.0145	0.0477	0.0045	0.1490	0.0002	
SBW-16-18.5					0.0399			0.0000		1.0000	0.0512	0.1080	0.0619	0.0031		0.0145	0.0473	0.0005	0.1130	0.0003	
SBW-17-18.5					0.0001			0.0000		1.0000	0.0523	0.1000	0.0180	0.0959		0.0124	0.0321		0.0987		
SBW-18-18.5					0.0164			0.0000		1.0000	0.0524	0.0989	0.0177	0.0969		0.0127	0.0218		0.1240		
SBW-19-18.5					0.0327			0.0000		1.0000	0.0533	0.0986	0.0180	0.0989		0.0128	0.0214		0.1260		
SBW-20-18.5					0.0327			0.0000		1.0000	0.0530	0.0985	0.0371	0.1000		0.0127	0.0213		0.1260		
SBW-21-18.5					0.0327			0.0000		1.0000	0.0542	0.0829	0.0382	0.1010		0.0127	0.0210		0.1260		
SBW-22-15					0.0416			0.0000		1.0000	0.0427	0.0528	0.0423	0.0176		0.0125	0.0497	0.0161	0.1129	0.0002	0.0013
SBW-22-18.5					0.0399			0.0000		1.0000	0.0518	0.0489	0.0406	0.0150		0.0149	0.0479	0.0152	0.1281	0.0002	0.0015
SBW-22-20					0.0392			0.0000		1.0000	0.0563	0.0467	0.0407	0.0147		0.0166	0.0462	0.0151	0.1350	0.0002	0.0017
SBW-22-25					0.0368			0.0000		1.0000	0.0703	0.0435	0.0400	0.0149		0.0210	0.0430	0.0146	0.1620	0.0002	0.0021
SBW-23-15					0.0416			0.0000		1.0000	0.0412	0.1020		0.0167		0.0427	0.0544	0.0004	0.0932	0.0002	0.0017
SBW-23-18.5					0.0399			0.0000		1.0000	0.0516	0.0972	0.0017	0.0163		0.0438	0.0528	0.0006	0.1110	0.0002	0.0020
SBW-23-20					0.0392			0.0000		1.0000	0.0554	0.0955	0.0015	0.0167		0.0450	0.0522	0.0006	0.1180	0.0002	0.0021
SBW-23-25					0.0368			0.0000		1.0000	0.0675	0.0884	0.0025	0.0166		0.0446	0.0485	0.0009	0.1410	0.0003	0.0024
SBW-24-18.5					0.0001			0.0000		1.0000											
SBW-25-15					0.0416			0.0000		1.0000	0.0418	0.1010	0.0494	0.1030		0.0112	0.0295	0.0155	0.0760	0.0001	0.0017
SBW-25-18.5					0.0399			0.0000		1.0000	0.0516	0.0959	0.0473	0.0998		0.0145	0.0277	0.0150	0.0952	0.0003	0.0019
SBW-25-20					0.0392			0.0000		1.0000	0.0559	0.0966	0.0484	0.1000		0.0145	0.0275	0.0149	0.1060	0.0002	0.0021
SBW-25-25					0.0368			0.0000		1.0000	0.0686	0.0911	0.0473	0.0978		0.0184	0.0258	0.0144	0.1240	0.0002	0.0025
SBW-26-18.5					0.0399			0.0000		1.0000											
SBW-27-18.5					0.0598			0.0000		1.0000											

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	SiO2 -a	ZrO2 -a	Ag2O -a	As2O3 -a	BaO -a	Bi2O3 -a	Br -a	CdO -a	Ce2O3 -a	CeO2 -a	Cl -a	CoO -a	Co2O3 -a	Cr2O3 -a	Cs2O -a	CuO -a	Eu2O3 -a	F -a	Ga2O3 -a	Gd2O3 -a	HgO -a
SBW-11-18.5	0.5410	0.0189												0.0004		0.0001				0.0001	
SBW-11-30																					
SBW-12-18.5	0.5410	0.0197												0.0004		0.0001					
SBW-13-18.5	0.5240	0.0196												0.0004		0.0001					
SBW-14-18.5	0.5430	0.0194												0.0004		0.0001					
SBW-15-18.5	0.5240	0.0002												0.0004		0.0001					
SBW-16-18.5	0.5710	0.0001												0.0006		0.0001					
SBW-17-18.5	0.5360	0.0000												0.0003		0.0001					
SBW-18-18.5	0.5140	0.0074												0.0003		0.0001					
SBW-19-18.5	0.5090	0.0076												0.0003		0.0001					
SBW-20-18.5	0.4990	0.0078												0.0004		0.0001					
SBW-21-18.5	0.5170	0.0076												0.0005		0.0001					
SBW-22-15	0.5842	0.0196												0.0003		0.0000				0.0001	
SBW-22-18.5	0.5393	0.0182												0.0007		0.0001				0.0001	
SBW-22-20	0.5500	0.0182												0.0006		0.0001				0.0001	
SBW-22-25	0.5222	0.0176												0.0006		0.0001				0.0001	
SBW-23-15	0.5630	0.0201												0.0003		0.0003				0.0001	
SBW-23-18.5	0.5240	0.0192												0.0004		0.0003				0.0001	
SBW-23-20	0.5240	0.0190												0.0005		0.0003				0.0001	
SBW-23-25	0.4990	0.0182												0.0005		0.0003				0.0001	
SBW-24-18.5																					
SBW-25-15	0.4860	0.0201												0.0003		0.0003					
SBW-25-18.5	0.4580	0.0190												0.0005		0.0010				0.0001	
SBW-25-20	0.4240	0.0200												0.0014		0.0003					
SBW-25-25	0.4560	0.0178												0.0007		0.0004					
SBW-26-18.5																					
SBW-27-18.5																					

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	I -a	La2O3 -a	MnO2 -a	MnO -a	MoO -a	MoO3 -a	Nb2O5 -a	Nd2O3 -a	PbO -a	PdO2 -a	PdO -a	Pr2O3 -a	Pr6O11 -a	Rb2O -a	ReO -a	ReO2 -a	Rh2O3 -a	RhO2 -a	RuO2 -a	Sb2O3 -a	Sb2O5 -a
SBW-11-18.5				0.0014																	
SBW-11-30																					
SBW-12-18.5				0.0015					0.0005												
SBW-13-18.5				0.0015					0.0004												
SBW-14-18.5				0.0015					0.0004												
SBW-15-18.5									0.0005												
SBW-16-18.5				0.0015					0.0004												
SBW-17-18.5				0.0014					0.0004												
SBW-18-18.5				0.0014					0.0004												
SBW-19-18.5				0.0014					0.0004												
SBW-20-18.5				0.0014					0.0004												
SBW-21-18.5				0.0014					0.0004												
SBW-22-15				0.0012		0.0010			0.0004												
SBW-22-18.5				0.0014		0.0010			0.0004												
SBW-22-20				0.0015		0.0010			0.0005												
SBW-22-25				0.0020		0.0009			0.0006												
SBW-23-15				0.0012					0.0003												
SBW-23-18.5				0.0015					0.0004												
SBW-23-20				0.0016					0.0005												
SBW-23-25				0.0020		0.0001			0.0006												
SBW-24-18.5																					
SBW-25-15				0.0012					0.0004												
SBW-25-18.5				0.0015		0.0001			0.0007												
SBW-25-20				0.0016		0.0001			0.0005												
SBW-25-25				0.0021		0.0001			0.0006												
SBW-26-18.5																					
SBW-27-18.5																					

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	SeO2 -a	Sm2O3 -a	SnO -a	SnO2 -a	SO3 -a	SrO -a	Tc2O7 -a	TeO2 -a	ThO2 -a	TiO2 -a	Tl2O3 -a	U3O8 -a	UO2 -a	UO3 -a	V2O5 -a	WO3 -a	Y2O3 -a	ZnO -a	Others -a	Sum -a
SBW-11-18.5					0.0075										0.0396					1.0217
SBW-11-30																				0.0000
SBW-12-18.5					0.0082															0.9651
SBW-13-18.5					0.0082															0.9565
SBW-14-18.5					0.0072															0.9876
SBW-15-18.5					0.0084															0.9941
SBW-16-18.5					0.0074															0.9808
SBW-17-18.5					0.0048										0.0009					0.9532
SBW-18-18.5					0.0060										0.0164					0.9704
SBW-19-18.5					0.0057										0.0324					0.9860
SBW-20-18.5					0.0059										0.0331					0.9966
SBW-21-18.5					0.0058										0.0329					1.0017
SBW-22-15					0.0060										0.0401			0.0000		1.0009
SBW-22-18.5					0.0074										0.0374			0.0000		0.9701
SBW-22-20					0.0081										0.0369			0.0000		0.9901
SBW-22-25					0.0107										0.0349			0.0000		1.0012
SBW-23-15					0.0061										0.0377			0.0002		0.9818
SBW-23-18.5					0.0078										0.0357			0.0001		0.9668
SBW-23-20					0.0084										0.0357			0.0001		0.9774
SBW-23-25					0.0112										0.0325			0.0001		0.9773
SBW-24-18.5																				0.0000
SBW-25-15					0.0051										0.0381			0.0002		0.9809
SBW-25-18.5					0.0058										0.0357			0.0004		0.9720
SBW-25-20					0.0059										0.0359			0.0001		0.9560
SBW-25-25					0.0085										0.0340			0.0002		1.0104
SBW-26-18.5																				0.0000
SBW-27-18.5																				0.0000

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	TM (°C)	Gradient TL (°C)	Uniform TL (°C)	Primary Phase	Quenched Visual/OM	Quenched SEM/EDS or TEM	Quenched XRD	Quenched Homogeneous?
SBW-11-18.5								
SBW-11-30								
SBW-12-18.5								
SBW-13-18.5								
SBW-14-18.5								
SBW-15-18.5								
SBW-16-18.5								
SBW-17-18.5								
SBW-18-18.5								
SBW-19-18.5								
SBW-20-18.5								
SBW-21-18.5								
SBW-22-15								
SBW-22-18.5								
SBW-22-20								
SBW-22-25								
SBW-23-15								
SBW-23-18.5								
SBW-23-20								
SBW-23-25								
SBW-24-18.5								
SBW-25-15								
SBW-25-18.5								
SBW-25-20								
SBW-25-25								
SBW-26-18.5								
SBW-27-18.5								

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	CCC Visual/OM	CCC SEM/EDS or TEM	CCC XRD	Heat Treated Visual/OM	Heat Treated SEM/EDS or TEM
SBW-11-18.5					
SBW-11-30					
SBW-12-18.5					
SBW-13-18.5					
SBW-14-18.5					
SBW-15-18.5					
SBW-16-18.5					
SBW-17-18.5					
SBW-18-18.5					
SBW-19-18.5					
SBW-20-18.5					
SBW-21-18.5					
SBW-22-15					
SBW-22-18.5					
SBW-22-20					
SBW-22-25					
SBW-23-15					
SBW-23-18.5					
SBW-23-20					
SBW-23-25					
SBW-24-18.5					
SBW-25-15					
SBW-25-18.5					
SBW-25-20					
SBW-25-25					
SBW-26-18.5					
SBW-27-18.5					

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	Heat Treated XRD	Density (g/cm^3)	Fulc Visc A	Fulc Visc B	Fulc Visc To	FV 1150°C (Pa·s)	Arrh Visc A	Arrh Visc B	AV 1150°C (Pa·s)	T (°C) at 2 Pa·s	T (°C) at 5 Pa·s	T (°C) at 10 Pa·s	T1 (°C)	V1 (Pa·s)	T2 (°C)
SBW-11-18.5							-8.682	14283.8	3.88				1150	3.9202	1095.5
SBW-11-30															
SBW-12-18.5															
SBW-13-18.5															
SBW-14-18.5															
SBW-15-18.5															
SBW-16-18.5															
SBW-17-18.5							-8.353	15801.1	15.66				1150	16.392	1089
SBW-18-18.5															
SBW-19-18.5															
SBW-20-18.5							-8.934	15147.9	5.53				1154.5	5.3519	1100.5
SBW-21-18.5							-8.488	14810.3	6.82				1148.5	6.9857	1090
SBW-22-15							-10.123	17398.0	8.20				1150	8.2552	1094.5
SBW-22-18.5							-10.122	17137.9	6.83				1151.5	6.7105	1098.5
SBW-22-20							-9.986	16871.6	6.49				1154	6.2008	1098
SBW-22-25							-9.954	16499.6	5.16				1145.5	5.3027	1091.5
SBW-23-15															
SBW-23-18.5							-9.350	15767.2	5.64				1150	5.6384	1099
SBW-23-20															
SBW-23-25															
SBW-24-18.5															
SBW-25-15															
SBW-25-18.5							-10.796	17984.2	6.31				1145	6.5209	1094.5
SBW-25-20							-10.215	17032.8	5.78				1151.1	5.5963	1094.5
SBW-25-25							-9.426	15478.7	4.27				1150.5	4.2057	1097
SBW-26-18.5							-11.308	18781.8	6.63				1149.5	6.5778	1082
SBW-27-18.5							-10.962	18222.3	6.32				1151	6.3862	1096

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	V2 (Pa·s)	T3 (°C)	V3 (Pa·s)	T4 (°C)	V4 (Pa·s)	T5 (°C)	V5 (Pa·s)	T6 (°C)	V6 (Pa·s)	T7 (°C)	V7 (Pa·s)	T8 (°C)	V8 (Pa·s)	T9 (°C)	V9 (Pa·s)	T10 (°C)	V10 (Pa·s)	T11 (°C)	V11 (Pa·s)	T12 (°C)	V12 (Pa·s)
SBW-11-18.5	5.7763	1043	8.7052	1150.5	3.8799	1206	2.604	1151.1	3.8987												
SBW-11-30																					
SBW-12-18.5																					
SBW-13-18.5																					
SBW-14-18.5																					
SBW-15-18.5																					
SBW-16-18.5																					
SBW-17-18.5	25.515	1046	37.396	1147	15.839	1199.5	10.522	1150	15.72												
SBW-18-18.5																					
SBW-19-18.5																					
SBW-20-18.5	8.4352	1046	12.476	1150.5	5.5187	1201	3.75	1150	5.5791												
SBW-21-18.5	11.477	1052.5	13.943	1147	6.9505	1201	4.6296	1152	6.7486												
SBW-22-15	13.366	1048	21.184	1152	8.0016	1200.5	5.4136	1151	8.1037												
SBW-22-18.5	10.681	1050	17.074	1152	6.719	1201	4.5329	1150	6.8233												
SBW-22-20	10.098	1052	15.724	1151.5	6.4145	1207	4.1454	1150	6.5172												
SBW-22-25	8.3954	1044.5	13.153	1151	5.103	1201	3.4698	1150	5.2039												
SBW-23-15																					
SBW-23-18.5	8.6219	1043	13.79	1149.5	5.6198	1204	3.7453	1151	5.6558												
SBW-23-20																					
SBW-23-25																					
SBW-24-18.5																					
SBW-25-15																					
SBW-25-18.5	10.507	1045.5	17.341	1150	6.2901	1207	3.9333	1151.5	6.2072												
SBW-25-20	9.3449	1043.5	15.489	1150	5.6779	1216	3.4956														
SBW-25-25	6.3985	1037	10.918	1152	4.2623	1208	2.7463	1149.5	4.4149												
SBW-26-18.5	12.804	1047.5	18.738	1151	6.5046	1202.5	4.2596	1150	6.5074												
SBW-27-18.5	10.561	1047.5	17.05	1149	6.273	1200	4.1094	1148	6.3546												

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	T13 (°C)	V13 (Pa·s)	T14 (°C)	V14 (Pa·s)	Q PCT B (g/m^2)	Q PCT Li (g/m^2)	Q PCT Na (g/m^2)	Q PCT Si (g/m^2)	Q PCT pH	CCC PCT B (g/m^2)	CCC PCT Li (g/m^2)	CCC PCT Na (g/m^2)	CCC PCT Si (g/m^2)	CCC PCT pH	Q PCT B at 20°C (g/m^2)	Q PCT Li at 20°C (g/m^2)
SBW-11-18.5					1.428	1.468	1.307	0.496		1.257	1.305	1.177	0.465			
SBW-11-30					0.598	0.558	0.720	0.251		0.494	0.514	0.604	0.226			
SBW-12-18.5					0.541	0.836	0.911	0.357		0.526	0.804	0.830	0.344			
SBW-13-18.5					14.883	13.479	13.341	4.165		14.928	13.467	13.334	4.177			
SBW-14-18.5					1.051	1.009	0.948	0.397		0.913	0.902	0.844	0.369			
SBW-15-18.5					0.298	0.614	0.691	0.165		0.232	0.546	0.564	0.142			
SBW-16-18.5					0.186	0.306	0.293	0.126		0.135	0.248	0.226	0.105			
SBW-17-18.5					0.176	0.299	0.194	0.136		0.124	0.212	0.143	0.109			
SBW-18-18.5					0.191	0.275	0.223	0.127		0.290	0.359	0.310	0.161			
SBW-19-18.5					0.454	0.509	0.421	0.186		0.437	0.499	0.406	0.187			
SBW-20-18.5					0.341	0.417	0.367	0.162		0.290	0.378	0.325	0.149			
SBW-21-18.5					0.230	0.344	0.301	0.144		0.240	0.349	0.315	0.149			
SBW-22-15					0.824	0.939	0.858	0.427		0.569	0.724	0.649	0.343			
SBW-22-18.5					0.350	0.578	0.558	0.258		0.365	0.596	0.548	0.265			
SBW-22-20					0.388	0.617	0.611	0.267		0.299	0.547	0.516	0.236			
SBW-22-25					0.376	0.721	0.803	0.302		0.341	0.694	0.714	0.285			
SBW-23-15					7.049	7.020	4.338	1.677		6.754	6.647	4.160	1.629			
SBW-23-18.5					7.500	6.998	6.318	1.894		7.013	7.080	5.234	1.894			
SBW-23-20					8.285	7.128	6.893	2.076		7.694	6.671	6.440	1.980			
SBW-23-25					8.841	7.368	9.441	2.298		7.730	6.503	8.155	2.067			
SBW-24-18.5					0.722	0.760	0.719	0.328		0.664	0.668	0.625	0.311			
SBW-25-15					0.750	0.654	0.429	0.200		0.516	0.472	0.303	0.169			
SBW-25-18.5					0.363	0.450	0.371	0.150		0.329		0.309	0.142			
SBW-25-20					0.389	0.367	0.351	0.139		0.374	0.356	0.351	0.139			
SBW-25-25					0.357	0.337	0.489	0.135		0.339	0.335	0.467	0.135			
SBW-26-18.5																
SBW-27-18.5																

SBW Melter Glass Formulation (Vienna et al. 2002)

Glass ID	Q PCT Na at 20°C (g/m^2)	Q PCT Si at 20°C (g/m^2)	Q pH at 20°C	TCLP Ag (ppm)	TCLP As (ppm)	TCLP Ba (ppm)	TCLP Cd (ppm)	TCLP Cr (ppm)	TCLP Ni (ppm)	TCLP Pb (ppm)	TCLP Se (ppm)	TCLP Zn (ppm)
SBW-11-18.5												
SBW-11-30												
SBW-12-18.5												
SBW-13-18.5												
SBW-14-18.5												
SBW-15-18.5												
SBW-16-18.5												
SBW-17-18.5												
SBW-18-18.5												
SBW-19-18.5												
SBW-20-18.5												
SBW-21-18.5												
SBW-22-15												
SBW-22-18.5												
SBW-22-20												
SBW-22-25												
SBW-23-15												
SBW-23-18.5												
SBW-23-20												
SBW-23-25												
SBW-24-18.5												
SBW-25-15												
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