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Expanded High-Level Waste Glass Property Data Development: Phase I

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January 2011

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Summary

This report summarizes and analyzes the data collected on a first matrix of glasses intended to expand the composition region over which high-level waste glass property models are valid. These glasses consisted of a one-component-at-a-time variation around a baseline glass where the following components were varied: Al_2O_3, B_2O_3, Bi_2O_3, CaO, Cr_2O_3, F, Fe_2O_3, K, Li_2O, MnO, Na_2O, NiO, P_2O_5, SiO_2, ZrO_2, and noble metal oxides (i.e., PdO + RuO_2 + Rh_2O_3). The analysis performed on these glasses include chemical composition (for target compositional verification), viscosity, electrical conductivity, liquidus temperature, equilibrium crystal fraction, canister centerline cooling with crystal identification, product consistency test, and toxicity characteristic leach procedure.

This report also includes data obtained for Hanford High Alumina (HAL) glasses formulated and tested as a part of DOE EM-31 Office of Waste Processing International Glass Program to develop high waste-loaded glasses for Hanford high-alumina high-level wastes.

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Acronyms & Abbreviations

AES	atomic emission spectroscopy
APEL	Applied Process Engineering Laboratory
APEL-PAD-V	operation manual for APEL XRD
ARM	Approved Reference Material
Ave.	average
bc	bias-corrected
CCC	canister centerline cooling heat treatment
C_F	crystal fraction
EA	Environmental Assessment
EC	electrical conductivity
EPA	U.S. Environmental Protection Agency
η	viscosity
GDL-ECC	Electrical Conductivity Calibration Procedure for Molten Glass
GDL-ELC	Electrical Conductivity Measurement Procedure
GDL-GBM	Glass Batching and Melting Procedure
GDL-HTR	Heat Treatment of Glass Procedure
GDL-LQT	Standard Test Methods for Determining Liquidus Temperature of Waste Glasses and Simulant Waste Glasses
GDL-VIS	Glass Development Laboratory Viscosity Measurement Procedure for Vitrified Nuclear Waste
GDL-VSC	Standard Viscosity Calibration Procedure
GDL-XRD	Glass Development Laboratory XRD Semiquantitative Analysis Procedure
HLW	high-level waste
Hz	hertz (electrical frequency unit)
IA	image analysis
ICP-AES	inductively coupled plasma – atomic emissions spectroscopy
LM	lithium metaborate ($LiBO_2$)
LRM	low-activity waste reference material
NM	noble metals
OM	optical microscopy
PCT	product consistency test
PF	peroxide fusion
PH	potassium hydroxide
PNNL	Pacific Northwest National Laboratory
RCRA	Resource Conservation and Recovery Act

RDL	reporting detection limits
rpm	revolutions per minute
SEM	scanning electron microscope or scanning electron microscopy
σ	electrical conductivity
SRNL	Savannah River National Laboratory
SRS	Savannah River Site
St. Dev.	standard deviation
T_a	upper bound of liquidus temperature (amorphous specimen)
T_c	lower bound of liquidus temperature (crystallized specimen)
TCLP	toxicity characteristic leaching procedure
T_L	liquidus temperature
UTS	Universal Treatment Standard
WCP	waste compliance plan
XRD	X-ray diffraction

1.0 Introduction

Two separate test matrices were developed as part of a U.S. Department of Energy (DOE), Office of Environmental Management (EM), Office of Engineering and Technology (EM-21, now Office of Technology Development & Innovation, EM-31) study to expand the range of waste glass property models to allow for prediction of properties for higher waste loaded glasses to potentially be processed at the Savannah River Site (SRS) and Hanford. This initial study included the development and testing of glasses in two matrices. The first matrix, developed using a single component-at-a-time design method and covering glasses of interest primarily to Hanford, is addressed in this report. The second matrix which was developed using a statistical design and covering glasses of interest primarily to SRS, was documented at Savannah River National Laboratory (SRNL) (Raszewski et al. 2008a). Test activities were performed jointly at the Pacific Northwest National Laboratory (PNNL) and the SRNL as described in Table 1.1.

Table 1.1. Description of Matrix Testing Responsibilities

Activity	Matrix I	Matrix II
Matrix design	PNNL	SRNL
Glass fabrication	PNNL	SRNL
Canister centerline cooling (CCC)	PNNL	SRNL
Crystal identification after canister centerline heat treatment	PNNL	PNNL
Liquidus temperature (T_L)	PNNL	PNNL
Crystal fraction (C_F) vs temperature	PNNL	PNNL*
Viscosity (η) vs temperature	PNNL	SRNL
Electrical conductivity (σ) vs temperature	PNNL	N/A
Chemical composition analyses	SRNL	SRNL
Product consistency test (PCT) analyses	SRNL	SRNL
Toxicity characteristic leaching procedure (TCLP)	SRNL	N/A
Matrix glass number	47	22

*this analysis was performed on 3 of the glasses
N/A: not applicable

This report summarizes the experimental methods to fabricate, heat treat, and test 48 Matrix I glasses prepared at PNNL. Originally, 38 glasses (including a duplicated baseline glass [EM07-BL-1 and BL-2]) were fabricated in 2007 and due to some gaps in the data, 10 extra glasses were fabricated in 2009 to complete the study. One of the glasses from the original set (EM07-P-025) was removed from this data package due to experimental difficulties. Therefore, 47 total glasses are reported. Measured properties related to glass performance and melter processing are described in this report and Appendices.

Additionally, Appendix G summarizes the target glass composition and the results of crystal identification and product consistency test (PCT) of the 25 high alumina (HAL) glasses developed for the DOE Office of Waste Processing International Glass Program to develop high waste-loaded glasses for Hanford high-alumina high-level wastes (HLW). Two glass compositions were selected from this study to test in Russian research scale melters (see Appendix G for details).

The data acquired in this study was used to generate preliminary models for some of the properties (viscosity, liquidus temperature and electrical conductivity) to confirm testing results and were included in a revised glass property model by Vienna et al. (2009). The targeted glass compositions (in mass fractions) are listed in Table 1.2.

Table 1.2. Targeted Compositions.

Glass ID	BL-1 / BL-2	Al-06	Al-15	Al-20	Al-225	B-05	B-125	B-15	B-175	B-20	Bi-025	Bi-05	Ca-035	Ca-07
Al_2O_3	0.10000	**0.06000**	**0.15000**	**0.20000**	**0.22500**	0.10556	0.09722	0.09444	0.09167	0.08889	0.09750	0.09500	0.09650	0.09300
B_2O_3	0.10000	0.10444	0.09444	0.08889	0.08611	**0.05000**	**0.12500**	**0.15000**	**0.17500**	**0.20000**	0.09750	0.09500	0.09650	0.09300
BaO	0.00050	0.00052	0.00047	0.00044	0.00043	0.00053	0.00049	0.00047	0.00046	0.00044	0.00049	0.00048	0.00048	0.00047
Bi_2O_3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	**0.02500**	**0.05000**	0.00000	0.00000
CaO	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	**0.03500**	**0.07000**
CdO	0.00140	0.00146	0.00132	0.00124	0.00121	0.00148	0.00136	0.00132	0.00128	0.00124	0.00137	0.00133	0.00135	0.00130
Ce_2O_3	0.00050	0.00052	0.00047	0.00044	0.00043	0.00053	0.00049	0.00047	0.00046	0.00044	0.00049	0.00048	0.00048	0.00047
Cr_2O_3	0.00500	0.00522	0.00472	0.00444	0.00431	0.00528	0.00486	0.00472	0.00458	0.00444	0.00488	0.00475	0.00483	0.00465
F	0.00100	0.00104	0.00094	0.00089	0.00086	0.00106	0.00097	0.00094	0.00092	0.00089	0.00098	0.00095	0.00097	0.00093
Fe_2O_3	0.10000	0.10444	0.09444	0.08889	0.08611	0.10556	0.09722	0.09444	0.09167	0.08889	0.09750	0.09500	0.09650	0.09300
K_2O	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
La_2O_3	0.00070	0.00073	0.00066	0.00062	0.00060	0.00074	0.00068	0.00066	0.00064	0.00062	0.00068	0.00067	0.00068	0.00065
Li_2O	0.02750	0.02872	0.02597	0.02444	0.02368	0.02903	0.02674	0.02597	0.02521	0.02444	0.02681	0.02613	0.02654	0.02558
MgO	0.00150	0.00157	0.00142	0.00133	0.00129	0.00158	0.00146	0.00142	0.00138	0.00133	0.00146	0.00143	0.00145	0.00140
MnO	0.02000	0.02089	0.01889	0.01778	0.01722	0.02111	0.01944	0.01889	0.01833	0.01778	0.01950	0.01900	0.01930	0.01860
Na_2O	0.15000	0.15667	0.14167	0.13333	0.12917	0.15833	0.14583	0.14167	0.13750	0.13333	0.14625	0.14250	0.14475	0.13950
Nd_2O_3	0.00070	0.00073	0.00066	0.00062	0.00060	0.00074	0.00068	0.00066	0.00064	0.00062	0.00068	0.00067	0.00068	0.00065
NiO	0.01000	0.01044	0.00944	0.00889	0.00861	0.01056	0.00972	0.00944	0.00917	0.00889	0.00975	0.00950	0.00965	0.00930
P_2O_5	0.01250	0.01306	0.01181	0.01111	0.01076	0.01319	0.01215	0.01181	0.01146	0.01111	0.01219	0.01188	0.01206	0.01163
PbO	0.00370	0.00386	0.00349	0.00329	0.00319	0.00391	0.00360	0.00349	0.00339	0.00329	0.00361	0.00352	0.00357	0.00344
PdO	0.00009	0.00009	0.00009	0.00008	0.00008	0.00010	0.00009	0.00009	0.00008	0.00008	0.00009	0.00009	0.00009	0.00008
Rh_2O_3	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
RuO_2	0.00018	0.00019	0.00017	0.00016	0.00016	0.00019	0.00018	0.00017	0.00017	0.00016	0.00018	0.00017	0.00017	0.00017
SiO_2	0.43330	0.45256	0.40923	0.38516	0.37312	0.45737	0.42126	0.40923	0.39719	0.38516	0.42247	0.41164	0.41813	0.40297
SO_3	0.00300	0.00313	0.00283	0.00267	0.00258	0.00317	0.00292	0.00283	0.00275	0.00267	0.00293	0.00285	0.00290	0.00279
SrO	0.00240	0.00251	0.00227	0.00213	0.00207	0.00253	0.00233	0.00227	0.00220	0.00213	0.00234	0.00228	0.00232	0.00223
TiO_2	0.00040	0.00042	0.00038	0.00036	0.00034	0.00042	0.00039	0.00038	0.00037	0.00036	0.00039	0.00038	0.00039	0.00037
ZnO	0.00060	0.00063	0.00057	0.00053	0.00052	0.00063	0.00058	0.00057	0.00055	0.00053	0.00059	0.00057	0.00058	0.00056
ZrO_2	0.02500	0.02611	0.02361	0.02222	0.02153	0.02639	0.02431	0.02361	0.02292	0.02222	0.02438	0.02375	0.02413	0.02325

Table 1.2 (contd)

Glass ID	Cr-001	Cr-012	Cr-0145	Cr-02	F-02	Fe-05	Fe-15	Fe-20	K-03	K-06	Li-00	Li-015	Li-04	Li-05
Al_2O_3	0.10040	0.09930	0.09905	0.09849	0.09810	0.10556	0.09444	0.08889	0.09700	0.09400	0.10283	0.10129	0.09871	0.09769
B_2O_3	0.10040	0.09930	0.09905	0.09849	0.09810	0.10556	0.09444	0.08889	0.09700	0.09400	0.10283	0.10129	0.09871	0.09769
BaO	0.00050	0.00050	0.00050	0.00049	0.00049	0.00053	0.00047	0.00044	0.00049	0.00047	0.00051	0.00051	0.00049	0.00049
Bi_2O_3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
CaO	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
CdO	0.00141	0.00139	0.00139	0.00138	0.00137	0.00148	0.00132	0.00124	0.00136	0.00132	0.00144	0.00142	0.00138	0.00137
Ce_2O_3	0.00050	0.00050	0.00050	0.00049	0.00049	0.00053	0.00047	0.00044	0.00049	0.00047	0.00051	0.00051	0.00049	0.00049
Cr_2O_3	**0.00100**	**0.01200**	**0.01450**	**0.02000**	0.00490	0.00528	0.00472	0.00444	0.00485	0.00470	0.00514	0.00506	0.00494	0.00488
F	0.00100	0.00099	0.00099	0.00098	**0.02000**	0.00106	0.00094	0.00089	0.00097	0.00094	0.00103	0.00101	0.00099	0.00098
Fe_2O_3	0.10040	0.09930	0.09905	0.09849	0.09810	**0.05000**	**0.15000**	**0.20000**	0.09700	0.09400	0.10283	0.10129	0.09871	0.09769
K_2O	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	**0.03000**	**0.06000**	0.00000	0.00000	0.00000	0.00000
La_2O_3	0.00070	0.00070	0.00069	0.00069	0.00069	0.00074	0.00066	0.00062	0.00068	0.00066	0.00072	0.00071	0.00069	0.00068
Li_2O	0.02761	0.02731	0.02724	0.02709	0.02698	0.02903	0.02597	0.02444	0.02668	0.02585	**0.00000**	**0.01500**	**0.04000**	**0.05000**
MgO	0.00151	0.00149	0.00149	0.00148	0.00147	0.00158	0.00142	0.00133	0.00146	0.00141	0.00154	0.00152	0.00148	0.00147
MnO	0.02008	0.01986	0.01981	0.01970	0.01962	0.02111	0.01889	0.01778	0.01940	0.01880	0.02057	0.02026	0.01974	0.01954
Na_2O	0.15060	0.14894	0.14857	0.14774	0.14715	0.15833	0.14167	0.13333	0.14550	0.14100	0.15424	0.15193	0.14807	0.14653
Nd_2O_3	0.00070	0.00070	0.00069	0.00069	0.00069	0.00074	0.00066	0.00062	0.00068	0.00066	0.00072	0.00071	0.00069	0.00068
NiO	0.01004	0.00993	0.00990	0.00985	0.00981	0.01056	0.00944	0.00889	0.00970	0.00940	0.01028	0.01013	0.00987	0.00977
P_2O_5	0.01255	0.01241	0.01238	0.01231	0.01226	0.01319	0.01181	0.01111	0.01213	0.01175	0.01285	0.01266	0.01234	0.01221
PbO	0.00371	0.00367	0.00366	0.00364	0.00363	0.00391	0.00349	0.00329	0.00359	0.00348	0.00380	0.00375	0.00365	0.00361
PdO	0.00009	0.00009	0.00009	0.00009	0.00009	0.00010	0.00009	0.00008	0.00009	0.00008	0.00009	0.00009	0.00009	0.00009
Rh_2O_3	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
RuO_2	0.00018	0.00018	0.00018	0.00018	0.00018	0.00019	0.00017	0.00016	0.00017	0.00017	0.00019	0.00018	0.00018	0.00018
SiO_2	0.43504	0.43025	0.42916	0.42677	0.42506	0.45737	0.40923	0.38516	0.42030	0.40730	0.44555	0.43887	0.42773	0.42328
SO_3	0.00301	0.00298	0.00297	0.00295	0.00294	0.00317	0.00283	0.00267	0.00291	0.00282	0.00308	0.00304	0.00296	0.00293
SrO	0.00241	0.00238	0.00238	0.00236	0.00235	0.00253	0.00227	0.00213	0.00233	0.00226	0.00247	0.00243	0.00237	0.00234
TiO_2	0.00040	0.00040	0.00040	0.00039	0.00039	0.00042	0.00038	0.00036	0.00039	0.00038	0.00041	0.00041	0.00039	0.00039
ZnO	0.00060	0.00060	0.00059	0.00059	0.00059	0.00063	0.00057	0.00053	0.00058	0.00056	0.00062	0.00061	0.00059	0.00059
ZrO_2	0.02510	0.02482	0.02476	0.02462	0.02452	0.02639	0.02361	0.02222	0.02425	0.02350	0.02571	0.02532	0.02468	0.02442

Table 1.2 (contd)

Glass ID	Mn-01	Mn-04	Na-05	Na-10	Na-20	Na-225	Ni-001	Ni-02	P-0	P-02	P-03	Si-30	Si-335	Si-37
Al_2O_3	0.10194	0.09796	0.11176	0.10588	0.09412	0.09118	0.10091	0.09899	0.10127	0.09924	0.09823	0.12352	0.11735	0.11117
B_2O_3	0.10194	0.09796	0.11176	0.10588	0.09412	0.09118	0.10091	0.09899	0.10127	0.09924	0.09823	0.12352	0.11735	0.11117
BaO	0.00051	0.00049	0.00056	0.00053	0.00047	0.00046	0.00050	0.00049	0.00051	0.00050	0.00049	0.00062	0.00059	0.00056
Bi_2O_3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
CaO	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
CdO	0.00143	0.00137	0.00156	0.00148	0.00132	0.00128	0.00141	0.00139	0.00142	0.00139	0.00138	0.00173	0.00164	0.00156
Ce_2O_3	0.00051	0.00049	0.00056	0.00053	0.00047	0.00046	0.00050	0.00049	0.00051	0.00050	0.00049	0.00062	0.00059	0.00056
Cr_2O_3	0.00510	0.00490	0.00559	0.00529	0.00471	0.00456	0.00505	0.00495	0.00506	0.00496	0.00491	0.00618	0.00587	0.00556
F	0.00102	0.00098	0.00112	0.00106	0.00094	0.00091	0.00101	0.00099	0.00101	0.00099	0.00098	0.00124	0.00117	0.00111
Fe_2O_3	0.10194	0.09796	0.11176	0.10588	0.09412	0.09118	0.10091	0.09899	0.10127	0.09924	0.09823	0.12352	0.11735	0.11117
K_2O	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
La_2O_3	0.00071	0.00069	0.00078	0.00074	0.00066	0.00064	0.00071	0.00069	0.00071	0.00069	0.00069	0.00086	0.00082	0.00078
Li_2O	0.02803	0.02694	0.03074	0.02912	0.02588	0.02507	0.02775	0.02722	0.02785	0.02729	0.02701	0.03397	0.03227	0.03057
MgO	0.00153	0.00147	0.00168	0.00159	0.00141	0.00137	0.00151	0.00148	0.00152	0.00149	0.00147	0.00185	0.00176	0.00167
MnO	**0.00100**	**0.04000**	0.02235	0.02118	0.01882	0.01824	0.02018	0.01980	0.02025	0.01985	0.01965	0.02470	0.02347	0.02223
Na_2O	0.15291	0.14694	**0.05000**	**0.10000**	**0.20000**	**0.22500**	0.15136	0.14848	0.15190	0.14886	0.14734	0.18528	0.17602	0.16675
Nd_2O_3	0.00071	0.00069	0.00078	0.00074	0.00066	0.00064	0.00071	0.00069	0.00071	0.00069	0.00069	0.00086	0.00082	0.00078
NiO	0.01019	0.00980	0.01118	0.01059	0.00941	0.00912	**0.00100**	**0.02000**	0.01013	0.00992	0.00982	0.01235	0.01173	0.01112
P_2O_5	0.01274	0.01224	0.01397	0.01324	0.01176	0.01140	0.01261	0.01237	**0.00000**	**0.02000**	**0.03000**	0.01544	0.01467	0.01390
PbO	0.00377	0.00362	0.00414	0.00392	0.00348	0.00337	0.00373	0.00366	0.00375	0.00367	0.00363	0.00457	0.00434	0.00411
PdO	0.00009	0.00009	0.00010	0.00010	0.00008	0.00008	0.00009	0.00009	0.00009	0.00009	0.00009	0.00011	0.00011	0.00010
Rh_2O_3	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00004	0.00004	0.00003
RuO_2	0.00018	0.00018	0.00020	0.00019	0.00017	0.00016	0.00018	0.00018	0.00018	0.00018	0.00018	0.00022	0.00021	0.00020
SiO_2	0.44170	0.42446	0.48428	0.45879	0.40781	0.39507	0.43724	0.42892	0.43878	0.43001	0.42562	**0.30000**	**0.33500**	**0.37000**
SO_3	0.00306	0.00294	0.00335	0.00318	0.00282	0.00274	0.00303	0.00297	0.00304	0.00298	0.00295	0.00371	0.00352	0.00334
SrO	0.00245	0.00235	0.00268	0.00254	0.00226	0.00219	0.00242	0.00238	0.00243	0.00238	0.00236	0.00296	0.00282	0.00267
TiO_2	0.00041	0.00039	0.00045	0.00042	0.00038	0.00036	0.00040	0.00040	0.00041	0.00040	0.00039	0.00049	0.00047	0.00044
ZnO	0.00061	0.00059	0.00067	0.00064	0.00056	0.00055	0.00061	0.00059	0.00061	0.00060	0.00059	0.00074	0.00070	0.00067
ZrO_2	0.02548	0.02449	0.02794	0.02647	0.02353	0.02279	0.02523	0.02475	0.02532	0.02481	0.02456	0.03088	0.02934	0.02779

Table 1.2 (contd)

Glass ID	Si-50	Zr-001	Zr-05	NM-0025
Al_2O_3	0.08823	0.10246	0.09744	0.09979
B_2O_3	0.08823	0.10246	0.09744	0.09979
BaO	0.00044	0.00051	0.00049	0.00050
Bi_2O_3	0.00000	0.00000	0.00000	0.00000
CaO	0.00000	0.00000	0.00000	0.00000
CdO	0.00124	0.00143	0.00136	0.00140
Ce_2O_3	0.00044	0.00051	0.00049	0.00050
Cr_2O_3	0.00441	0.00512	0.00487	0.00499
F	0.00088	0.00102	0.00097	0.00100
Fe_2O_3	0.08823	0.10246	0.09744	0.09979
K_2O	0.00000	0.00000	0.00000	0.00000
La_2O_3	0.00062	0.00072	0.00068	0.00070
Li_2O	0.02426	0.02818	0.02679	0.02744
MgO	0.00132	0.00154	0.00146	0.00150
MnO	0.01765	0.02049	0.01949	0.01996
Na_2O	0.13235	0.15369	0.14615	0.14968
Nd_2O_3	0.00062	0.00072	0.00068	0.00070
NiO	0.00882	0.01025	0.00974	0.00998
P_2O_5	0.01103	0.01281	0.01218	0.01247
PbO	0.00326	0.00379	0.00361	0.00369
PdO	0.00008	0.00009	0.00009	**0.00072**
Rh_2O_3	0.00003	0.00003	0.00003	**0.00024**
RuO_2	0.00016	0.00018	0.00018	**0.00144**
SiO_2	**0.50000**	0.44397	0.42219	0.43239
SO_3	0.00265	0.00307	0.00292	0.00299
SrO	0.00212	0.00246	0.00234	0.00239
TiO_2	0.00035	0.00041	0.00039	0.00040
ZnO	0.00053	0.00061	0.00058	0.00060
ZrO_2	0.02206	**0.00100**	**0.05000**	0.02495

NM: noble metals

2.0 Methods

2.1 Glass Fabrication

Glass fabrication was performed according to the PNNL procedure GDL-GBM for glass batching and melting with the exception of the addition of PdO and RuO_2. For PdO and RuO_2, nitrate solutions were carefully weighed and added, drop by drop, to 100 g of SiO_2 dispersed on a Petri dish to absorb the liquid. The dish was placed in a 105 °C oven for about 1 hour and cooled. The dried SiO_2 cake was incorporated into the rest of the chemical batch and mixed in an agate milling chamber.

Each glass was prepared in Pt-alloy crucibles using a two step melt process. The first melt was of raw materials after mechanically mixing in an agate milling chamber. Melting was performed nominally at 1200 °C for 2 hours. A second melt of the glass was accomplished after the quenched glass was ground to a fine powder. Generally, the second melt was at 25 to 50 °C lower than the initial melt and between 45 to 60 minute in duration (See Table 2.1 for specific melt times and temperatures). A few of the matrix glasses required temperatures above 1200 °C to adequately melt the batch.

Table 2.1. Melting Temperatures and Times Used in Fabricating the EM07 Glasses

	First Melt		Second Melt	
GLASS ID	**Temp. (°C)**	**Time (hrs)**	**Temp. (°C)**	**Time (hrs)**
EM07-BL-1	1200	2	1150	1
EM07-BL-2	1200	2	1150	1
EM07-Al-06	1200	2	1150	0.75
EM07-Al-15	1250	2.25	1250	0.75
EM07-Al-20	1300	2	1300	0.75
EM07-Al-225	1225	1	1225*	1
EM07-B-05	1200	2	1175	0.75
EM07-B-125	1150	0.75	1150	1
EM07-B-15	1200	2	1150	1
EM07-B-175	1150	1	1150	1
EM07-B-20	1200	2	1175	0.75
EM07-Bi-025	1200	2	1175	0.75
EM07-Bi-05	1200	2	1175	0.75
EM07-Ca-035	1200	2	1175	0.75
EM07-Ca-07	1200	2	1175	0.75
EM07-Cr-001	1200	2	1150	0.75
EM07-Cr-012	1200	2	1200	0.75
EM07-Cr-0145	1250	1	1200	1
EM07-Cr-02	1225	2	1225	1
EM07-F02	1200	2	1150	1
EM07-Fe-05	1200	2	1150	1
EM07-Fe-15	1200	2	1150	1

	First Melt		Second Melt	
GLASS ID	**Temp. (°C)**	**Time (hrs)**	**Temp. (°C)**	**Time (hrs)**
EM07-Fe-20	1200	2	1150	1
EM07-K-03	1200	2	1175	0.75
EM07-K-06	1200	2	1175	0.75
EM07-Li-00	1200	1	1150	1
EM07-Li-015	1200	2	1175	0.75
EM07-Li-04	1200	2	1175	0.75
EM07-Li-05	1125	1	1100	1
EM07-Mn-01	1200	2	1150	1
EM07-Mn-04	1200	2	1150	1
EM07-Na-05	1200	2	1175	0.75
EM07-Na-10	1200 & 1225[+]	1.15 & 0.75	1175	0.75
EM07-Na-20	1200	2	1150	0.75
EM07-Na-225	1150	1.25	1150	1
EM07-Ni-001	1200	2	1175	1
EM07-Ni-02	1200	2	1175	0.75
EM07-P-0	1200	2	1175	0.75
EM07-P-02	1075	1	1100	1
EM07-P-03	1050	1	1075	1
EM07-Si-30	1150	2	1150	0.75
EM07-Si-335	1200	1	1150	1
EM07-Si-37	1200	2	1150	1
EM07-Si-50	1250	2	1175	0.75
EM07-Zr-001	1200	2	1175	0.75
EM07-Zr-05	1200	2	1175	0.75
EM07-NM-0025	1200	2	1175	0.75

*3rd melt: 1225 °C for 0.5 hours

[+] The 1st melt was heated for 70 minutes at 1200°C then at 1225°C for 45 minutes. The 2nd melt was heated 45 minutes at 1175°C.

2.2 Chemical Analysis of Glass Composition

To confirm that the "as-fabricated" glasses correspond to the defined target compositions, a representative sample of each glass was chemically analyzed at the SRNL Process Science Analytical Laboratory (PSAL). Three dissolution methods were utilized in measuring these chemical compositions: samples prepared by lithium metaborate (LM=$LiBO_2$) fusion followed by HNO_3 dissolution were used to measure elemental concentrations of Al, Ba, Bi, Ca, Cd, Ce, Cr, Fe, K, La, Mg, Mn, Na, Nd, Ni, P, Pb, S, Ti, Zn, and Zr, while samples from glasses prepared by sodium peroxide fusion (PF – Na_2O_2) and HNO_3 dissolution were used to measure elemental concentrations of boron (B), lithium (Li), and silicon (Si) and a sample from a select glass was prepared by potassium hydroxide (PH – KOH) method to conduct a fluorine (F) measurement. For each glass, measurements were obtained from samples prepared in duplicate by each of these fusion/dissolution methods. All of the prepared samples were analyzed (twice

for each element of interest) by inductively coupled plasma – atomic emission spectroscopy (ICP-AES). The instrument was re-calibrated between the duplicate analyses.

Samples of two glass standards were included in the analytical plans to provide an opportunity for checking the performance of the instrumentation over the course of the analyses and for potential bias correction. Specifically, several samples of the Defense Waste Processing Facility (DWPF) waste compliance plan (WCP) batch 1 were included in the LM and PF portions of both analytical plans. The low-activity reference material (LRM) was included in the PH portion of the analytical plan. This standard contains fluorine, which was of interest for the PH-prepared samples of one of the glasses.

A detailed statistical analysis of the chemical compositions is published elsewhere (Raszewski et al. 2008b). A short summary of these results is included below in the results section.

2.3 Viscosity

The viscosity of glasses was measured as a function of temperature following PNNL procedure GDL-VIS using a Brookfield rotating spindle digital viscometer (DV-III) staged above a high temperature Deltech® furnace and equipped with a Pt/Rh spindle which fitted through a hole in the top of the furnace. A 50 mL glass sample, measured by liquid displacement, was added into a Pt/Rh crucible and placed into the furnace set at 1150 °C. The spindle was immersed into the molten glass in the center of the crucible with its lower end of the rod at 5.1 mm above the bottom. A thermocouple was located directly under the bottom, center of the crucible. The furnace was set to the required ramp/soak schedule and digital data collection of spindle torque and temperature commenced. The temperature sequence was 1150, 1100, 1050, 1000, 950, 1050, 1150, 1200, and then 1150 °C. The soak time was 30 min at each temperature except the second soak at 1150 °C for 45 min. The hysteresis approach allows for the potential impacts of crystallization (at lower temperatures) to be assessed (via reproducibility) with duplicate measurements being taken in the range at which the melter is anticipated to be operating and volatilization (at higher temperatures) minimized by measuring viscosity at temperatures above 1150 °C as the final viscosity measurement. The viscometer was calibrated with a standard glass (DWPF Start-up Frit) at specified intervals following PNNL procedure GDL-VSC.

2.4 Electrical Conductivity

The electrical conductivities of molten glasses were measured as a function of temperature using a probe with two platinum-10% rhodium blades according to the PNNL procedures GDL-ELC (for measurement) and GDL-ECC (for calibration). The 50 mL of glass used for viscosity measurements was added back into a Pt/Rh crucible and placed into the furnace at 1100 °C. The probe was then lowered through a hole in the top of the furnace and into the melt, making sure that the probe was in the center of the crucible. Using the automated Solartron Analytical 1455 Cell Test System which was connected to the probe, the probe was lowered into the glass precisely 1.27 cm. The glass soaked at 1200, 1100, 1000, and 900 °C for 45 minutes at each temperature, allowing the program to collect impedance data at frequencies of 10000, 1000, 100 and 63 Hz at five minutes apart at the end of each temperature setting when the sample was at thermal equilibrium. Only the 1000 Hz frequency data were used in the conductivity calculation since these were the closest values to real impedance. Measured data was exported into Microsoft Excel, where the impedance data was converted into conductance.

The electrical conductivity system was checked at specified intervals in 0.1 and 1 M solutions of KCl at room temperature to determine a cell constant. Two measurements were taken at intervals of ~ 5 minutes for each solution. The cell constant was then used to calculate the conductivity of each glass melt.

2.5 Liquidus Temperature and Equilibrium Crystal Fraction

The liquidus temperature and equilibrium crystal fraction as a function of temperature were measured in Pt-alloy crucibles and boats with tight fitting lids (to minimize volatility) according the PNNL procedure GDL-LQT. The heat treatment times were 48 ± 2 hours for heat treatment temperatures < 850 °C, 24 ± 2 hours for 850-1300 °C, and ~ 4 hours for > 1300 °C to ensure equilibrium was achieved without excessive volatility. Samples were quenched and analyzed to determine the type and quantity of crystal fractions (quantitative analyses) according to the PNNL procedure GDL-XRD. Heat treatment temperatures were varied so that the temperature at 0% crystals can be narrowed to within 10 °C for the liquidus temperature. For the equilibrium crystal fraction as a function of temperature, heat treatment was performed for the temperature range from the liquidus temperature down to the approximate temperature of maximum crystallization. Notes were taken on the location of crystals within the crucible to distinguish between surface and bulk crystals (see Appendix D).

2.6 Canister Centerline Cooling (CCC) and Crystal Identification

Each glass was subjected to slow cooling heat treatments (roughly 150 g glass sample) according to the simulated CCC profile the glass in the canister centerline experiences following the PNNL procedure GDL-HTR. Table 2.2 and Figure 2.1 show the temperature schedule of CCC heat treatment for Hanford HLW glasses used at WTP.[1]

Table 2.2. Temperature Schedule during CCC Treatment

Segment	Time (min)	Start Temp. (°C)	Rate (°C/min)
1	0-45	1050	-1.556
2	45-107	980	-0.806
3	107-200	930	-0.591
4	200-329	875	-0.388
5	329-527	825	-0.253
6	527-707	775	-0.278
7	707-1776	725	-0.304

[1] Memorandum, Canister Centerline Cooling Data, Revision 1, CCN: 074851, RPP-WTP, October 29, 2003.

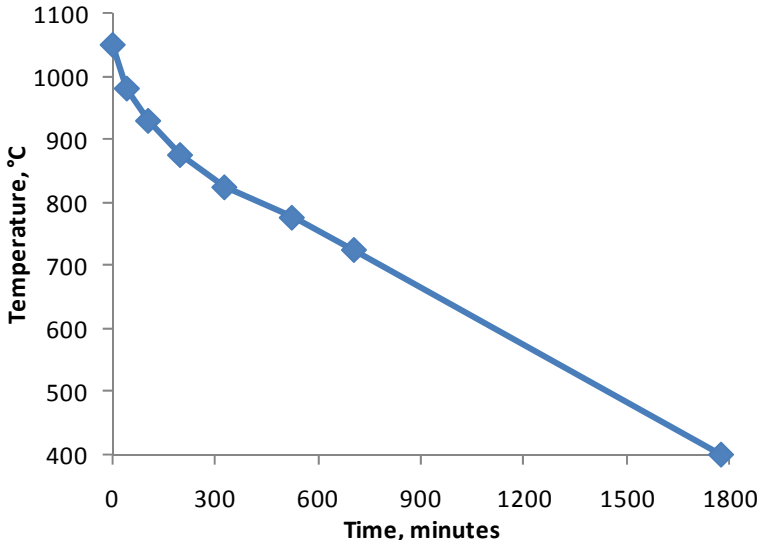


Figure 2.1. Plot of Temperature Schedule during CCC Treatment

The amount and type of crystalline phases that formed during CCC heat treatment were analyzed by X-ray diffraction (XRD) according to the PNNL procedures APEL-PAD-V and GDL-XRD. Powdered samples were prepared using five weight percent of CaF_2 as an internal standard phase with about 1.5 to 2.5 g of glass. Glass and CaF_2 were milled together for 2 minutes in a 10 cm^3 tungsten carbide disc mill to a fine powder. The powder samples were loaded XRD sample holders and scanned at a 0.04° 2θ step size, 4 seconds dwell time, from 10 to 70° 2θ. Spectra were analyzed with Jade® 6.0 Software (MDI, Inc.) for phase identification. Full-pattern Rietveld refinement using RIQAS® 4 (MDI Inc.) was performed to quantify the amounts of crystal phases on some samples with the high crystalline content.

Optical microscopy-image analysis (OM-IA) was also used to examine the crystalline phases found in some CCC glass samples. Scanning electron microscopy (SEM) was not used for this study.

2.7 Product Consistency Test (PCT)

Product consistency test (PCT) responses were measured at SRNL in triplicate on each of the glasses including quenched and CCC samples using Method A of the procedure (ASTM 2008). Also included in the experimental test matrix and tested in triplicate was the Environmental Assessment (EA) (Jantzen et al. 1993) glass, the Approved Reference Material (ARM) (Mellinger and Daniel 1984) glass, and blanks from the sample cleaning batch. Glass samples were ground, washed, and prepared according to the standard PCT procedure. The resulting solutions were sampled (filtered and acidified) and analyzed by PSAL under the auspices of an analytical plan (SRNL-SCS-2007-00059). Samples of a multi-element, standard solution were also included in the analytical plan (as a check on the accuracy of the ICP-AES). Normalized release rates were calculated based on target, measured, and bias-corrected (bc) compositions using the average of the logs of the leachate concentrations. Results from the PCT are published elsewhere (Raszewski et al. 2008b) and short summary of these results is included below in the results section.

2.8 Toxicity Characteristic Leaching Procedure (TCLP)

The toxicity characteristic leaching procedure (TCLP) was performed on both quenched and CCC glass samples at Davis and Floyd Laboratory under an SRNL subcontract. The extraction and analyses were performed according to SW 846 Method 1311 (U.S. Environmental Protection Agency, or EPA, 1992) and SW-846 quality assurance/quality control requirements were followed. Crushed glass pieces that passed through a 9.5 mm (0.4 inch) sieve and ≥ 100 g in mass, are placed in dilute acetic acid (pH value of 4.98 ± 0.05) and agitated at 30 ± 2 rpm for 18 ± 2 hours at room temperature. The concentrations of hazardous metals in solution were then measured by ICP and analyzed values checked against the values specified by the Resource Conservation and Recovery Act (RCRA) and by the Universal Treatment Standard (UTS) put forth by the EPA (40 CFR 268.48) for certain waste categories defined in 40 CFR 268.48 in May 1998.

3.0 Results and Discussion

3.1 Chemical Analysis of Glass Composition

Since the results from chemical analysis are published elsewhere (Raszewski et al. 2008b), only select observations will be made here. Target composition when compared to analyzed composition had excellent agreement except for some general observations discussed below.

Phosphorus content in 37 glasses (EM07-P-0 had no P) was low. For most glasses there was a 20 to 30 percent difference between the target composition and the analyzed P level, but for a few glasses the P was much lower. For example: glass EM07-P-025 (target P_2O_5 = 2.5 mass%) had analyzed P content about the same as the baseline glass (target P_2O_5 = 1.25 mass%) even though the correct level of $NaPO_3$ was added to the chemical batch. This is of concern because property measurements, such as T_L, viscosity and TCLP, would likely be affected by this magnitude of composition change. This glass also had the lowest analyzed total oxides of the 38 glasses (about 96 mass% with the next lowest glass at about 97.5 mass%). The cause of discrepancies in P_2O_5 contents between target and analyzed glass compositions could be caused by 1) the $NaPO_3$ source containing less phosphorous than stoichiometric, 2) the phosphorous was separated from the glass during fabrication (e.g., volatilizing), or 3) the analyses had a systematic bias. Although not certain, it appears based on previous studies showing little impurities in $NaPO_3$ and relatively low crucible melt volatility of phosphorous that the third option is the most likely.

Zirconium was another metal with the analyzed concentrations, on average, about 20 mass% lower than the targeted in all 38 glasses. The source of this difference is unknown, but one possibility is that there may have been difficulty in dissolving all Zr into solution while preparing the samples for ICP analysis, which has often occurred with glass analyses in the past.

The other noticeable observation from the chemical analyses is that EM07-Zr-001 had roughly double the target amount of Nd in glass. As this was not a systematic difference it is most likely caused by a batching error. The small amount of excess Nd in the glass is not likely to affect the chemical and property measurements made in this study. This glass will be given a reported composition containing double the targeted Nd_2O_3.

3.2 Viscosity (η)

The results of viscosity measurements are listed in Appendix A and summarized in Table 3.1. Note that viscosity was measured three times at 1150°C, at the beginning, in the middle, and at the end of the testing sequence. The centroid (EM07-BL-1), EM07-Bi-025 and Bi-05 glasses were batched and tested twice. Low-temperature viscosities were not measured for a number of glasses (EM07-Al-15, Al-20, BL-1, Fe-20, Li-015, Na-05, Na-10, and Si-50) because the viscosity had increased beyond the ~1000 P upper limit for the viscometer. The viscosity data as a function of temperature are presented in Table 3.1.

All data are graphically displayed for each component varied in this study as a spider plot (Figure **3**.1) and individually (Figure 3.2). Note that most of the data points of repeated measurements are indistinguishable even for glasses with high concentrations of components that may produce crystallinity (Cr_2O_3, NiO, and Fe_2O_3). Oxides that change their valence state with increasing temperature [Fe(III) to Fe(II) and Cr(VI) to Cr(III)] exhibited slightly irregular responses, such as an increase of the ln(η) versus

x_i slope at $x_{Fe_2O_3} > 0.15$ or the different form of the ln(η) versus $x_{Cr_2O_3}$ function at 1200 °C and 950 °C. Also, the ln(η) versus x_i slope sharply increased at $x_{Na_2O} < 0.1$.

Table 3.1. Measured log(η/Pa·s) Values Versus Temperature (in the sequence of measurement) for Glasses Tested; EM07-BL-1 and EM07-BL-2 Are Centroid Glass Duplicates (note that EM07-Bi-05 glass also has a duplicate)

***T*, °C**	**1150**	**1100**	**1050**	**1000**	**950**	**1050**	**1150**	**1200**	**1150**
Glass ID	**log(η/Pa·s)**								
EM07-BL-1	0.859	1.065	1.299	1.552	1.848	1.308	0.864	0.669	0.857
EM07-BL-2	0.850	1.063	1.295	1.557	1.853	1.302	0.864	0.667	0.860
EM07-Al-06	0.616	0.806	1.019	1.254	1.529	1.025	0.626	0.453	0.623
EM07-Al-15	1.209	1.457	1.703	1.988	-	1.710	1.227	0.996	1.223
EM07-Al-20	1.673	1.964	-	-	-	-	-	1.372	1.630
EM07-B-05	1.166	1.406	1.664	1.949	-	1.668	1.180	0.956	1.167
EM07-B-15	0.641	0.844	1.065	1.311	1.599	1.064	0.650	0.469	0.642
EM07-B-20	0.487	0.673	0.889	1.130	1.408	0.896	0.484	0.314	0.478
EM07-Bi-025	0.809	1.015	1.246	1.507	1.802	1.253	0.827	-	-
EM07-Bi-05a	0.780	0.990	1.220	1.476	1.765	1.228	0.788	0.593	0.775
EM07-Bi-05b	0.775	0.979	1.207	1.461	1.751	1.220	0.782	0.592	0.774
EM07-Ca-035	0.689	0.898	1.128	1.386	1.679	1.142	0.691	0.496	0.677
EM07-Ca-07	0.533	0.742	0.974	1.233	1.534	0.992	0.542	0.353	0.528
EM07-Cr-001	0.869	1.059	1.254	1.500	1.786	1.283	0.857	0.682	0.854
EM07-Cr-012	0.921	1.134	1.366	1.623	1.920	1.358	0.926	0.732	0.926
EM07-Cr-02	1.092	1.313	1.555	1.781	2.085	1.535	1.093	0.899	1.078
EM07-F-02	0.747	0.951	1.180	1.443	1.721	1.200	0.766	0.585	0.751
EM07-Fe-05	0.875	1.067	1.283	1.530	1.807	1.293	0.878	0.696	0.873
EM07-Fe-15	0.861	1.102	1.359	1.627	1.930	1.351	0.867	0.652	0.867
EM07-Fe-20	1.023	1.330	1.613	1.903	-	1.574	1.006	0.745	1.028
EM07-K-03	0.749	0.943	1.155	1.392	1.664	1.163	0.757	0.571	0.750
EM07-K-06	0.677	0.869	1.075	1.308	1.568	1.089	0.686	0.520	0.693
EM07-Li-015	1.154	1.386	1.636	1.927	-	1.638	1.156	0.941	1.143
EM07-Li2-04	0.648	0.852	1.072	1.312	1.592	1.074	0.662	0.474	0.649
EM07-Mn-01	0.933	1.143	1.381	1.623	1.916	1.383	0.939	0.747	0.935
EM07-Mn-04	0.823	1.039	1.283	1.546	1.821	1.283	0.836	0.620	0.808
EM07-Na-05	2.414	-	-	-	-	-	-	1.964	2.366
EM07-Na-10	1.451	1.708	1.978	-	-	1.983	1.473	1.197	1.440
EM07-Na-20	0.496	0.678	0.877	1.095	1.340	0.880	0.504	0.340	0.503
EM07-Ni-001	0.861	1.064	1.286	1.536	1.818	1.291	0.873	-	-
EM07-Ni-02	0.834	1.063	1.315	1.599	1.902	1.300	0.853	0.646	0.851
EM07-P-0	0.884	1.095	1.331	1.590	1.895	1.333	0.890	0.693	0.886
EM07-P-025	0.845	1.051	1.281	1.539	1.825	1.286	0.851	0.656	0.846
EM07-Si-30	0.214	0.425	0.642	0.875	1.139	0.624	0.208	-0.013	0.184

EM07-Si-37	0.526	0.739	0.969	1.216	1.489	0.965	0.535	0.339	0.528
EM07-Si-50	1.257	1.484	1.731	2.025	-	1.733	1.264	1.062	1.258
EM07-Zr-001	0.860	1.054	1.273	1.515	1.816	1.280	0.868	0.681	0.867
EM07-Zr-05	0.930	1.153	1.405	1.689	2.014	1.416	0.934	0.716	0.927

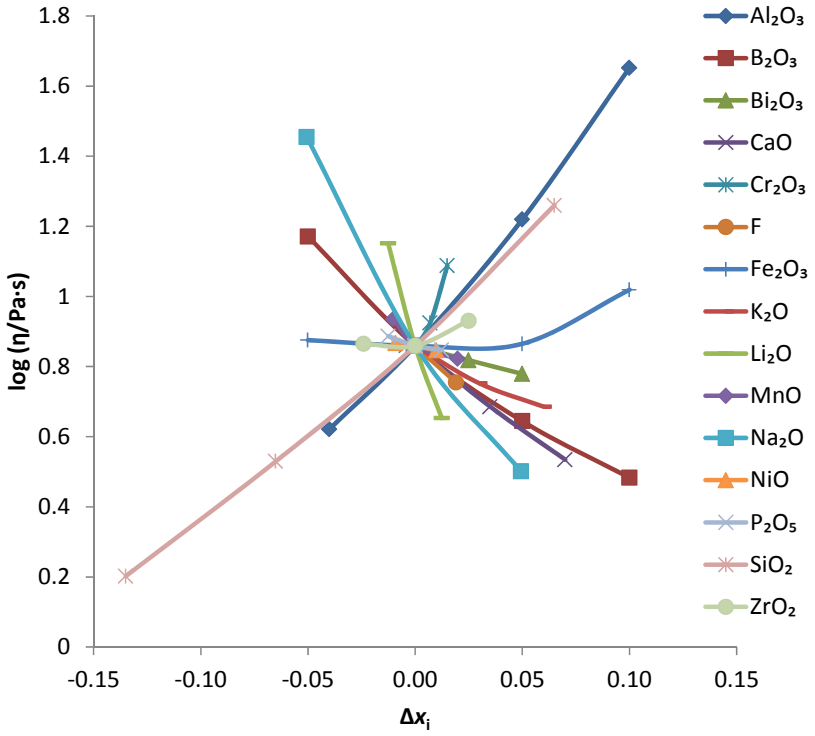
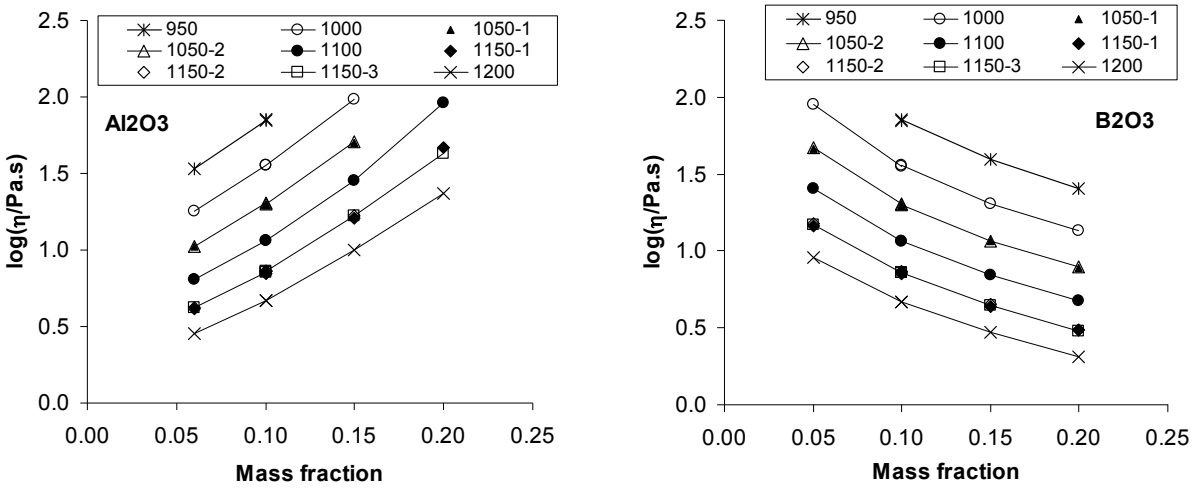
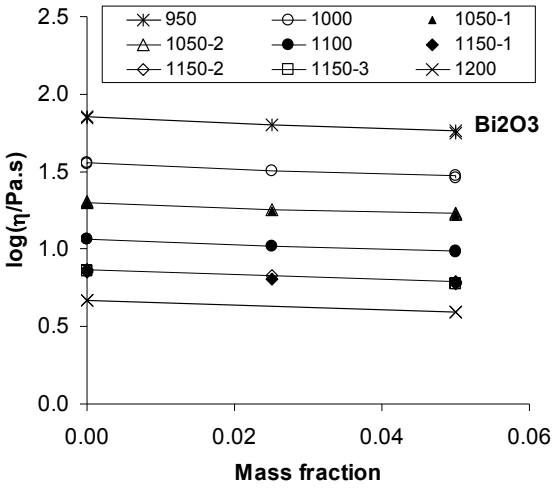
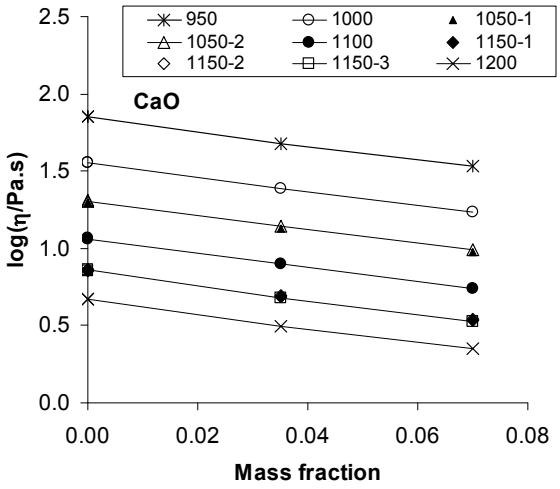
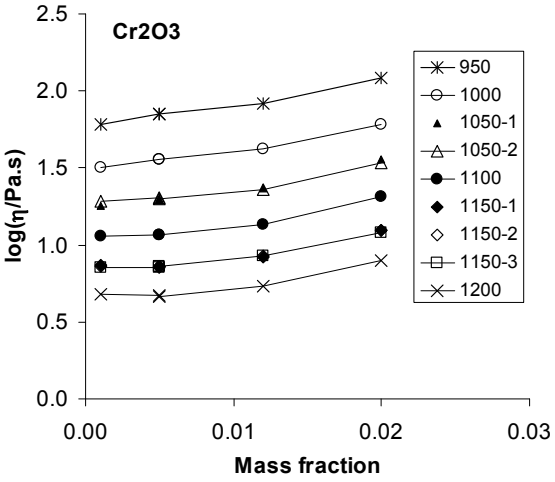


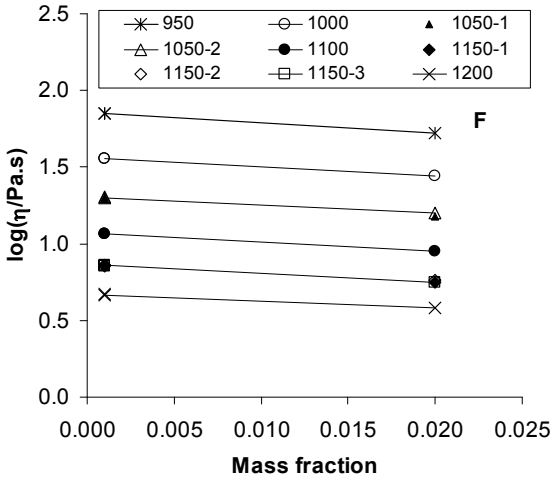
Figure 3.1. Spider Plot of Viscosity at 1150°C versus Component Mass Fraction

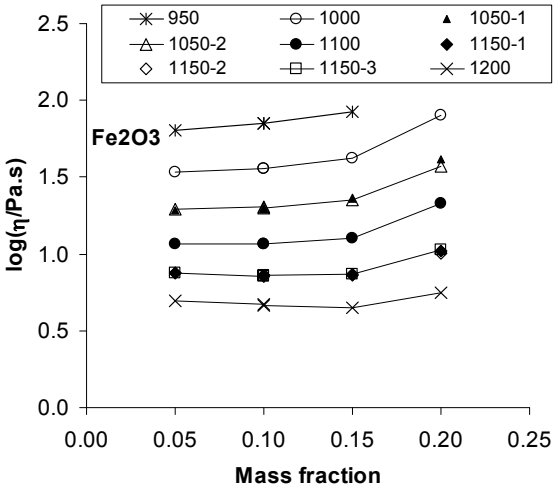


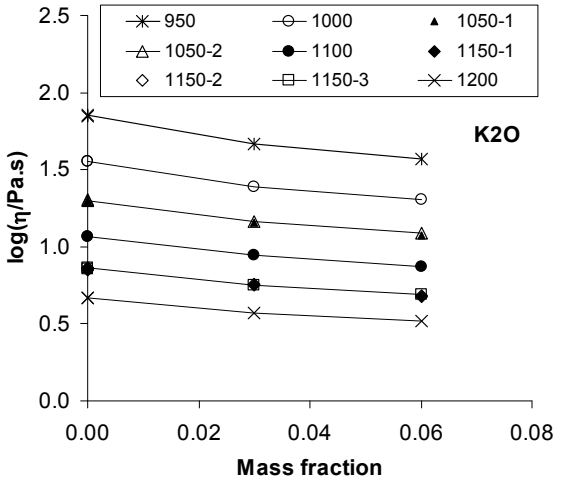

950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
Bi2O3
log(η/Pa.s)
Mass fraction

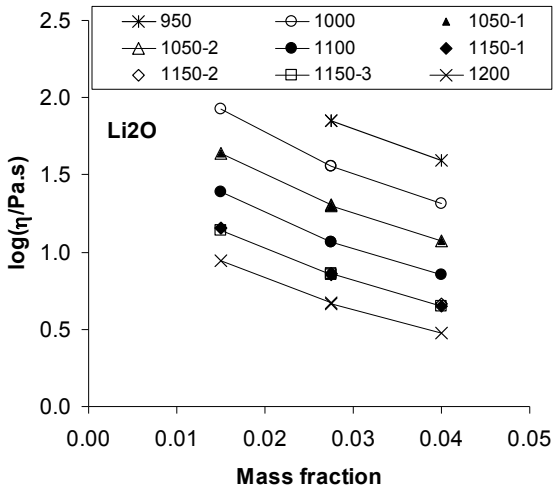

950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
CaO
log(η/Pa.s)
Mass fraction

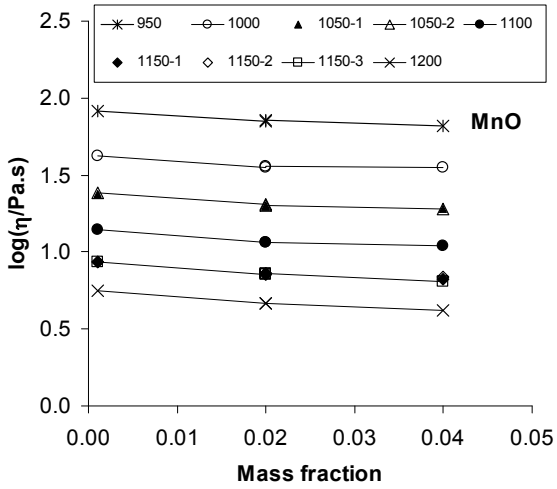

Cr2O3
950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
log(η/Pa.s)
Mass fraction

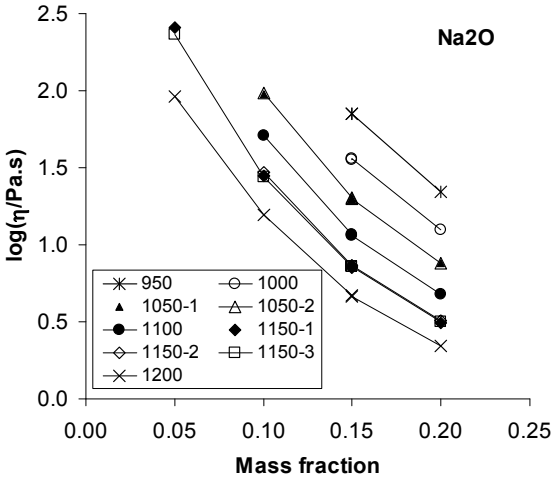

950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
F
log(η/Pa.s)
Mass fraction

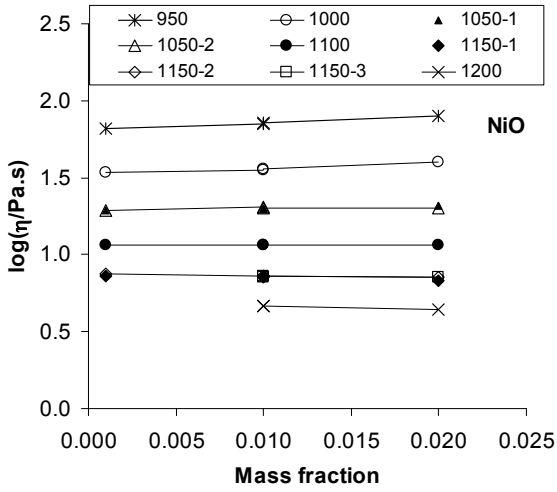

950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
Fe2O3
log(η/Pa.s)
Mass fraction

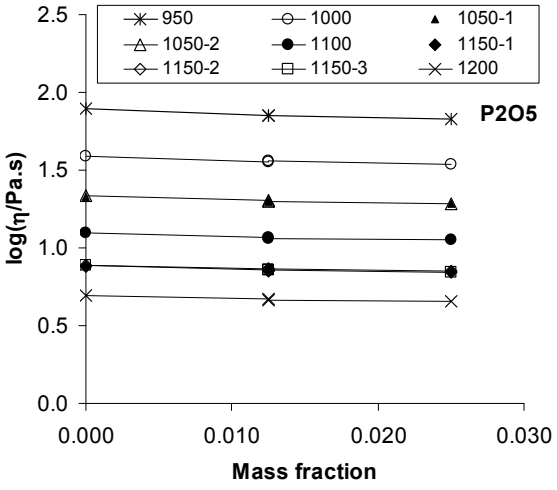

950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
K2O
log(η/Pa.s)
Mass fraction

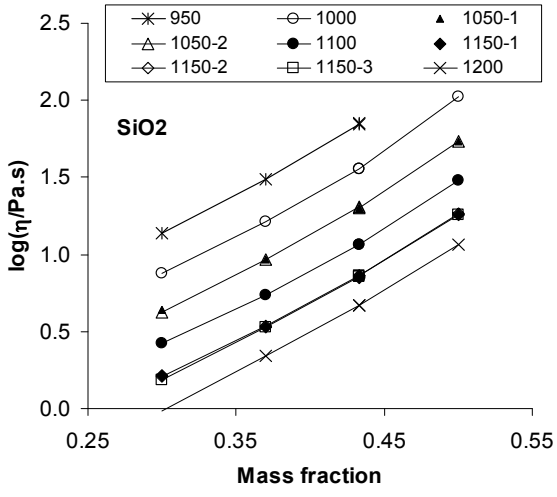

950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
Li2O
log(η/Pa.s)
Mass fraction


950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
MnO
log(η/Pa.s)
Mass fraction


Na2O
950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
log(η/Pa.s)
Mass fraction


950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
NiO
log(η/Pa.s)
Mass fraction


950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
P2O5
log(η/Pa.s)
Mass fraction


950
1000
1050-1
1050-2
1100
1150-1
1150-2
1150-3
1200
SiO2
log(η/Pa.s)
Mass fraction

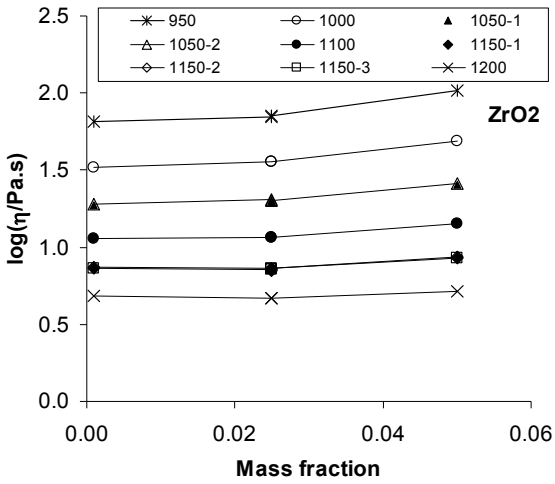


Figure 3.**2.** Viscosity versus Component Mass Fraction and Temperature

To represent viscosity as a function of temperature and composition, Equation (1) was fitted to data. Not included were all EM07-Na-05 glass data and low-temperature data of EM07-Fe-20 glass because viscosity measurements were affected by crystallization which caused these values to substantially deviated from linearity (See Figure 3.2) as defined by Equation (1). Also excluded were three data points for which $\eta > 100$ Pa·s because of their slight but systematic deviations from Arrhenius behavior. The resulting values were $A = -11.59$ (ln[Pa·s]) and the B coefficient listed in Table 3.2. Note that A appears to be independent of composition. Figure 3.3 compares the model-calculated and measured viscosities.

$$\ln(\eta) = A + \left(10^4 / T\right) \sum_{i=1}^{N} B_i x_i \qquad (1)$$

where x_i is the mass fraction of the i-th oxide component, A is a constant (ln[Pa·s]), T is the absolute temperature (K), B_i is the coefficient for an Arrhenius constant B for the i-th component (10^{-4} K), and N is the number of model components. The model forms for viscosity in this section and for electrical conductivity in Section 3.3 are based on the Arrhenius equation for their temperature dependence, $\ln(\eta \text{ or } \sigma) = A + B / T$ where A and B are independent of temperature.

The viscosity model was developed for the narrow composition range described in Table 3.2. This range is narrower than the original range described in Table 1.2 because it excludes EM07-Na-05 and only marginally predicted EM07-Fe-20 for which the 950°C data is excluded. Note in Figure 3.3 how EM07-Na-05 data are clear outliers whereas EM07-Fe-20 data are hard to distinguish as outliers.

Model uncertainty will likely be high if the model is used beyond the range in Table 3.2. The experimental design within this study did not test component interactions which may be influential in this glass composition region and will affect the use of the model if used in predicting outside the narrow scope of this study.

Table 3.2. The B_i Values from Fitting Equation (1) to Data
$R^2 = 0.989$, $R^2_{adj} = 0.988$, standard deviation is 0.102

Oxide	x_i ranges		$x_i^{centroid}$	B_i
	Min	max		10^{-4}K
Al_2O_3	0.060	0.200	0.100	4.102
B_2O_3	0.050	0.200	0.100	0.637
Bi_2O_3	0.000	0.050	0.000	1.153
CaO	0.000	0.070	0.000	0.362
Cr_2O_3	0.001	0.020	0.005	5.766
F	0.001	0.020	0.001	-0.246
Fe_2O_3	0.050	0.200	0.100	2.159
K_2O	0.000	0.060	0.000	0.654
Li_2O	0.015	0.040	0.028	-4.465
MnO	0.001	0.040	0.020	1.153
Na_2O	0.100	0.200	0.150	-0.352
NiO	0.001	0.020	0.010	2.126
P_2O_5	0.000	0.025	0.013	1.396
SiO_2	0.300	0.500	0.433	2.894
ZrO_2	0.001	0.050	0.025	2.568
Others	0.014	0.019	0.016	1.071

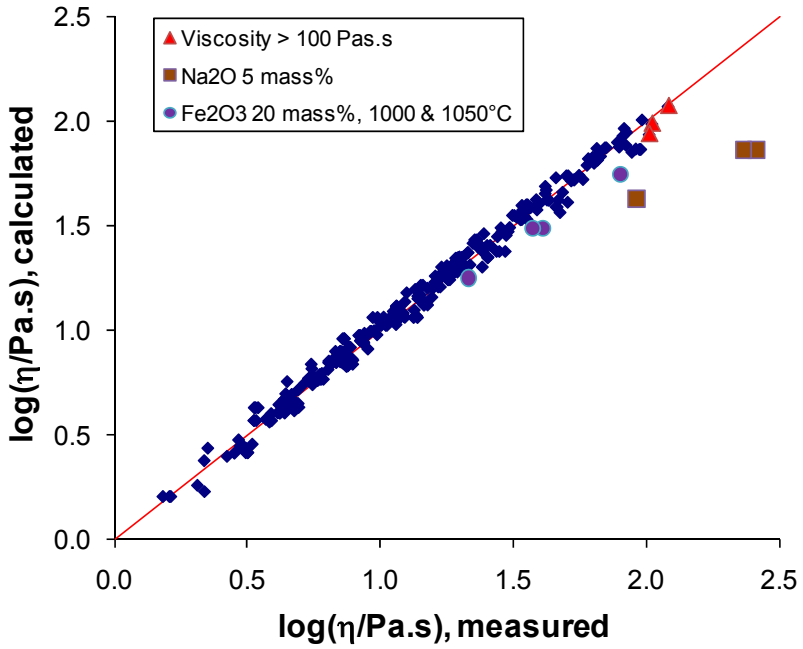


Figure 3.3. Viscosity Data, Calculated, Using Equation (1) with Coefficients Listed in Table 3.2, Versus Measured (outliers are identified in legend)

3.3 Electrical Conductivity (σ)

See Appendix C for the data obtained from the EC experiments. Two model forms were used to fit the EC data. Model 1 used the coefficients presented in Table 3.3 and Equation (2)

$$\ln(\sigma) = A + \left(10^4 / T\right)\sum_{i=1}^{N} B_i x_i \tag{2}$$

where x_i is the mass fraction of the i-th oxide component, A is a constant (with respect to composition and temperature) (ln[S/m]), T is the absolute temperature (K), B_i is the coefficient for Arrhenius constant B for the i-th component (10^{-4} K), and N is the number of model components. The resulting calculated EC values were plotted against the measured values in Figure 3.4. Model 2 utilized the coefficients presented in Table 3.4 and Equation (3). The resulting calculated values from Model 2 were plotted against the measured values in Figure 3.5.

$$\ln(\sigma) = \sum_{i=1}^{N} A_i x_i + \left(10^4 / T\right)\sum_{i=1}^{N} B_i x_i \tag{3}$$

where A_i is the coefficient for Arrhenius constant A for the i-th component (ln[S/m]).

Table 3.3. EC Model 1 Coefficients. In this model, A = 8.55 ln(S/m), R^2 = 0.967, R^2(adj) = 0.965, and p (number of model parameters) = 18

Oxide	B_i, ln(S/m)K
Al_2O_3	-0.92
B_2O_3	-0.98
Bi_2O_3	-0.62
CaO	-1.22
Cr_2O_3	-1.26
F	1.67
Fe_2O_3	-0.79
K_2O	-0.82
Li_2O	0.56
MnO	-1.31
Na_2O	0.45
NiO	-2.50
P_2O_5	0.84
SiO_2	-0.91
ZrO_2	-0.81
NM	-30.48
Others	-2.55

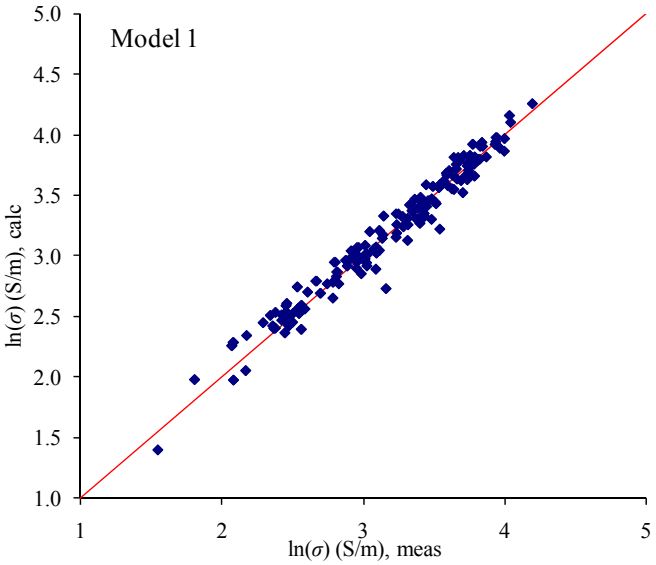


Figure 3.4. Calculated EC Versus Measured Using Model 1

Table 3.4. EC Model 2 Coefficients. In this model, $R^2 = 0.971$, R^2(adj) = 0.968, and p (number of model parameters) = 34

Oxide	A_i, ln(S/m)	B_i, ln(S/m)K
Al_2O_3	10.69	-1.20
B_2O_3	12.00	-1.42
Bi_2O_3	9.32	-0.72
CaO	24.81	-3.31
Cr_2O_3	15.15	-2.11
F	-1.99	3.03
Fe_2O_3	7.79	-0.69
K_2O	16.82	-1.89
Li_2O	21.44	-1.09
MnO	2.36	-0.51
Na_2O	12.81	-0.10
NiO	-7.66	-0.36
P_2O_5	-83.30	12.66
SiO_2	10.03	-1.10
ZrO_2	15.04	-1.64
NM	-119.44	-14.01
Others	-47.67	4.65

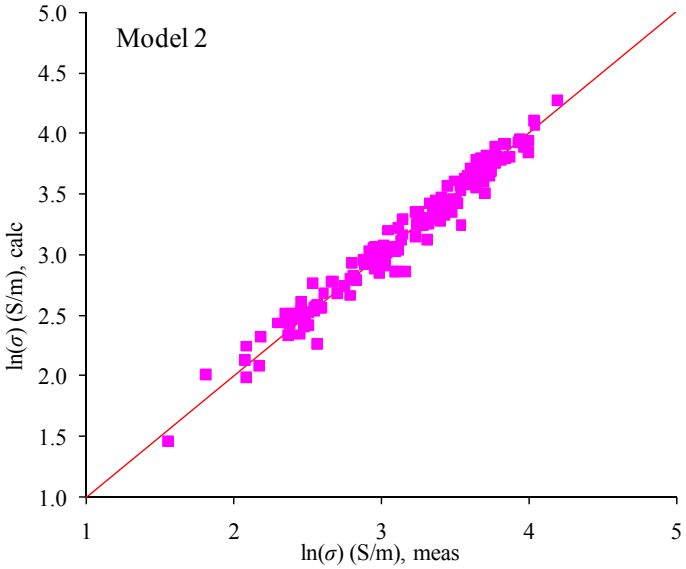


Figure 3.5. Calculated EC versus Measured Using Model 2

It is interesting to note that the EC model that assumes a composition independent *A* model, Model 1, yields an R^2 that is 0.39% lower than that of the composition dependent *A* model, Model 2, and contains roughly half of the coefficients (18 vs. 34). This suggests that like in the case of viscosity, the pre-exponential is composition independent. Electrical conductivity values at 1150°C for each of the 38 glasses in the Matrix 1 test were plotted against the composition variation from the baseline glass (see Figure 3.6).

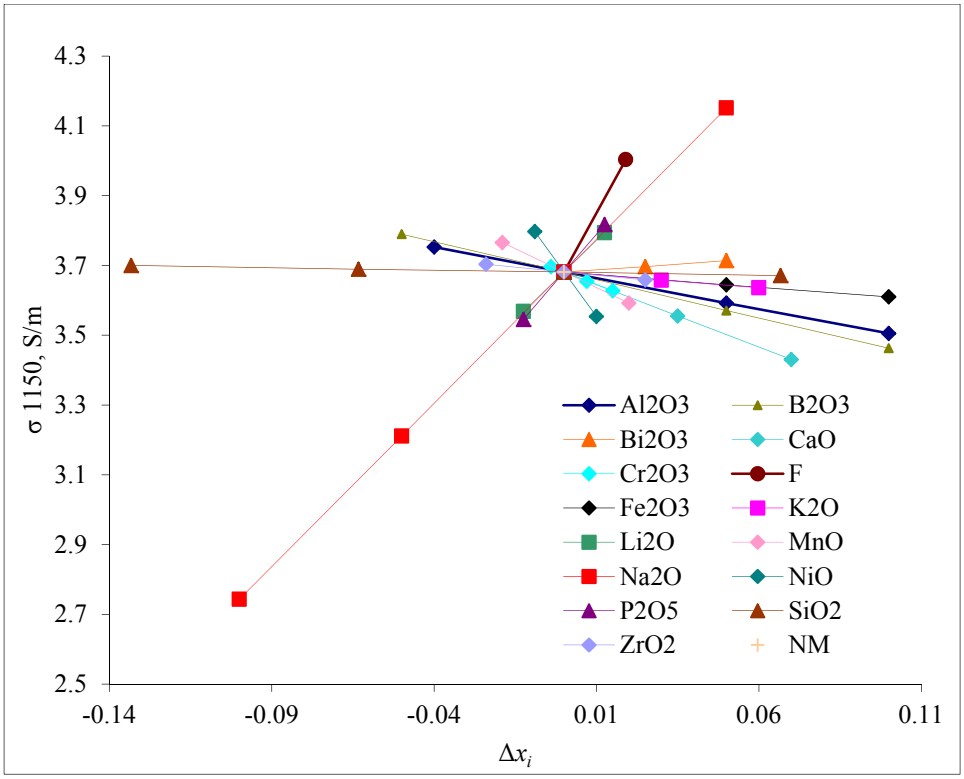


Figure 3.6. Spider Plot for EC Data as a Function of Compositional Deviation from the Baseline (Δx_i in mass fraction)

3.4 Liquidus Temperature (T_L)

Liquidus temperature (T_L) was measured on all of these glasses using both optical and by crystal fraction as a function of temperature (semiquantitative analysis by XRD method) though some data points were not achieved due to difficulty with the measurements at elevated temperatures. The data was analyzed and models were generated from the data. Some gaps were observed in the variation of T_L as a function of each component variation from the baseline composition.

Eight additional glasses were added to the original experimental plan to verify the gaps in the optical T_L data and these glasses include: EM07-Al-225, EM07-B-125, EM07-B-175, EM07-Cr-0145, EM07-Li-00, EM07-Li-05, EM07-Na-225, EM07-P-02, EM07-P-03, and EM07-Si-335. Optical T_L measurements for EM07-Al-225 and EM07-Cr-0145 were abandoned because not enough glass was available to complete the analysis. EM07-B-125 and EM07-B-175 were omitted from the data processing after careful consideration due to problems with the data. There was a significant difference from the baseline for these to glasses as they showed an enormous inconsistency with the other data points for boron variations. EM07-Na-225 was significantly different from the other sodium variant glasses in the matrix and was included on the spider plot (Figure 3.7) for optical T_L but was omitted from the data used to generate the 1st order model as an outlier.

A spider plot was constructed to observe the variations in T_L of glasses in comparison to the mass fraction change in composition from the baseline (EM07-BL-1) of the *i*-th oxide component, Δg_i, and is presented in Figure 3.7. The component with the most dramatic positive effect on optical T_L is Cr_2O_3 (slope of 258°C/mass%) and the 2nd most impactful component was NiO (83°C/mass%). The largest negative effect was caused by the change in Li_2O, Na_2O and K_2O (-46, -34 and -30 °C/ mass%, respectively).

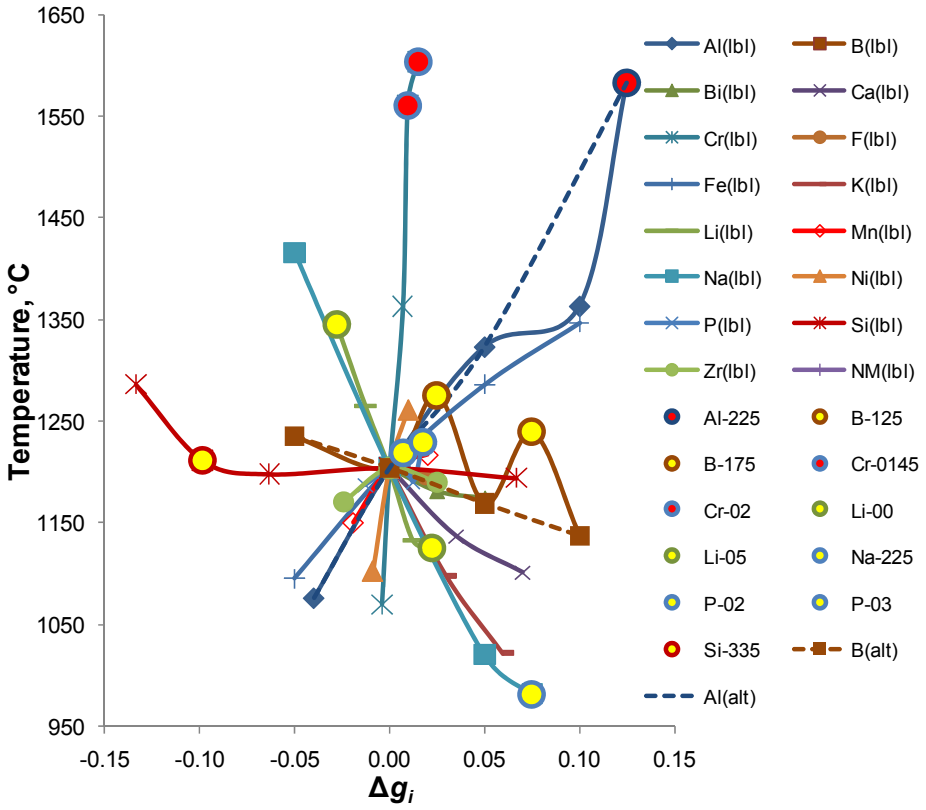


Figure 3.7. Spider Plot of Optical T_L as Determined by Optical Method vs. Change in Composition from the Baseline (designated by element of oxide components). This spider plot shows the location of additional glasses made for verifying data gaps from the original study. Yellow circles points show data points of new glasses that were measured by the optical method (EM07-B-125, B-175, Li-00, Li-05, Na-225, P-02, P-03, and Si-335) and red circles show data points of glasses that could not be measured by the optical method but were measured by the crystal fraction method (EM07-Al-225, Cr-0145, and Cr-02).

3.4.1 Optical T_L

A log of the heat treatments and optical observations for the Matrix I and HWL (Matrix II by SRNL) glasses is documented in Appendix D. For each sample, T_c and T_a values were first obtained, where T_c is the lower bound of liquidus temperature (highest temperature heat treated specimen containing crystals) and T_a is the upper bound of liquidus temperature (lowest temperature heat treated specimen not containing crystals), and then a T_L was determined from these T_c and T_a values where the cognizant scientist extrapolated the T_L as a value between T_c and T_a though not necessarily the average of T_c and T_a.

The T_c, T_a, and T_L data for the EM07 glasses are summarized in Table 3.5. Glasses EM07-Cr-02 and EM07-Na-05 were found to have such high liquidus temperatures that they were abandoned (optically) due to their tendency to crystallize severely upon cooling and listed as having a T_L values higher than 1500°C and 1361°C, respectively.

In the glasses with measured $T_L \sim 1250$°C and above, a Fe_2O_3 to FeO reduction was observed at high resulting in a very dark glassy matrix where visible spinels could only be seen optically by the Fe-depleted halo surrounding the opaque spinel crystals. In order to optically observe the spinels in the high temperature heat treatments ($T \geq 1250$°C) for the high T_L glasses, the thin sections made of heat treatment specimens had to be polished extremely thin.

3.4.2 Crystal Fraction (C_F) T_L

For each glass composition, several heat treatment specimens were prepared to cover a large ΔT to make the crystal fraction extrapolation method (or C_F) more efficient and reduce error in the calculations. Heat treated specimens were doped with 5 mass% CaF_2, milled to powderize the glass and adequately mix, and then analyzed using XRD. The CaF_2 doped into the specimen was used as a standard for semi-quantitative analysis to determine the mass fraction of crystal phase(s) in a specimen. For the equilibrium C_F as a function of temperature, heat treatments were run from T_L down towards at temperature of ~ 2–3 mass% crystallinity (more in some glasses).

The mass % of each crystalline phase was plotted versus temperature and the crystal mass fraction was extrapolated to zero mass% yielding the "T_L Mass%" value for each glass (see Table 3.5). Once C_F data were calculated for each heat treatment, the remaining mass of glass could be calculated as a difference. The mass fraction of glass, g_g, is given by

$$g_g = g_t - \sum_{i=1}^{N} g_{c,i} \tag{4}$$

where g_t is the total mass (in this case, the value is normalized to 1 and thus component values are mass fractions) and g_c is the mass fraction of a given crystalline phase. By converting the g_i values into mole fractions, M_i, the density of glass, ρ_g, can be computed using Equation (5)

$$\rho_g = \sum_{i=1}^{N} M_i MW_i \Big/ \sum_{i=1}^{N} M_i V_{M,i} \tag{5}$$

where M_i is the mole fraction of the i-th component additive, MW_i is the molecular weight of the i-th oxide, and $V_{M,i}$ is the molar volume of the i-th component additive explained elsewhere (Vienna, 2002). The total volume of each heat treatment, V_{HT}, was calculated using Equation (6)

$$V_{HT} = g_g \Big/ \rho_g + \sum_{i=1}^{N} g_i \Big/ \rho_i \tag{6}$$

where g_i is the mass fraction of component i of N total phases in the heat treated specimen and ρ_i is the density of component i; the value used for spinel, $\rho_{trevorite}$ = 5.33 g/cm^3 since trevorite was the primary spinel phase determined by XRD for all glasses (Lide 2007-2008). The volume % of the i-th component, V_i, in the heat treated specimen is denoted by

$$V_i = 100 \cdot \frac{g_i}{\rho_i \cdot V_{HT}} \tag{7}$$

The values of V_i were plotted as a function of temperature and a linear correlation fit to the data using $V_i = mT + b$ where $T_{1\%} = (V_i - b) / m$ when $V_i = 1$ and the temperature at which each glass would contain 1 vol%, $T_{1\%}$, of trevorite was calculated. This data is presented in Table 3.5. In general, "T_L Optical" data aligns reasonably well with the crystal fraction T_L ("T_L Mass%" and T_L Vol%" data.

Table 3.5. Summary of Liquidus Temperature Results. Tabulated below are the results for T_L determined using optical observations ("T_c", "T_a", and "T_L, Optical"), crystal fraction results for both mass% ("T_L Mass%") and volume% ("T_L Vol%") data, and $T_{1\%}$. Additional data are included such as the # of temperatures used to calculate crystal fraction ("# Pts"), the slope of the line used to calculate the crystal fraction (temperature vs. crystal fraction, "Slope"), as well as the furnace used to make the measurements for the data presented ("Furnace Used"). Glasses that precipitated micron-sized crystals upon cooling are listed with Glass ID in bold and italics. The primary phase in all glasses was spinel. Crystal fraction and optical T_L were not determined for all of the glasses.

	Optical Values			*Mass% Values*			*Vol% Values*		
Glass ID	**T_c (°C)**	**T_a (°C)**	**T_L Optical (°C)**	**# Pts**	**Slope**	**T_L Mass% (°C)**	**T_L Vol% (°C)**	**$T_{1\%}$ (°C)**	**Furnace Used**
EM07-BL-1	1200	1208	1204	4	-116.2	1181	1180	952.9	10
EM07-BL-2	1201	1208	1204	3	-96.92	1182	1182	992.6	10
EM07-Al-06	1074	1077	1076	4	-84.62	1086	1086	921.3	10
EM07-Al-15	1318	1327	1323	3	-135.1	1297	1296	1030	5
EM07-Al-20	1360	1364	1363	3	-101.0	1380	1377	1178	5
EM07-Al-225	Not measured for this glass			3	-73.58	1581	1575	1432	5
EM07-B-05	1230	1239	1235	4	-107.7	1228	1227	1018	10
EM07-B-125	1276	1281	1271	Not measured for this glass					8
EM07-B-15	1165	1173	1169	3	-66.13	1107	1106	976.6	10
EM07-B-175	1234	1244	1239	Not measured for this glass					5
EM07-B-20	1134	1140	1137	4	-172.1	1143	1143	798.3	8
EM07-Bi-025	1177	1184	1181	4	-121.4	1173	1173	939.7	8
EM07-Bi-05	1170	1177	1174	4	-146.3	1174	1174	897.8	10
EM07-Ca-035	1134	1141	1137	5	-92.52	1126	1125	946.2	8
EM07-Ca-07	1099	1102	1101	4	-104.4	1112	1111	910.6	5
EM07-Cr-001	1065	1074	1070	5	-86.68	1067	1067	896.6	8

	Optical Values			*Mass% Values*			*Vol% Values*		
Glass ID	**T_c (°C)**	**T_a (°C)**	**T_L Optical (°C)**	**# Pts**	**Slope**	**T_L Mass% (°C)**	**T_L Vol% (°C)**	**$T_{1\%}$ (°C)**	**Furnace Used**
EM07-Cr-012	1360	1364	1363	3	-125.5	1320	1319	1075	5
EM07-Cr-0145	Not measured for this glass			3	-166.0	1561	1558	1237	5
EM07-Cr-02	Not measured for this glass			4	-189.3	1603	1599	1235	N/A
EM07-F-02	1191	1198	1195	4	-158.3	1182	1181	870.5	8
EM07-Fe-05	1090	1099	1095	5	-154.6	1065	1065	755.5	5
EM07-Fe-15	1281	1292	1286	4	-110.0	1270	1269	1058	5
EM07-Fe-20	1343	1350	1347	3	-88.21	1398	1394	1232	5
EM07-K-03	1093	1099	1098	4	-101.1	1105	1105	906.4	5
EM07-K-06	1018	1024	1022	3	-112.9	1048	1047	825.8	8
EM07-Li-00	1340	1349	1345	Not measured for this glass					5
EM07-Li-015	1262	1268	1265	3	-165.0	1283	1283	958.9	5
EM07-Li-04	1129	1134	1133	5	-60.13	1075	1074	957.1	8
EM07-Li-05	1121	1131	1126	Not measured for this glass					5
EM07-Mn-01	1148	1151	1150	3	-113.1	1134	1133	910.3	8
EM07-Mn-04	1213	1220	1217	4	-91.87	1143	1143	965.6	5
EM07-Na-05	Not measured for this glass			2	-100.0	1598	1581	1393	N/A
EM07-Na-10	1410	1418	1416	3	-150.0	1424	1423	1129	5
EM07-Na-20	1018	1024	1021	4	-90.95	1006	1005	828.7	8
EM07-Na-225	972	992	982	3	-127.8	978	978	729.8	8
EM07-Ni-001	1099	1105	1102	5	-156.5	1076	1076	766.4	5
EM07-Ni-02	1257	1264	1261	4	-115.0	1264	1263	1040	8
EM07-P-0	1184	1191	1187	5	-104.9	1174	1173	968.8	8
EM07-P-02	1215	1224	1220	Not measured for this glass					5
EM07-P-03	1224	1234	1229	Not measured for this glass					5
EM07-Si-30	1280	1288	1286	3	-101.9	1284	1284	1091	8
EM07-Si-335	1208	1215	1212	Not measured for this glass					5
EM07-Si-37	1194	1201	1198	4	-73.17	1198	1197	1057	10
EM07-Si-50	1190	1197	1194	4	-147.3	1184	1183	890.0	10
EM07-Zr-001	1166	1176	1171	4	-93.50	1160	1160	974.8	8
EM07-Zr-05	1184	1191	1190	3	-108.2	1170	1170	960.7	8
EM07-NM-0025	1203	1214	1206	3	-129.8	1220	1220	965.5	10

Since the data for T_L, Mass% and T_L, Vol% were so similar, only a spider plot for T_L, Mass% was assembled for the extrapolated T_L obtained using crystal fraction data for each glass in Table 3.5 with crystal fraction data as a function of the concentration change from EM07-BL-1 of the i-th oxide

component, Δg_i, and can be found in Figure 3.8. The effect of component concentration change on the $T_{1\%}$ is presented in Figure 3.9 for those glasses in Table 3.5 with crystal fraction data. Figure 3.10 compares the T_L Mass% data with the optical T_L data.

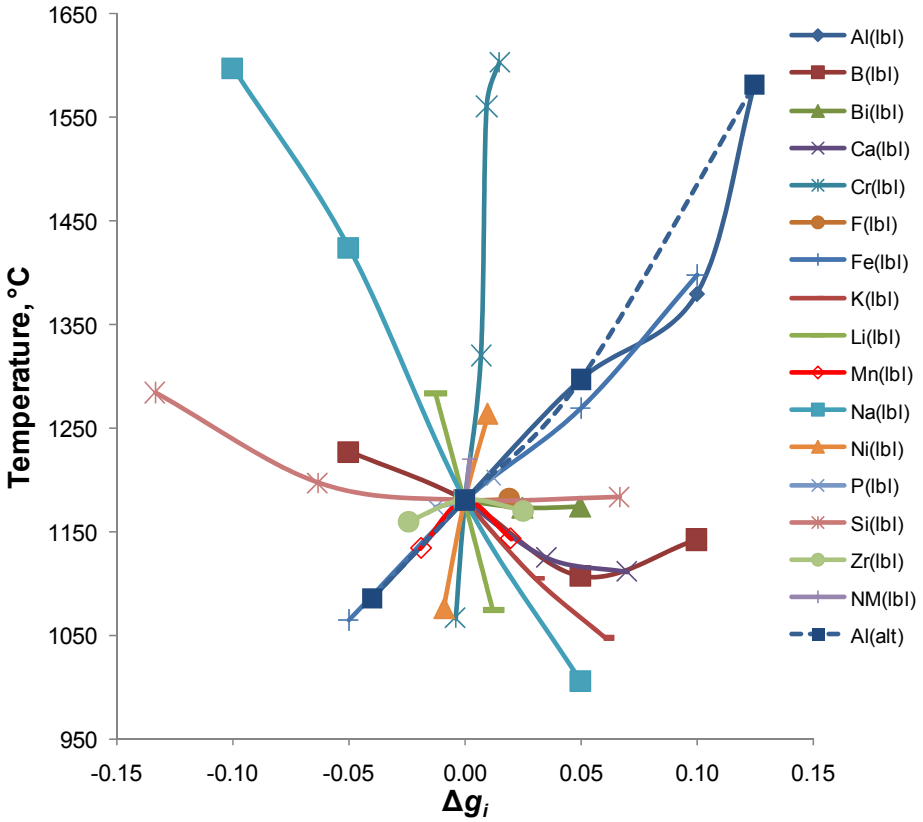


Figure 3.8. Spider Plot of Crystal Fraction T_L, Mass% as Determined by XRD Crystal Fraction Method vs. Change in Composition from the Baseline as Δg_i.

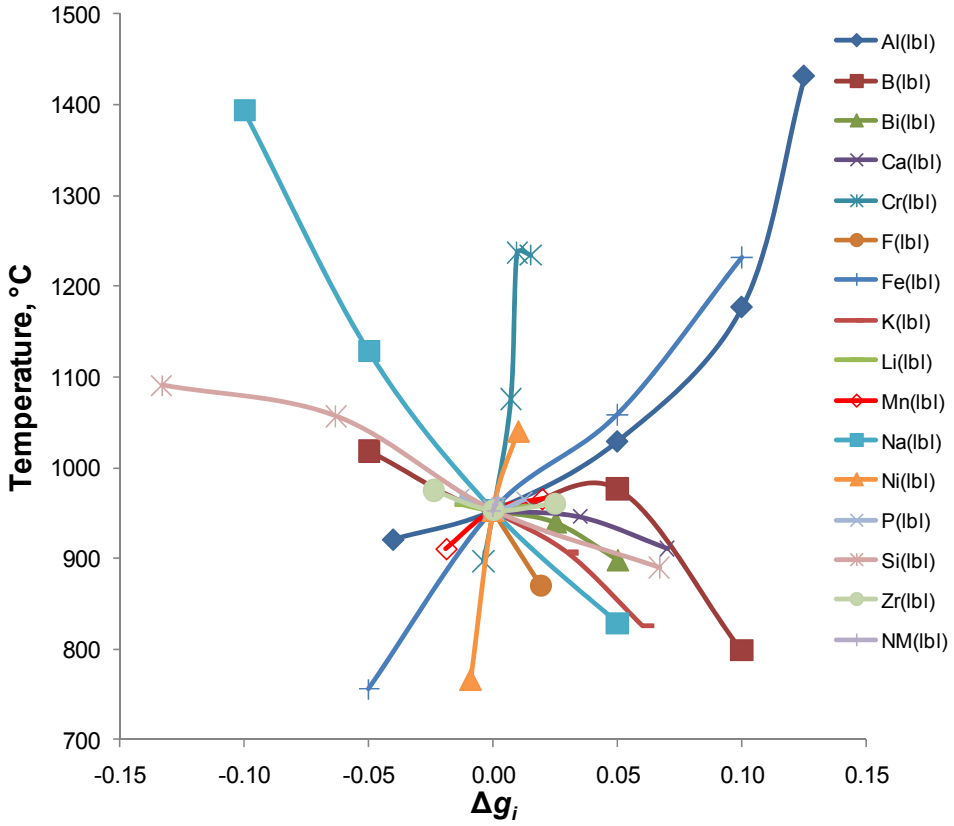


Figure 3.9. Spider Plot of $T_{1\%}$ for EM07 Glasses as Determined by XRD Crystal Fraction Method vs. Change in Composition from the Baseline as Δg_i.

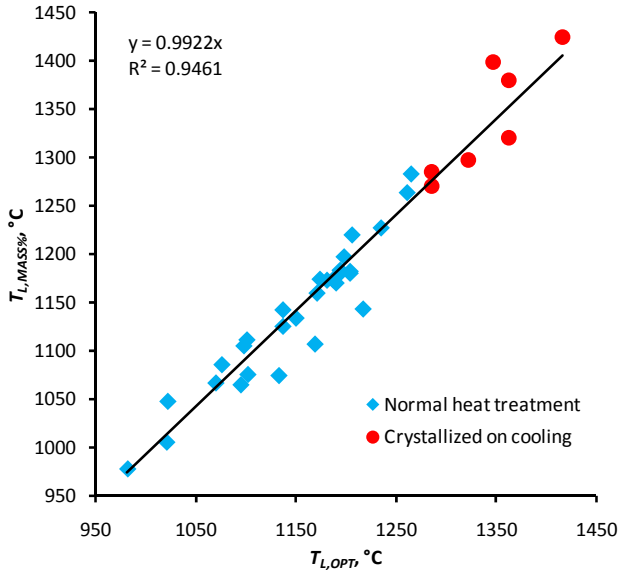


Figure 3.10. Comparison of T_L Data Obtained Using XRD (mass%) Methods against Data Obtained Using Optical Methods for the 36 Glasses for Which Data was Collected Using Both Methods. Trend line presented runs through all data points presented.

First-order, standard least squares models were fit to the data for Optical T_L, T_L Mass%, and $T_{1\%}$ (using volume %) using JMP® 6.0 software and the coefficients are presented in Table 3.6.

Table 3.6. First-Order Regression Coefficients for the Calculated vs. Measured T_L data. *The data presented for "Others" refers to the minor components in the glasses (i.e., BaO, CdO, MgO, PbO, PdO, Rh_2O_3, RuO_2, SO_3, SrO, Ce_2O_3, La_2O_3, Nd_2O_3, TiO_2, and ZnO).

	Optical T_L	**T_L Mass%**	**$T_{1\%}$**
Al_2O_3	2975	3572	3550
B_2O_3	645.7	573.4	-138.9
Bi_2O_3	719.0	965.7	-231.4
CaO	-230.4	37.42	292.6
Cr_2O_3	26835	30792	21307
F	1134	1108	-3823
Fe_2O_3	2677	3083	3494
K_2O	-1782	-1138	-1215
Li_2O	-3316	-7027	958.1
MnO	2875	1336	2342
Na_2O	-1664	-2029	-2148
NiO	9405	10837	14908
P_2O_5	2859	1822	443.0
SiO_2	980.6	866.1	360.3
ZrO_2	1572	1356	701.3
Others*	7670	15014	5670

Using the coefficients listed in Table 3.6 and Equation (8) T_L values were calculated for each glass for Optical T_L, T_L Mass%, and $T_{1\%}$ methods. In Equations (8) J is the method used for calculating T_L, N is the number of applicable glasses ($N = 41$ for Optical T_L and $N = 40$ for T_L Mass% and $T_{1\%}$), g_i is the i-th oxide component addition to the glass (in mass fraction), and b_i is the i-th oxide additive component coefficient (see Table 3.6). These values are presented in Table 3.7 along with the measured values. For all cases, the calculated values align well with the measured values and the correlations are plotted in Figure 3.11.

$$T_{L,J} = \sum_{i=1}^{N} g_i b_i \tag{8}$$

Table 3.7. Calculated Data for the Three Different Regression Data Fits Presented in Table 3.6. Values were calculated even for glasses where data could not be measured (see Table 3.5).

Glass ID	**$T_{L,OPT}$ (°C)**	**$T_{L,MASS\%}$ (°C)**	**$T_{1\%}$ (°C)**
EM07-BL-1	1196	1183	961
EM07-BL-2	1196	1183	961
EM07-Al-06	1117	1077	846
EM07-Al-15	1295	1316	1105

Glass ID	$T_{L,OPT}$ (°C)	$T_{L,MASS\%}$ (°C)	$T_{1\%}$ (°C)
EM07-Al-20	1394	1449	1249
EM07-Al-225	1443	1515	1321
EM07-B-05	1227	1217	1023
EM07-B-15	1166	1149	900
EM07-B-20	1135	1115	839
EM07-Bi-025	1184	1178	932
EM07-Bi-05	1172	1172	902
EM07-Ca-035	1146	1143	938
EM07-Ca-07	1096	1103	915
EM07-Cr-001	1093	1064	880
EM07-Cr-012	1377	1391	1105
EM07-Cr-0145	1441	1466	1156
EM07-Cr-02	1583	1629	1268
EM07-F-02	1195	1182	870
EM07-Fe-05	1114	1078	821
EM07-Fe-15	1278	1289	1102
EM07-Fe-20	1361	1394	1243
EM07-K-03	1107	1113	896
EM07-K-06	1018	1044	831
EM07-Li-00	1324	1415	962
EM07-Li-015	1254	1289	962
EM07-Li-04	1138	1078	961
EM07-Li-05	1092	993	961
EM07-Mn-01	1164	1180	935
EM07-Mn-04	1230	1186	990
EM07-Na-05	1533	1561	1327
EM07-Na-10	1364	1372	1144
EM07-Na-20	1028	994	779
EM07-Na-225	944	900	687
EM07-Ni-001	1122	1095	835
EM07-Ni-02	1279	1281	1102
EM07-P-0	1175	1175	968
EM07-P-02	1209	1188	958
EM07-P-03	1226	1194	952
EM07-Si-30	1247	1258	1103
EM07-Si-335	1234	1238	1066
EM07-Si-37	1220	1218	1029
EM07-Si-50	1171	1146	891
EM07-Zr-001	1187	1179	968
EM07-Zr-05	1206	1188	955
EM07-NM-0025	1210	1212	971

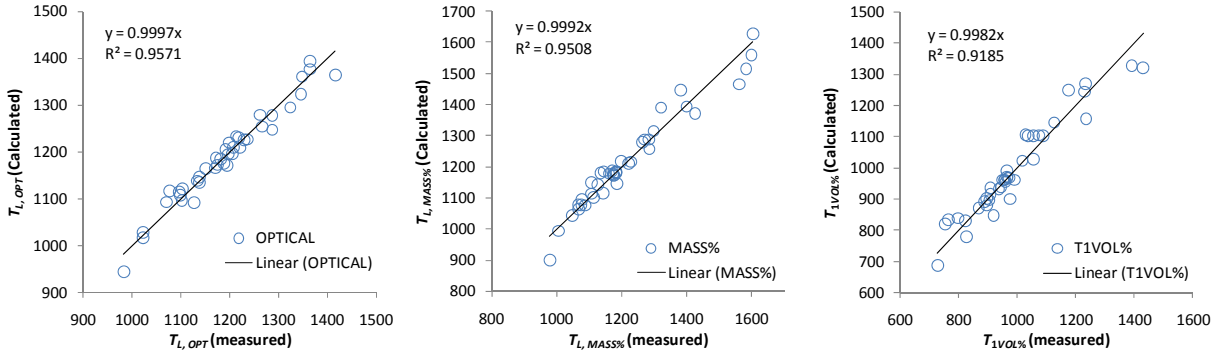


Figure 3.11. Calculated vs. Measured Data for the Different Data Sets.

These models are not valid through the compositional range listed in Table 1.2 but the validity ranges for each T_L measurement method are dictated by the component range for which data was measured successfully (Table 3.5). For example, EM07-Al-225 was not successfully measured with $T_{L,OPT}$ and thus, the upper validity limit for Al_2O_3 additions to the baseline composition is 20 mass% Al_2O_3 (EM07-Al-20), the next highest Al_2O_3-loaded glass tested in this study.

3.5 Canister Centerline Cooling (CCC)

See Appendix B for XRD data obtained from CCC heat treatments. XRD scans of CCC samples identified spinel crystals in all 38 Matrix I glass samples. Crystal content in the matrix glasses ranged from a minimum of 2.2 mass% observed in EM07-Fe-05 and a maximum of 37 mass% present in EM07-Si-30. Nineteen samples were evaluated by quantitative analysis using RIQAS and are in Table 3.8 as values without an approximation (~) symbol. All other weight percent determinations of crystal content are estimations.

Thirty two samples (84%) have crystal content between 2.2 and about 6 mass%. Four samples have crystal content between approximately 7 and 8.3 mass% while two samples, EM07-Na-05 and Si-30, have greater than 10 mass% crystallinity. These last two samples contain zircon and nepheline respectively in addition to spinel.

Table 3.8. Determination of Weight Percent Crystallinity and Identification of Crystals of CCC Heat Treated Glasses by XRD

Glass-ID	Mass% Crystallinity	Crystal Phase Identification
EM07-BL-1	~5	Trevorite
EM07-BL-2	~5	Trevorite
EM07-Al-06	~5	Trevorite
EM07-Al-15	~7	Chromite
EM07-Al-20	7 - 8	Magnetite
EM09-Al-22.5	6.6 14.4	Magnetite Nepheline
EM07-B-05	~4	Trevorite
EM09-B-125	3.9	Magnetite
EM07-B-15	~4	Trevorite
EM09-B-175	0.8	Magnetite
EM07-B-20	5 - 6	Magnetite
EM07-Bi-025	~4	Trevorite
EM07-Bi-05	4.2	Trevorite
EM07-Ca-035	~4	Chromite
EM07-Ca-07	2.9	Trevorite
EM07-Cr-001	~4	Trevorite
EM07-Cr-012	~5	Trevorite
EM09-Cr-0145	3.7	Magnetite
EM07-Cr-02	~6	Trevorite
EM07-F-02	~3.5	Chromite
EM07-Fe-05	2.2	Trevorite
EM07-Fe-15	7.4	Chromite
EM07-Fe-20	8.3	Chromite
EM07-K-03	~4	Trevorite
EM07-K-06	2.8	Magnetite
EM09-Li-0	4.1	Magnetite
EM07-Li-015	~4	Magnetite
EM07-Li-04	~4	Trevorite
EM09-Li-05	2.5 1.4	Magnetite Corundum
EM07-Mn-01	~4	Trevorite
EM07-Mn-04	~4	Chromite
EM07-Na-05	8.0 2.3	Magnetite Zircon
EM07-Na-10	~6	Chromite
EM07-Na-20	~3	Trevorite
EM09-Na-225	1.8	Magnetite
EM07-Ni-001	~3	Trevorite
EM07-Ni-02	~6	Trevorite
EM07-P-0	~4	Trevorite
EM09-P-02	4.5	Magnetite
EM09-P-03	3.7 2.6 3.1	Magnetite Corundum Lithium Phosphate
EM07-Si-30	27.7 9.2	Nepheline Magnesium iron oxide
EM09-Si-335	5.4 7.5 3.0	Magnetite Nepheline Corundum
EM07-Si-37	5.9	Trevorite

EM07-Si-50	~3	Trevorite
EM07-Zr-001	~5	Trevorite
EM07-Zr-05	~6	Chromite
EM07-NM-0025	4.8	Magnetite

3.6 Product Consistency Test (PCT)

The results of PCT are published elsewhere (Raszewski et al. 2008b) but are summarized in Table 3.9. Most glasses have a release rate for Na an order of magnitude below the EA glass and about the same release rate as the ARM-1 glass used as a reference glass in the test. Exceptions to this are EM07-Si-30 which had high levels of nepheline crystals in the CCC heat treated glass and had Na release rates (3,600 to 3,800 ppm) over twice that of the EA glass (1,600 to 1,700 ppm). The quenched Si-30 glass was one of the glasses that had elevated Na release rates (300 ppm) above most EM07 glasses. Other glasses that had similar release rates as quenched Si-30 were EM07-Na-20, both quenched (150 ppm) and CCC (175 ppm) samples and EM07-K-06 CCC samples (150 to 175 ppm). All other samples were below these levels except for EM07-B-20 which had Na release rates at about 400 and 650 ppm for quenched and CCC samples respectively, the highest release rate except the Si-30 CCC samples.

Table 3.9. PCT Results (in ppm) taken from Raszewski et al. 2008b

Glass ID	Type	B		Li		Na		Si	
		Ave.	St. Dev.	Ave.	St. Dev.	Ave.	St. Dev.	Ave.	St. Dev.
EM07-BL-1	Quenched	8.82	0.55	3.63	0.13	32.8	0.36	36.7	1.55
	CCC	8.37	0.42	3.59	0.09	30.5	0.91	38.8	1.04
EM07-BL-2	Quenched	8.87	0.16	3.64	0.09	31.9	0.35	35.7	0.64
	CCC	8.75	0.27	3.51	0.07	29.7	0.67	36.7	0.30
EM07-Al-06	Quenched	13.4	0.40	4.64	0.14	44.7	0.21	41.6	1.37
	CCC	11.5	0.25	4.15	0.09	35.7	0.71	31.8	0.40
EM07-Al-15	Quenched	7.86	0.21	3.90	0.07	28.0	3.93	34.7	0.23
	CCC	7.09	0.10	3.47	0.08	25.0	0.06	37.0	0.47
EM07-Al-20	Quenched	8.77	2.65	5.33	1.64	27.7	8.98	44.8	13.8
	CCC	8.04	0.26	4.39	0.08	22.8	0.71	37.6	0.23
EM07-B-05	Quenched	5.38	2.32	3.84	0.10	41.5	1.00	41.3	0.72
	CCC	5.47	0.88	3.88	0.13	39.2	0.26	42.8	0.35
EM07-B-15	Quenched	38.1	2.82	8.36	0.13	55.8	1.06	28.8	0.51
	CCC	49.0	5.39	10.3	0.20	64.5	1.59	31.1	0.45
EM07-B-20	Quenched	248	6.24	39.2	0.44	221	5.86	20.4	0.17
	CCC	371	11.8	58.1	1.19	323	6.56	20.2	0.55
EM07-Bi-025	Quenched	9.74	1.09	3.98	0.11	34.1	1.01	35.0	1.16
	CCC	10.2	3.75	3.84	0.08	30.8	0.36	36.1	1.05
EM07-Bi-05	Quenched	8.24	0.55	3.87	0.13	33.0	0.56	33.5	1.01
	CCC	8.77	0.19	3.90	0.13	31.6	0.60	35.1	1.25
EM07-Ca-035	Quenched	6.59	5.36	3.83	-	37.3	-	30.6	-
	CCC	8.41	0.38	3.61	0.14	32.6	1.01	29.5	0.65
EM07-Ca-07	Quenched	12.1	0.31	4.95	0.09	47.8	0.85	29.0	0.38
	CCC	8.56	0.15	4.19	0.04	37.5	0.55	24.8	0.75

Glass ID	Type	B		Li		Na		Si	
		Ave.	St. Dev.	Ave.	St. Dev.	Ave.	St. Dev.	Ave.	St. Dev.
EM07-Cr-001	Quenched	9.27	0.20	3.87	0.06	32.9	0.32	37.8	0.12
	CCC	9.67	0.20	4.05	0.08	32.2	0.36	41.6	0.26
EM07-Cr-012	Quenched	8.78	0.44	3.73	0.13	32.3	1.04	36.5	1.48
	CCC	9.10	0.54	3.89	0.14	32.9	0.83	40.7	1.47
EM07-Cr-02	Quenched	8.88	0.55	3.75	0.10	32.7	0.35	37.8	1.31
	CCC	8.31	0.37	3.51	0.10	29.3	0.30	38.7	0.98
EM07-F-02	Quenched	7.97	0.69	3.58	0.11	31.1	1.30	32.4	1.01
	CCC	7.31	0.29	3.21	0.02	28.2	0.42	33.1	0.45
EM07-Fe-05	Quenched	9.45	0.21	3.52	0.09	34.4	0.72	36.5	0.65
	CCC	8.93	0.24	3.63	0.10	32.3	0.46	38.7	0.60
EM07-Fe-15	Quenched	9.08	0.17	3.98	0.09	31.7	0.55	35.4	0.85
	CCC	8.97	0.59	3.69	0.27	30.8	1.91	40.5	2.55
EM07-Fe-20	Quenched	9.22	0.26	4.15	0.08	30.4	1.21	35.0	0.44
	CCC	7.90	0.14	3.13	0.05	28.6	0.72	37.9	0.26
EM07-K-03	Quenched	9.49	0.45	3.55	0.10	34.8	0.70	32.6	1.10
	CCC	11.0	0.32	4.11	0.14	36.8	1.97	36.2	0.23
EM07-K-06	Quenched	16.5	1.08	5.99	0.34	51.7	1.53	35.9	1.10
	CCC	22.6	4.56	8.12	1.80	68.3	13.9	46.4	15.8
EM07-Li-015	Quenched	7.48	0.34	1.95	0.02	29.8	1.80	31.0	0.60
	CCC	7.36	0.48	2.01	0.10	29.0	1.13	34.3	1.61
EM07-Li-04	Quenched	9.47	0.30	5.71	0.07	37.3	0.60	37.0	0.87
	CCC	9.22	0.18	5.74	0.05	35.5	0.12	39.5	0.35
EM07-Mn-01	Quenched	8.44	0.41	3.61	0.08	32.6	0.70	37.0	0.64
	CCC	8.36	0.33	3.63	0.10	31.2	0.40	38.4	1.16
EM07-Mn-04	Quenched	9.51	0.21	3.88	0.04	34.4	1.25	37.7	1.39
	CCC	8.70	0.33	3.67	0.07	31.9	0.21	37.4	1.19
EM07-Na-05	Quenched	6.32	0.12	5.26	0.26	1.22	-	34.6	2.35
	CCC	6.07	0.32	5.33	0.19	0.59	0.39	33.7	1.31
EM07-Na-10	Quenched	7.31	0.27	5.45	0.05	10.4	0.38	35.0	0.30
	CCC	6.48	0.22	4.56	0.06	10.6	0.12	36.3	0.49
EM07-Na-20	Quenched	15.5	0.30	3.54	0.02	87.3	2.29	42.6	0.57
	CCC	17.7	0.21	4.59	0.09	89.7	0.61	45.2	1.15
EM07-Ni-001	Quenched	7.90	0.59	3.59	0.03	31.3	0.67	33.1	0.46
	CCC	7.73	0.27	3.57	0.05	30.3	0.91	35.8	0.61
EM07-Ni-02	Quenched	8.21	0.26	3.67	0.11	33.6	1.98	34.3	1.16
	CCC	8.07	0.20	3.64	0.05	32.0	1.71	35.9	0.40
EM07-P-0	Quenched	10.4	1.00	3.75	0.11	32.6	0.59	34.8	0.68
	CCC	8.98	1.89	3.74	0.08	31.4	0.29	37.2	1.12
EM07-P-025	Quenched	10.4	0.81	3.93	0.11	32.8	0.97	34.9	1.33
	CCC	8.67	0.30	7.74	0.09	38.1	0.25	38.5	0.55
EM07-Si-30	Quenched	64.7	1.45	16.6	0.21	154	1.00	35.1	0.85
	CCC	1300	10.0	294	21.1	2197	103	91.9	0.97
EM07-Si-37	Quenched	17.4	2.82	5.00	0.09	52.1	0.35	31.5	0.57
	CCC	24.5	0.72	7.27	0.01	66.8	0.06	36.3	0.78

Glass ID	Type	B		Li		Na		Si	
		Ave.	St. Dev.	Ave.	St. Dev.	Ave.	St. Dev.	Ave.	St. Dev.
EM07-Si-50	Quenched	6.56	0.72	3.53	0.08	20.8	0.82	36.7	0.80
	CCC	6.75	0.52	3.39	0.07	20.2	0.60	39.5	0.65
EM07-Zr-001	Quenched	9.14	0.15	3.73	0.05	35.3	0.81	39.7	0.87
	CCC	9.12	0.37	3.83	0.06	34.2	1.31	42.5	0.31
EM07-Zr-05	Quenched	7.34	0.34	3.55	0.08	29.2	1.19	29.5	0.79
	CCC	6.88	0.04	3.39	0.03	27.3	0.93	30.3	0.15
EM07-NM-0025	Quenched	9.18	0.35	3.72	0.15	31.9	0.67	35.7	1.10
	CCC	8.52	0.36	3.55	0.08	30.4	0.50	39.0	0.40

*Standard deviation (St. Dev.) was not calculated for entries where three measured values were not acquired (sometimes values were below detection limit) and thus a "-" is presented for these entries.

3.7 Toxicity Characteristic Leach Procedure (TCLP)

See Appendix F for the data obtained from the TCLP measurements (quenched glass results page F.1 through F.23 and CCC from F.24 through F.39). Note, only the 2007 Matrix I glasses (38 glasses) were tested by TCLP. Results of TCLP tests of hazardous metals above Reporting Detection Limits (RDL) are found in Table 3.11. Note that only Pb and Cd were above RDL and their concentrations were well below the EPA's limits listed in Table 3.10.

Table 3.10. EPA TCLP Limits for Characteristically Hazardous Designation (ppm)

As	**Ba**	**Cd**	**Cr**	**Pb**	**Se**	**Ag**
5	100	1	5	5	1	5

Table 3.11. Pb and Cd Metals Detected above the Reporting Detection Limit of the ICP of 0.1 ppm for Pb and 0.05 ppm for Cd.

	Quenched		*CCC*	
Glass	**Pb (ppm)**	**Cd (ppm)**	**Pb (ppm)**	**Cd (ppm)**
EM07-BL-1	0.20	-	0.12	-
EM07-Al-20	0.15	-	-	-
EM07-B-05	0.18	-	-	-
EM07-B-15	0.13	-	0.12	-
EM07-B-20	0.13	0.072	0.20	0.10
EM07-Bi-025	0.12	-	0.10	-
EM07-Ca-035	-	-	0.10	-
EM07-Ca-07	0.13	0.079	0.12	0.53
EM07-F-02	-	-	-	0.051
EM07-K-03	-	-	0.12	-
EM07-K-06	0.12	0.065	0.11	-
EM07-Na-05	-	-	-	0.11
EM07-Na-20	-	0.057	0.16	0.053
EM07-Ni-001	-	-	0.11	-
EM07-P-0	-	-	0.14	-
EM07-Si-30	0.41	0.20	0.10	0.25
EM07-Si-37	0.15	0.07	0.15	0.093
EM07-Si-50	-	-	0.37	-

4.0 References

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Appendix A: Viscosity Data

A.1 EM07-BL-1 Viscosity Data

Table A.1. Viscosity data for EM07-BL-1

EM07-BL-1

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1145	58.85	40.66	10.47	7.232	7.053	1.978
1100.0	1097	36.53	41.25	10.29	11.616	7.301	2.452
1050.0	1047	21.35	41.91	10.15	19.932	7.577	2.992
1000.0	997	11.53	40.92	10.06	35.708	7.874	3.575
950.0	947	9.80	68.86	10.04	70.580	8.195	4.257
1050.0	1042	21.48	43.03	10.15	20.345	7.602	3.013
1150.0	1144	60.51	42.27	10.48	7.322	7.056	1.991
1200.0	1194	70.00	30.96	10.55	4.667	6.814	1.540
1150.0	1146	61.62	42.28	10.49	7.197	7.044	1.974

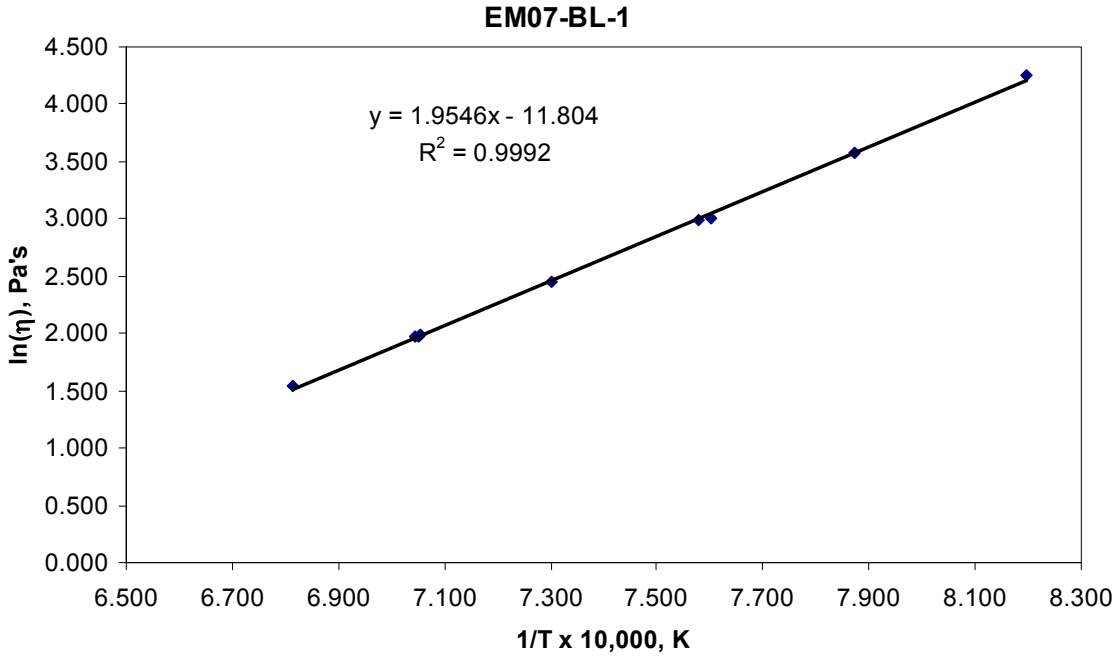

Figure A.1. Viscosity trend for EM07-BL-1

A.2 EM07-BL-2 Viscosity Data

Table A.2. Viscosity data for EM07-BL-2

EM07-BL-2

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1144	58.85	39.81	10.47	7.081	7.054	1.957
1100.0	1096	36.35	40.86	10.29	11.562	7.303	2.448
1050.0	1046	21.53	41.84	10.15	19.734	7.580	2.982
1000.0	996	11.17	40.08	10.06	36.083	7.879	3.586
950.0	946	9.96	70.84	10.05	71.421	8.202	4.269
1050.0	1043	22.75	44.84	10.17	20.038	7.596	2.998
1150.0	1145	60.61	42.26	10.48	7.308	7.051	1.989
1200.0	1195	70.00	30.84	10.55	4.648	6.812	1.536
1150.0	1146	60.70	42.00	10.48	7.252	7.049	1.981

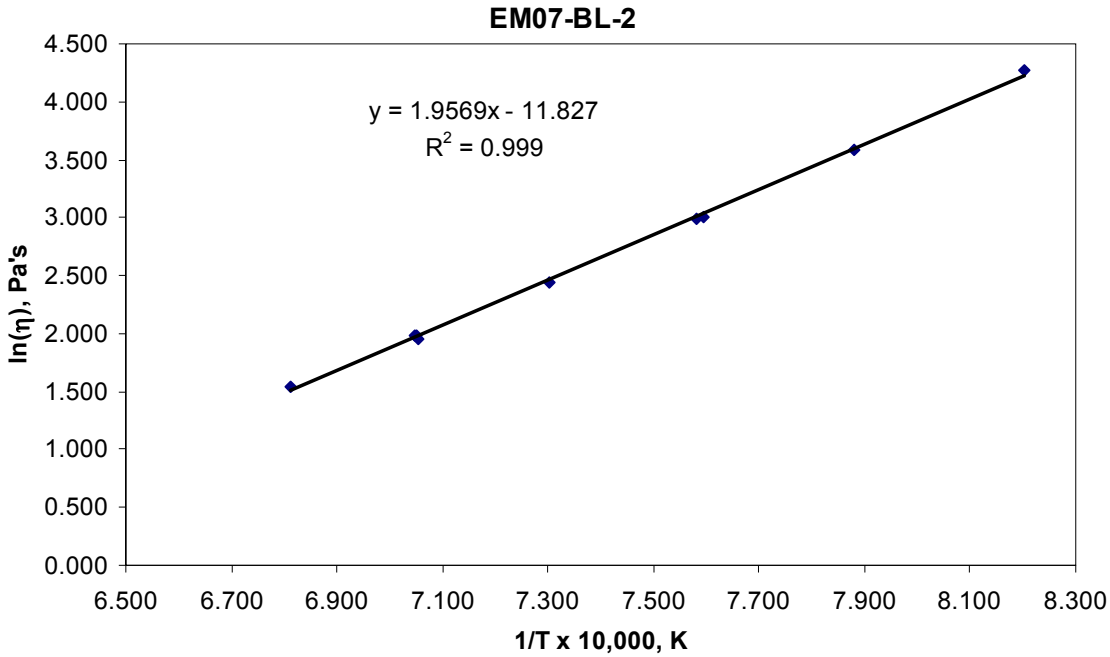

Figure A.2. Viscosity Trend for EM07-BL-2

A.3 EM07-Al-06 Viscosity Data

Table A.3. Viscosity data for EM07-Al-06

EM07-Al-06

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1144	63.85	25.10	10.51	4.130	7.058	1.418
1100.0	1095	41.17	25.50	10.33	6.397	7.308	1.856
1050.0	1046	23.85	24.51	10.18	10.458	7.582	2.347
1000.0	996	13.85	24.69	10.08	17.973	7.878	2.889
950.0	946	11.10	37.30	10.06	33.798	8.201	3.520
1050.0	1043	28.12	29.14	10.21	10.586	7.596	2.360
1150.0	1143	66.45	26.67	10.52	4.224	7.060	1.441
1200.0	1194	70.00	18.84	10.55	2.840	6.818	1.044
1150.0	1145	65.86	26.29	10.52	4.200	7.053	1.435

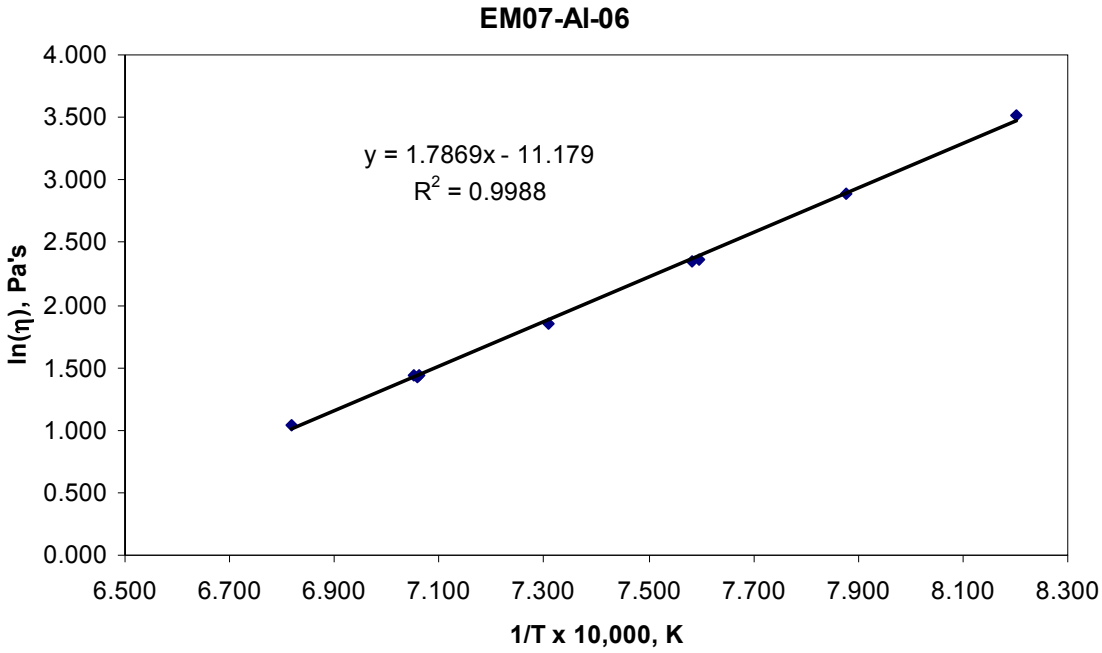

Figure A.3. Viscosity Trend for EM07-Al-06

A.4 EM07-Al-15 Viscosity Data

Table A.4. Viscosity data for EM07-Al-15

EM07-Al-15

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	25.10	39.92	10.19	16.201	7.046	2.785
1100.0	1097	13.85	39.32	10.08	28.630	7.299	3.354
1050.0	1047	11.10	55.70	10.06	50.469	7.575	3.921
1000.0	996	7.78	75.48	10.03	97.291	7.876	4.578
950.0	949	2.64	61.47	9.97	232.266	8.180	5.448
1050.0	1045	11.53	58.78	10.06	51.299	7.587	3.938
1150.0	1143	28.28	46.70	10.22	16.867	7.063	2.825
1200.0	1195	45.41	43.47	10.36	9.919	6.811	2.294
1150.0	1146	28.57	46.73	10.22	16.716	7.046	2.816

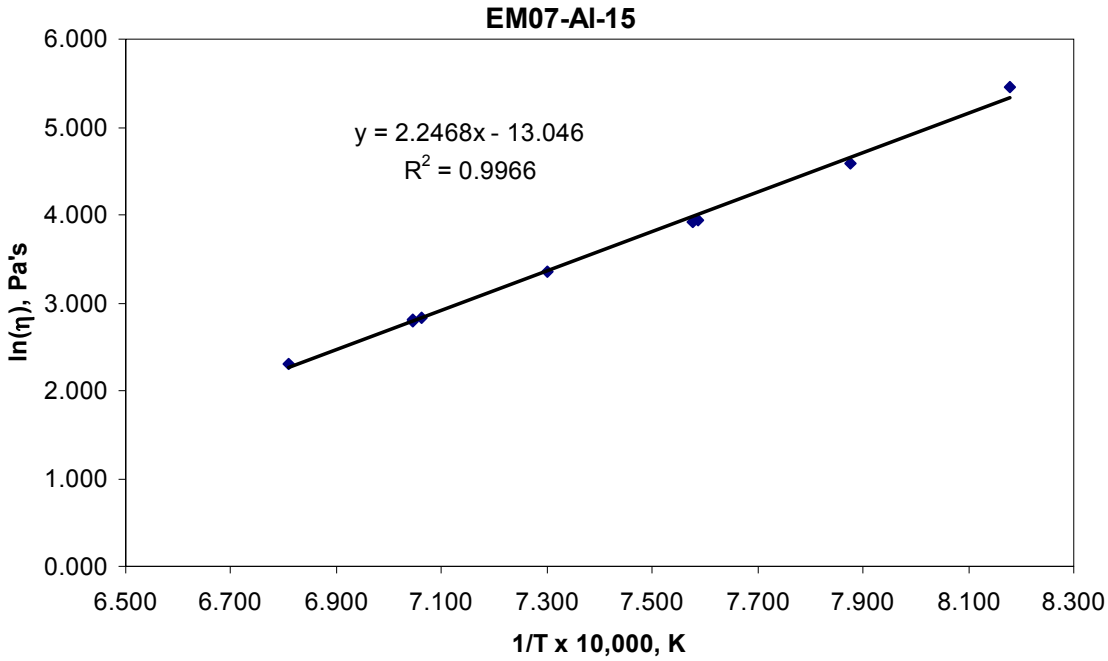

Figure A.4. Viscosity Trend for EM07-Al-15

A.5 EM07-Al-20 Viscosity Data

Table A.5. Viscosity data for EM07-Al-20

EM07-Al-20

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	11.10	51.98	10.06	47.100	7.048	3.852
1100.0	1096	7.57	69.64	10.02	92.159	7.303	4.524
1050.0							
1000.0							
950.0							
1050.0							
1150.0							
1200.0	1195	18.29	42.55	10.12	23.552	6.813	3.159
1150.0	1146	12.49	52.95	10.07	42.693	7.046	3.754

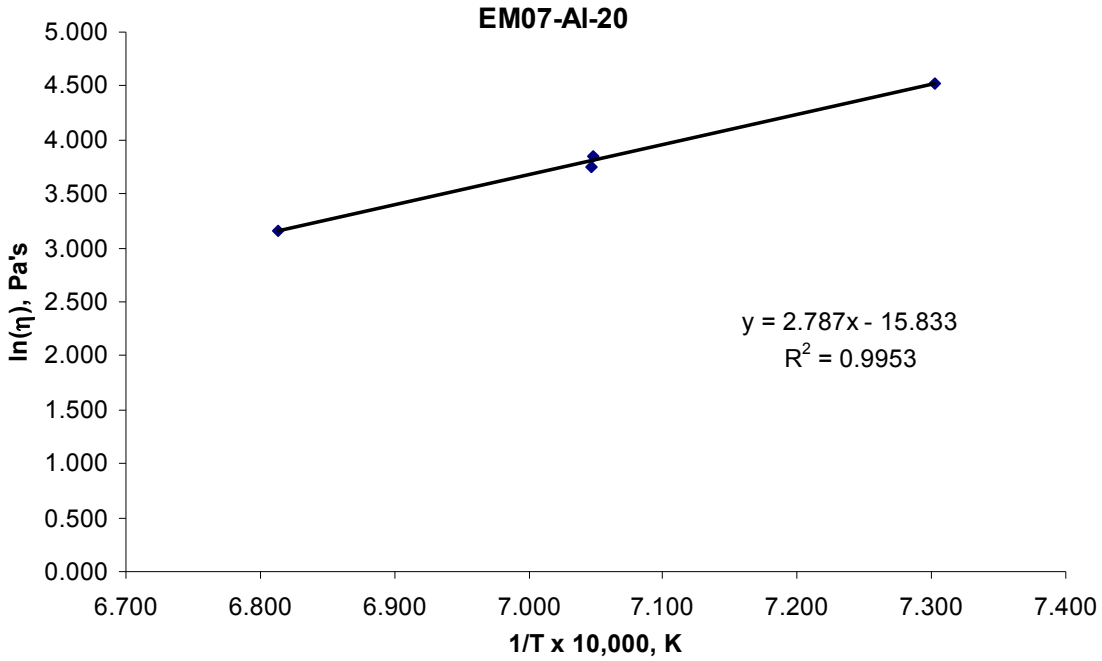

Figure A.5. Viscosity Trend for EM07-Al-20

A.6 EM07-B-05 Viscosity Data

Table A.6. Viscosity Data for EM07-B-05

EM07-B-05

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1147	27.18	39.09	10.21	14.676	7.043	2.686
1100.0	1098	16.17	40.83	10.10	25.510	7.293	3.239
1050.0	1047	11.17	51.32	10.06	46.203	7.573	3.833
1000.0	998	8.49	75.35	10.03	89.039	7.865	4.489
950.0	949	2.86	62.08	9.98	216.578	8.185	5.378
1050.0	1045	11.87	54.95	10.06	46.591	7.586	3.841
1150.0	1146	30.78	45.57	10.24	15.160	7.049	2.719
1200.0	1196	49.64	43.14	10.40	9.033	6.806	2.201
1150.0	1147	32.30	46.34	10.25	14.707	7.040	2.688

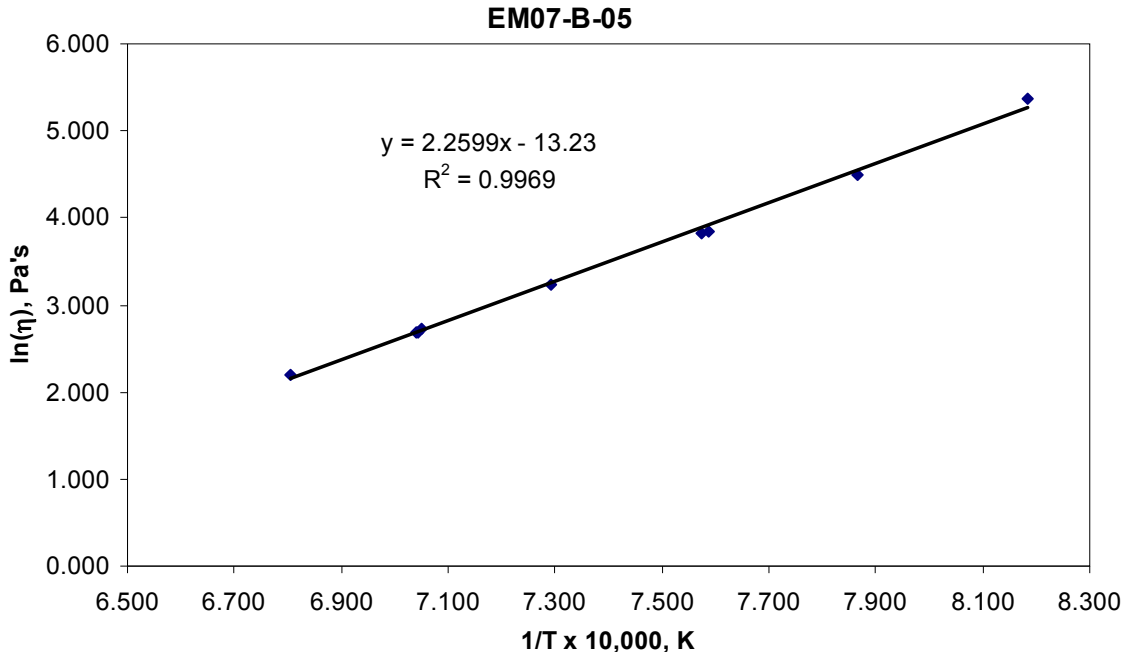

Figure A.6. Viscosity Trend for EM07-B-05

A.7 EM07-B-15 Viscosity Data

Table A.7. Viscosity Data for EM07-B-15

EM07-B-15

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1140	75.00	31.03	10.59	4.379	7.074	1.477
1100.0	1092	63.33	42.13	10.50	6.987	7.326	1.944
1050.0	1041	39.46	44.46	10.31	11.617	7.609	2.452
1000.0	992	21.36	43.04	10.15	20.463	7.905	3.019
950.0	942	12.09	47.73	10.07	39.740	8.227	3.682
1050.0	1038	39.61	44.56	10.31	11.602	7.627	2.451
1150.0	1137	75.00	31.63	10.59	4.465	7.091	1.496
1200.0	1188	75.00	20.85	10.59	2.944	6.842	1.080
1150.0	1141	75.00	31.09	10.59	4.389	7.069	1.479

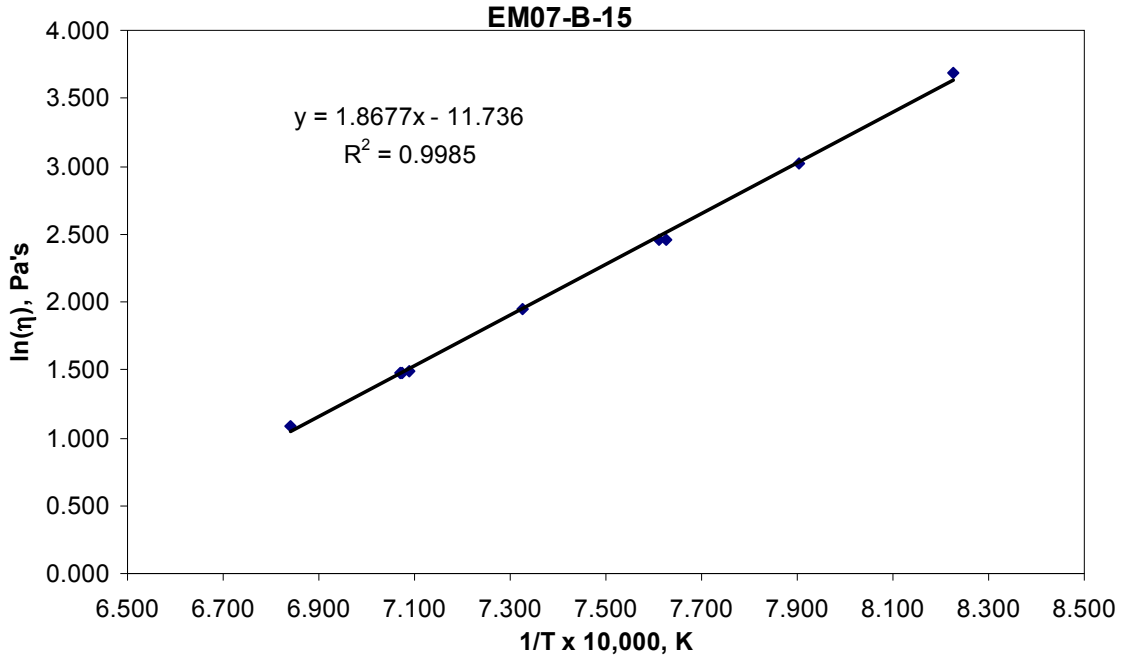

Figure A.7. Viscosity Trend for EM07-B-15

A.8 EM07-B-20 Viscosity Data

Table A.8. Viscosity Data for EM07-B-20

EM07-B-20

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1142	70.00	20.36	10.55	3.068	7.065	1.121
1100.0	1096	70.00	31.27	10.55	4.713	7.303	1.550
1050.0	1046	57.41	42.52	10.46	7.745	7.581	2.047
1000.0	996	34.29	45.12	10.27	13.510	7.878	2.603
950.0	948	17.14	43.37	10.11	25.595	8.190	3.242
1050.0	1043	56.83	42.79	10.45	7.871	7.596	2.063
1150.0	1145	70.00	20.22	10.55	3.048	7.051	1.115
1200.0	1194	70.00	13.67	10.55	2.060	6.815	0.723
1150.0	1146	70.00	19.96	10.55	3.009	7.047	1.102

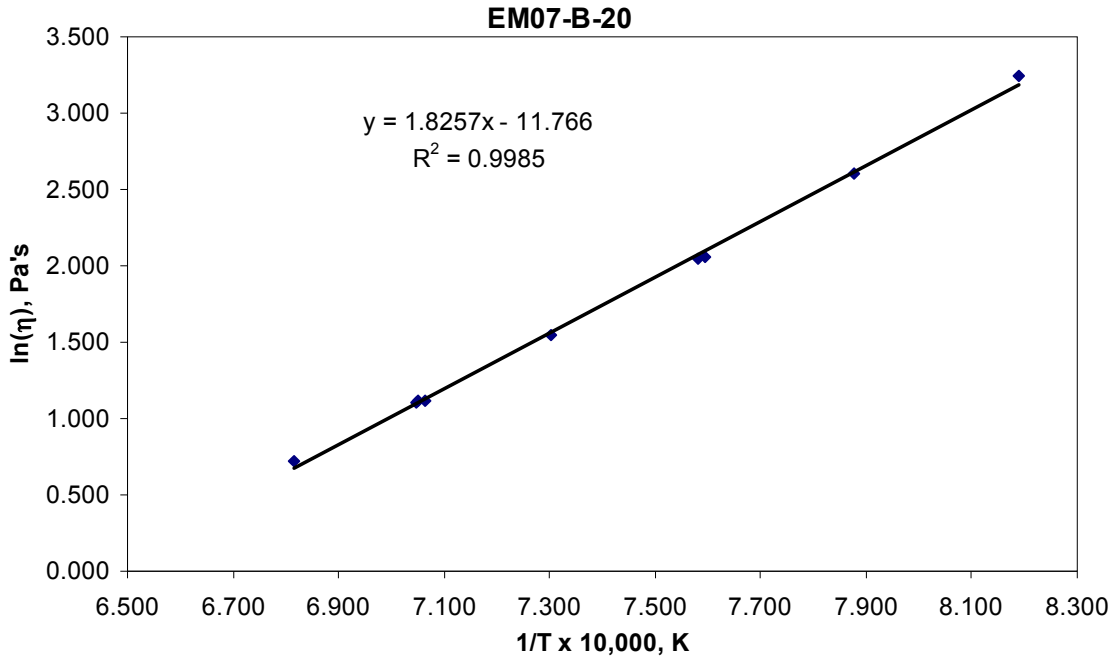

Figure A.8. Viscosity Trend for EM07-B-20

A.9 EM07-Bi-025 Viscosity Data

Table A.9. Viscosity Data for EM07-Bi-025

EM07-Bi-025

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1140	75.00	23.03	10.59	3.251	7.076	1.179
1100.0	1091	75.00	35.03	10.59	4.945	7.331	1.598
1050.0	1041	56.99	42.50	10.45	7.795	7.608	2.054
1000.0	991	35.18	44.17	10.28	12.900	7.910	2.557
950.0	945	19.01	42.51	10.13	22.655	8.212	3.120
1050.0	1040	56.26	42.60	10.45	7.912	7.615	2.068
1150.0	1139	75.00	23.63	10.59	3.336	7.083	1.205
1200.0	1190	75.00	16.27	10.59	2.296	6.835	0.831
1150.0	1142	75.00	23.65	10.59	3.338	7.068	1.205

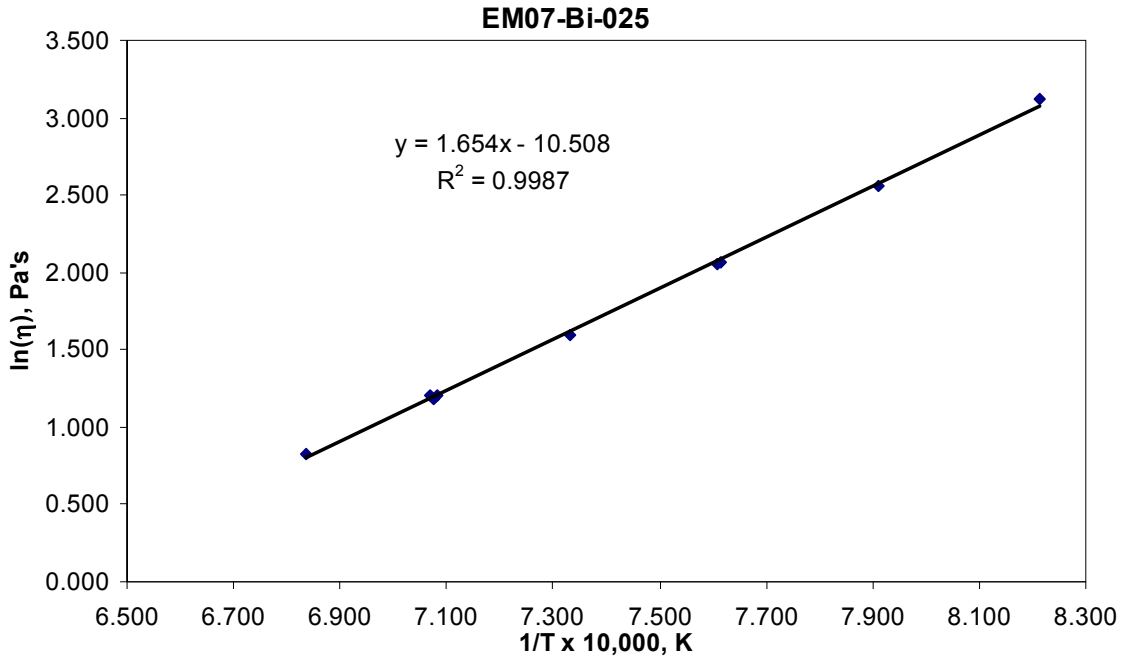

Figure A.9. Viscosity Trend for EM07-Bi-025

A.10 EM07-Bi-025 Duplicate Viscosity Data

Table A.10. Viscosity Data for EM07-Bi-025 Duplicate

EM07-Bi-025 Duplicate

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1145	66.35	40.60	10.52	6.439	7.053	1.862
1100.0	1096	38.71	38.91	10.31	10.358	7.303	2.338
1050.0	1047	23.71	41.12	10.17	17.645	7.573	2.870
1000.0	996	12.24	39.12	10.07	32.168	7.881	3.471
950.0	945	11.35	71.55	10.06	63.413	8.211	4.150
1050.0	1043	26.42	46.43	10.20	17.924	7.595	2.886
1150.0	1142	65.54	41.83	10.52	6.713	7.065	1.904

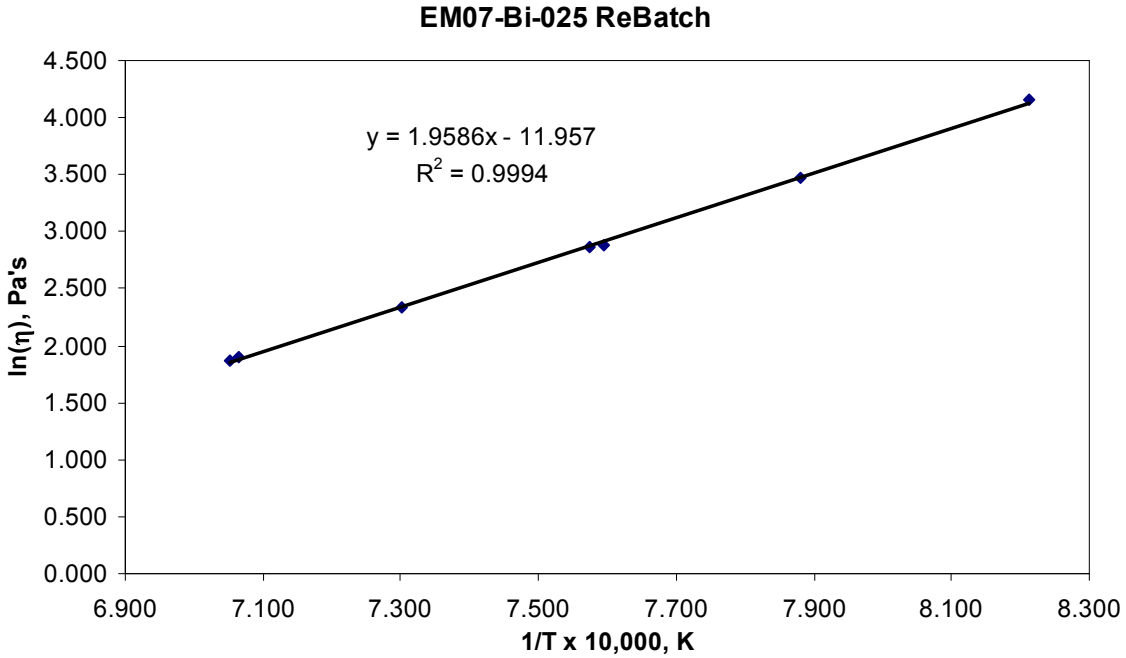

Figure A.11. Viscosity Trend for EM07-Bi-025 Duplicate

A.12 EM07-Bi-05 Viscosity Data

Table A.12. Viscosity Data for EM07-Bi-05

EM07-Bi-05

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	70.00	39.97	10.55	6.024	7.049	1.796
1100.0	1096	46.36	43.73	10.37	9.780	7.303	2.280
1050.0	1046	28.69	46.67	10.22	16.621	7.579	2.811
1000.0	997	14.83	44.05	10.09	29.971	7.875	3.400
950.0	945	12.11	70.14	10.07	58.303	8.206	4.066
1050.0	1042	28.02	46.43	10.21	16.925	7.604	2.829
1150.0	1143	70.00	40.74	10.55	6.141	7.059	1.815
1200.0	1194	70.00	26.00	10.55	3.919	6.814	1.366
1150.0	1147	70.00	39.57	10.55	5.964	7.042	1.786

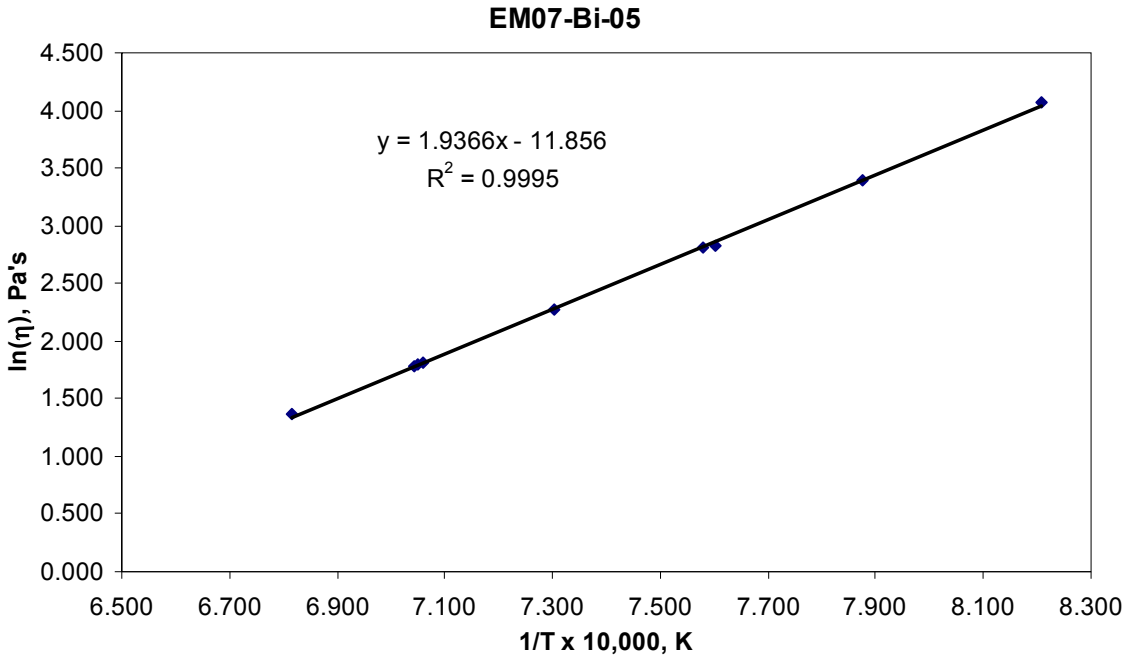

Figure A.13. Viscosity Trend for EM07-Bi-05

A.14 EM07-Bi-05 Duplicate Viscosity Data

Table A.14. Viscosity Data for EM07-Bi-05 Duplicate

EM07-Bi-05 Duplicate

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1145	70.00	39.54	10.55	5.960	7.054	1.785
1100.0	1096	46.89	43.10	10.37	9.534	7.306	2.255
1050.0	1045	29.66	46.75	10.23	16.119	7.584	2.780
1000.0	996	15.27	43.73	10.10	28.913	7.876	3.364
950.0	946	12.05	67.48	10.07	56.374	8.200	4.032
1050.0	1041	28.57	46.48	10.22	16.621	7.612	2.811
1150.0	1143	70.00	40.21	10.55	6.060	7.060	1.802
1200.0	1191	70.00	25.93	10.55	3.908	6.830	1.363
1150.0	1145	70.00	39.46	10.55	5.947	7.052	1.783

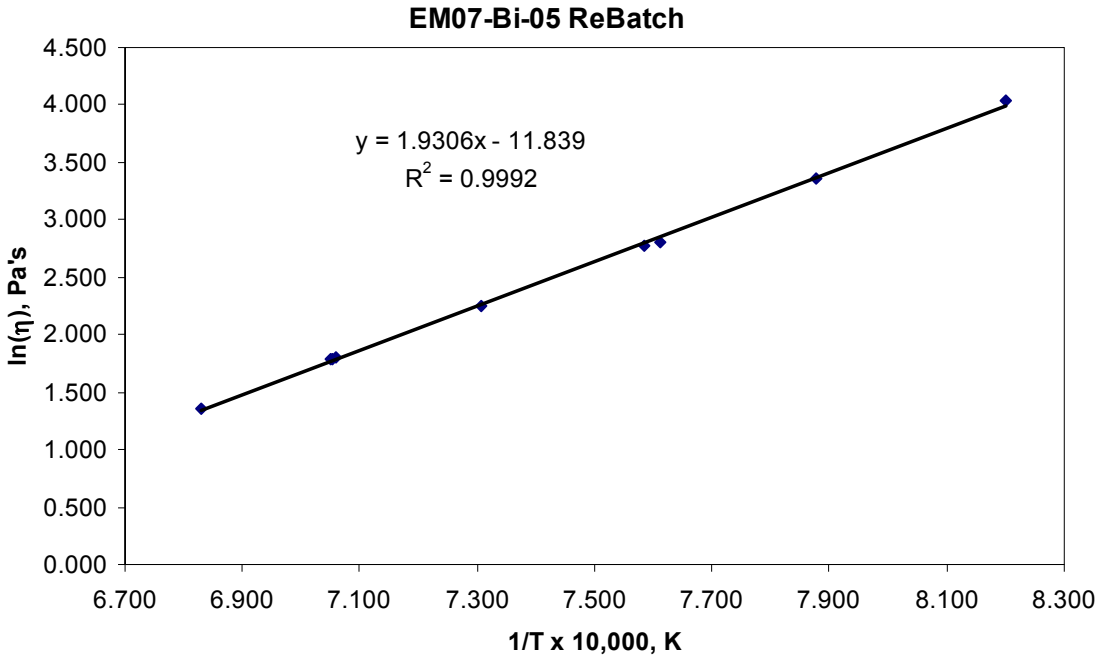

Figure A.15. Viscosity Trend for EM07-Bi-05 Duplicate

A.16 EM07-Ca-035 Viscosity Data

Table A.16. Viscosity Data for EM07-Ca-035

EM07-Ca-035

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1145	70.00	32.39	10.55	4.882	7.054	1.586
1100.0	1095	56.18	42.57	10.45	7.916	7.307	2.069
1050.0	1046	34.54	45.16	10.27	13.425	7.582	2.597
1000.0	996	17.83	42.90	10.12	24.348	7.878	3.192
950.0	947	11.98	56.87	10.07	47.778	8.198	3.867
1050.0	1040	33.51	45.35	10.26	13.885	7.617	2.631
1150.0	1142	70.00	32.60	10.55	4.914	7.064	1.592
1200.0	1193	70.00	20.79	10.55	3.134	6.820	1.142
1150.0	1145	70.00	31.54	10.55	4.753	7.051	1.559

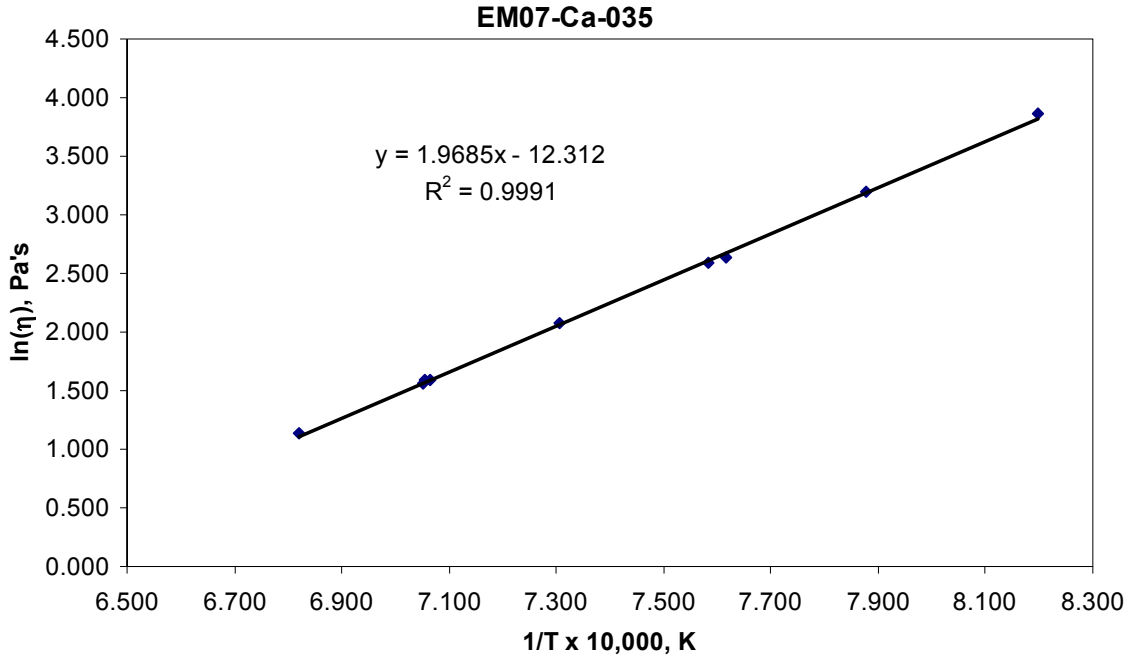

Figure A.16. Viscosity Trend for EM07-Ca-035

A.17 EM07-Ca-07 Viscosity Data

Table A.17. Viscosity Data for EM07-Ca-07

EM07-Ca-07

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1145	70.00	22.64	10.55	3.412	7.050	1.227
1100.0	1096	70.00	36.66	10.55	5.526	7.304	1.709
1050.0	1046	47.77	43.40	10.38	9.430	7.584	2.244
1000.0	997	28.09	47.06	10.21	17.111	7.875	2.840
950.0	947	12.48	42.37	10.07	34.187	8.198	3.532
1050.0	1042	46.35	43.87	10.37	9.814	7.603	2.284
1150.0	1144	70.00	23.13	10.55	3.486	7.059	1.249
1200.0	1194	70.00	14.96	10.55	2.254	6.815	0.813
1150.0	1147	70.00	22.38	10.55	3.374	7.044	1.216

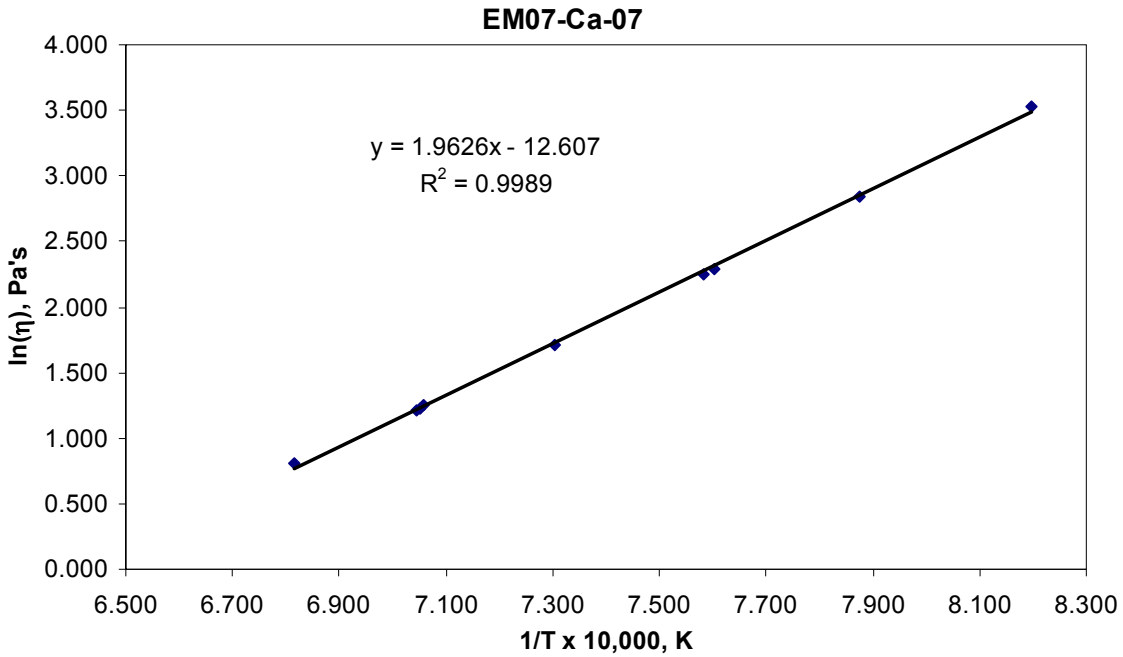

Figure A.17. Viscosity Trend for EM07-Ca-07

A.18 EM07-Cr-001 Viscosity Data

Table A.18. Viscosity Data for EM07-Cr-001

EM07-Cr-001

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1145	56.35	39.90	10.45	7.399	7.051	2.001
1100.0	1096	36.17	40.32	10.28	11.462	7.305	2.439
1050.0	1046	22.60	39.94	10.16	17.963	7.579	2.888
1000.0	996	13.16	41.29	10.08	31.628	7.877	3.454
950.0	947	11.35	68.91	10.06	61.071	8.197	4.112
1050.0	1042	26.08	49.09	10.20	19.191	7.603	2.954
1150.0	1144	61.52	42.24	10.49	7.201	7.058	1.974
1200.0	1194	70.00	31.94	10.55	4.815	6.815	1.572
1150.0	1145	62.26	42.37	10.49	7.140	7.050	1.966

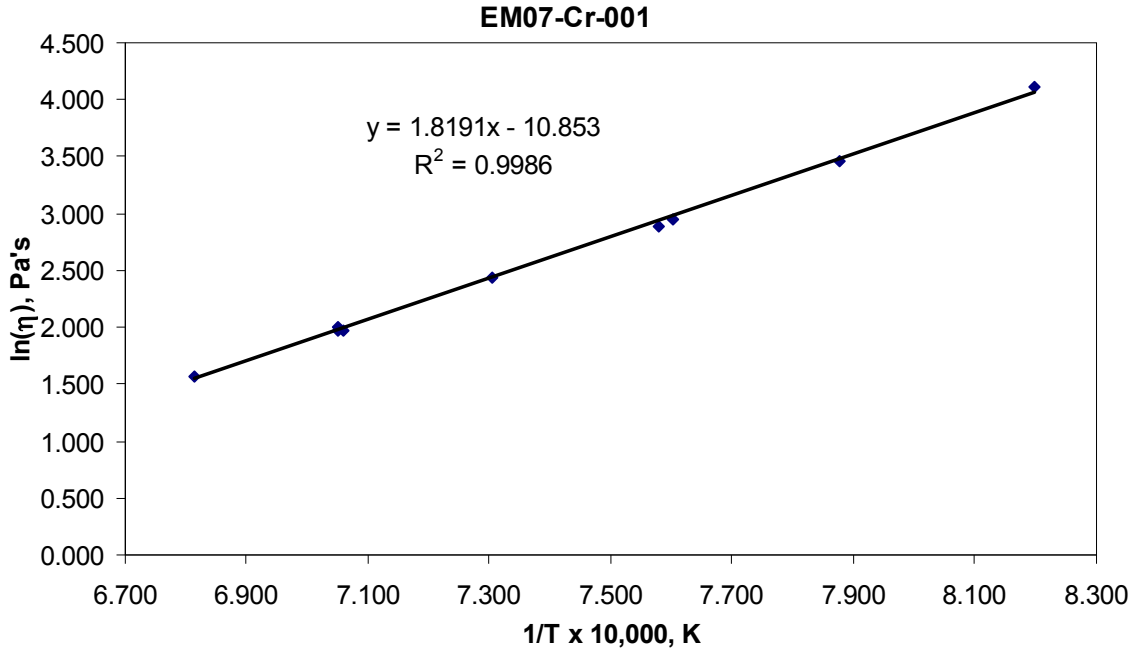

Figure A.18. Viscosity Trend for EM07-Cr-001

A.19 EM07-Cr-012 Viscosity Data

Table A.19. Viscosity Data for EM07-Cr-012

EM07-Cr-012

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	49.03	39.36	10.39	8.342	7.049	2.121
1100.0	1096	29.68	39.52	10.23	13.618	7.304	2.611
1050.0	1045	17.24	39.62	10.11	23.243	7.585	3.146
1000.0	995	11.69	48.86	10.06	42.052	7.887	3.739
950.0	945	8.76	72.72	10.03	83.304	8.207	4.422
1050.0	1042	19.29	43.42	10.13	22.813	7.601	3.127
1150.0	1142	52.97	42.83	10.42	8.428	7.066	2.132
1200.0	1194	70.00	35.83	10.55	5.401	6.815	1.687
1150.0	1146	52.67	42.64	10.42	8.437	7.045	2.133

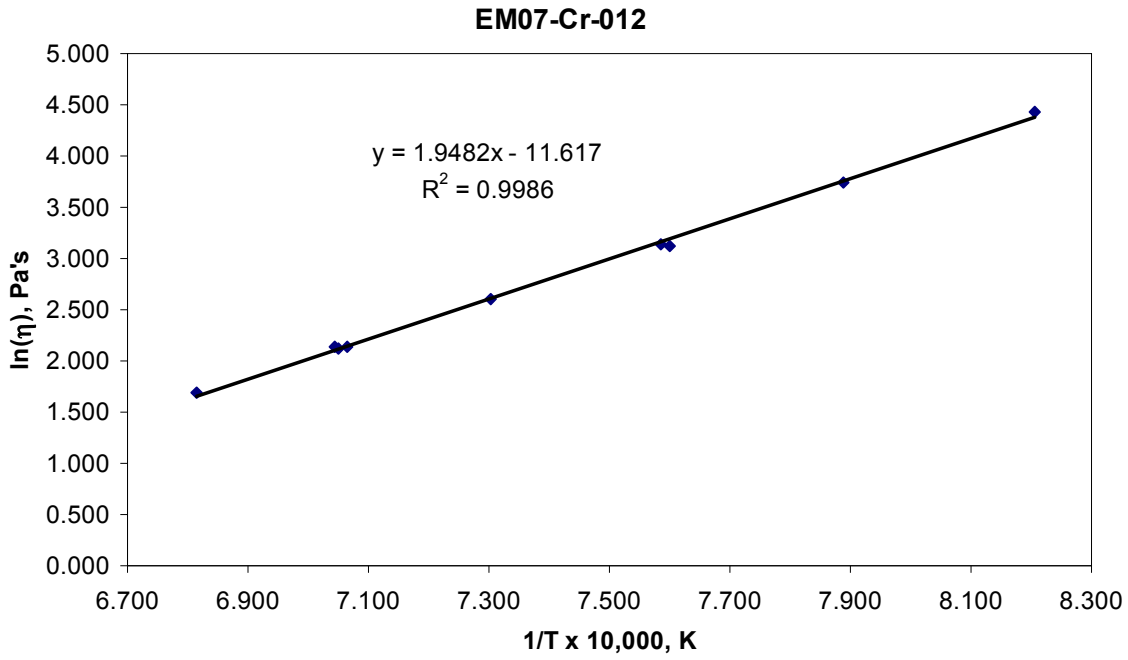

Figure A.19. Viscosity Trend for EM07-Cr-012

A.20 EM07-Cr-02 Viscosity Data

Table A.20. Viscosity Data for EM07-Cr-02

EM07-Cr-02

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1145	33.67	40.53	10.26	12.352	7.054	2.514
1100.0	1097	18.67	37.94	10.13	20.581	7.301	3.024
1050.0	1047	11.17	39.90	10.06	35.926	7.576	3.581
1000.0	997	11.35	68.12	10.06	60.373	7.871	4.101
950.0	947	5.72	69.59	10.01	121.786	8.194	4.802
1050.0	1043	12.31	41.93	10.07	34.298	7.599	3.535
1150.0	1144	36.89	44.41	10.29	12.386	7.054	2.517
1200.0	1195	56.03	42.55	10.45	7.933	6.811	2.071
1150.0	1149	38.75	44.97	10.31	11.960	7.034	2.482

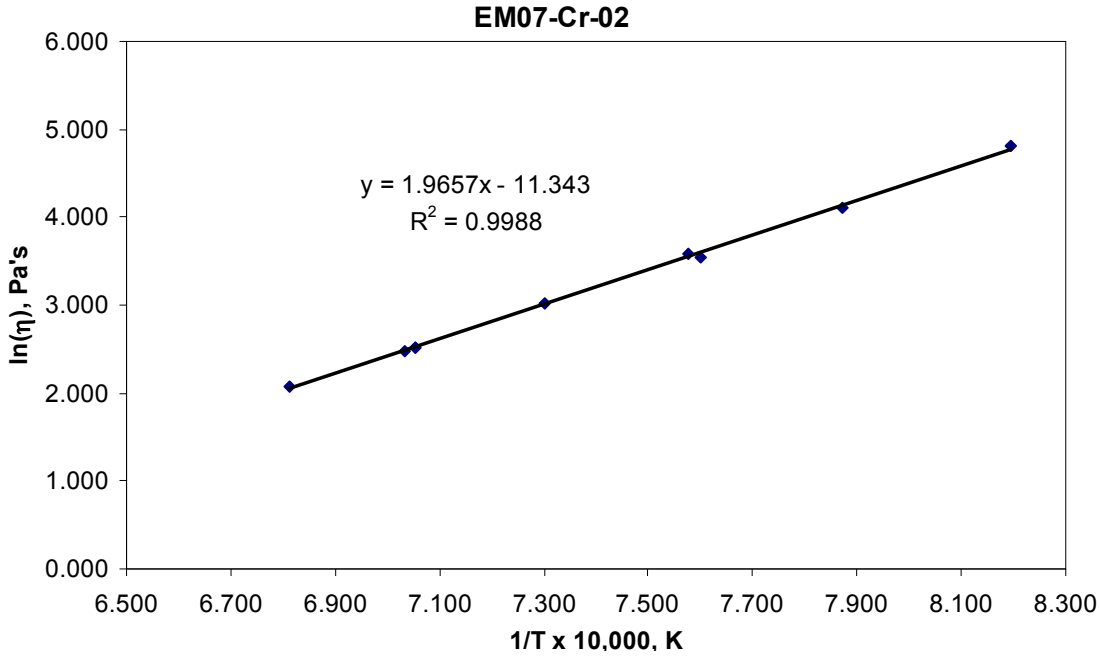

Figure A.20. Viscosity Trend for EM07-Cr-02

A.21 EM07-F-02 Viscosity Data

Table A.21. Viscosity Data for EM07-F-02

EM07-F-02

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1140	75	39.605	10.59	5.590	7.076	1.721
1100.0	1091.7	50.07	42.98	10.40	8.927	7.327	2.189
1050.0	1041	30.97	45.79	10.24	15.140	7.609	2.717
1000.0	990	15.72	43.21	10.10	27.772	7.916	3.324
950.0	940.7	12.21	63.865	10.07	52.659	8.238	3.964
1050.0	1038	29.88	46.35	10.23	15.867	7.629	2.764
1150.0	1138	73.75	40.74	10.58	5.842	7.085	1.765
1200.0	1182	75	27.26	10.59	3.848	6.872	1.347
1150.0	1142	75	39.925	10.59	5.635	7.066	1.729

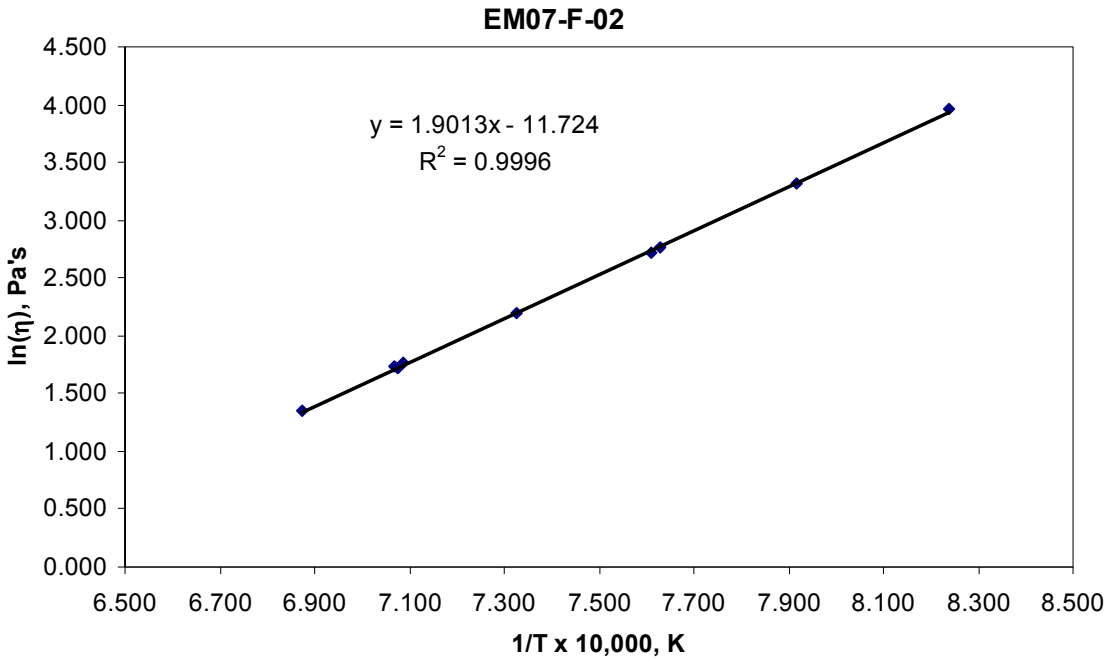

Figure A.21. Viscosity Trend for EM07-F-02

A.22 EM07-Fe-05 Viscosity Data

Table A.22. Viscosity Data for EM07-Fe-05

EM07-Fe-05

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	56.53	40.53	10.45	7.493	7.046	2.014
1100.0	1097	35.10	39.89	10.27	11.676	7.301	2.458
1050.0	1047	21.35	40.41	10.15	19.216	7.575	2.956
1000.0	997	11.17	37.64	10.06	33.890	7.873	3.523
950.0	947	11.53	73.60	10.06	64.229	8.194	4.162
1050.0	1043	22.06	42.62	10.16	19.633	7.598	2.977
1150.0	1144	59.11	42.64	10.47	7.554	7.054	2.022
1200.0	1195	70.00	32.94	10.55	4.965	6.812	1.602
1150.0	1146	59.26	42.27	10.47	7.469	7.046	2.011

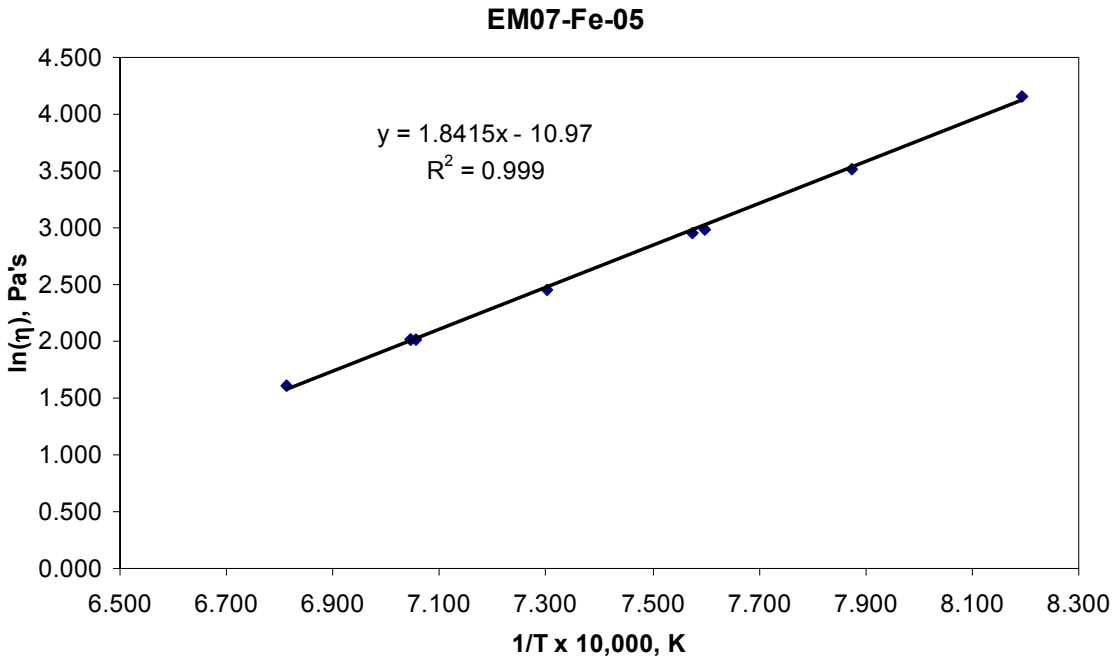

Figure A.22. Viscosity Trend for EM07-Fe-05

A.23 EM07-Fe-15 Viscosity Data

Table A.23. Viscosity Data for EM07-Fe-15

EM07-Fe-15

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	57.24	39.76	10.46	7.263	7.046	1.983
1100.0	1096	31.98	39.46	10.25	12.645	7.302	2.537
1050.0	1046	17.24	38.97	10.11	22.858	7.578	3.129
1000.0	996	11.86	49.98	10.06	42.410	7.876	3.747
950.0	946	8.20	69.64	10.03	85.133	8.200	4.444
1050.0	1044	19.13	42.42	10.13	22.471	7.594	3.112
1150.0	1145	60.21	42.32	10.48	7.364	7.050	1.997
1200.0	1195	70.00	29.76	10.55	4.485	6.812	1.501
1150.0	1146	60.27	42.34	10.48	7.361	7.045	1.996

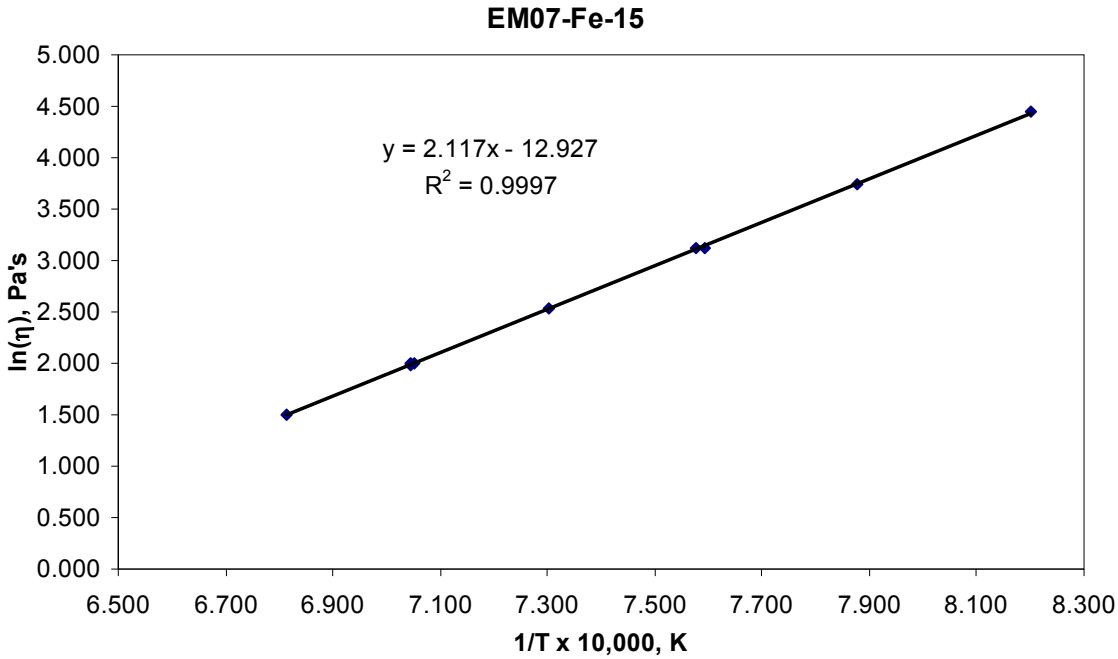

Figure A.23. Viscosity Trend for EM07-Fe-15

A.24 EM07-Fe-20 Viscosity Data

Table A.24. Viscosity Data for EM07-Fe-20

EM07-Fe-20

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1145	38.67	39.57	10.31	10.546	7.051	2.356
1100.0	1097	18.85	39.85	10.13	21.415	7.301	3.064
1050.0	1046	12.12	49.41	10.07	41.036	7.578	3.714
1000.0	996	8.85	70.50	10.04	79.988	7.877	4.382
950.0	946	2.98	63.63	9.98	212.978	8.200	5.361
1050.0	1043	11.52	42.98	10.06	37.534	7.596	3.625
1150.0	1145	44.56	43.66	10.35	10.145	7.051	2.317
1200.0	1195	70.00	36.87	10.55	5.558	6.813	1.715
1150.0	1146	42.55	43.88	10.34	10.663	7.045	2.367

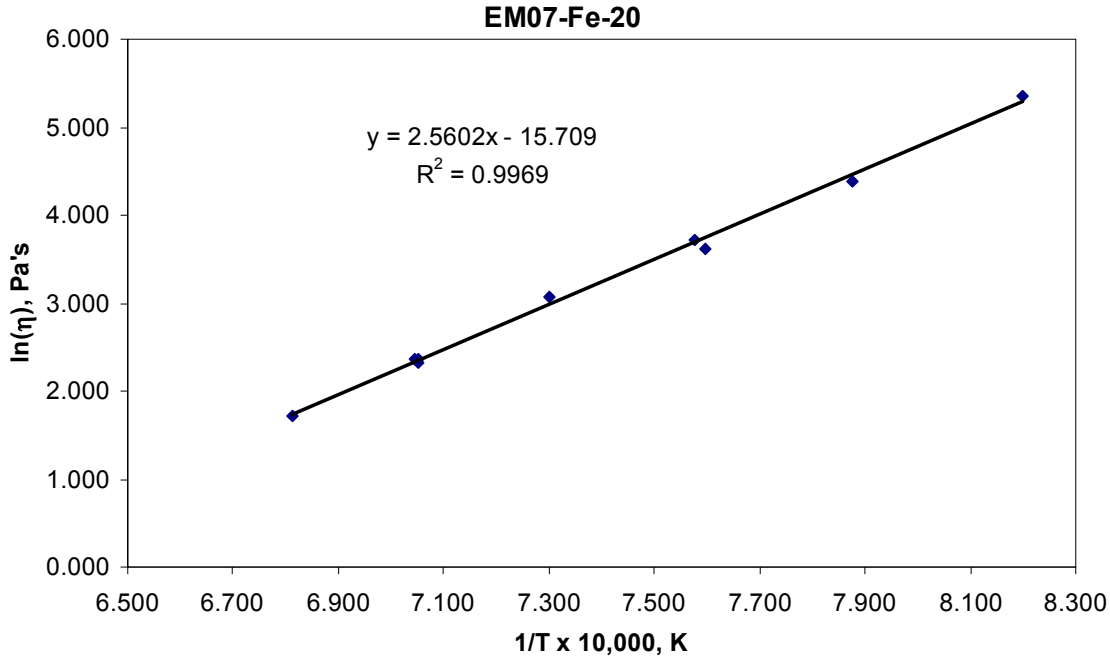

Figure A.24. Viscosity Trend for EM07-Fe-20

A.25 EM07-K-03 Viscosity Data

Table A.25. Viscosity Data for EM07-K-03

EM07-K-03

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1142	70.00	37.25	10.55	5.614	7.065	1.725
1100.0	1095.1	50.99	42.95	10.41	8.767	7.309	2.171
1050.0	1046	33.02	46.03	10.26	14.298	7.580	2.660
1000.0	996	17.57	42.88	10.12	24.694	7.878	3.207
950.0	946	12.49	57.21	10.07	46.125	8.199	3.831
1050.0	1043	32.36	45.96	10.25	14.559	7.598	2.678
1150.0	1143	70.00	37.91	10.55	5.715	7.060	1.743
1200.0	1193	70.00	24.73	10.55	3.728	6.819	1.316
1150.0	1145	70.00	37.32	10.55	5.624	7.053	1.727

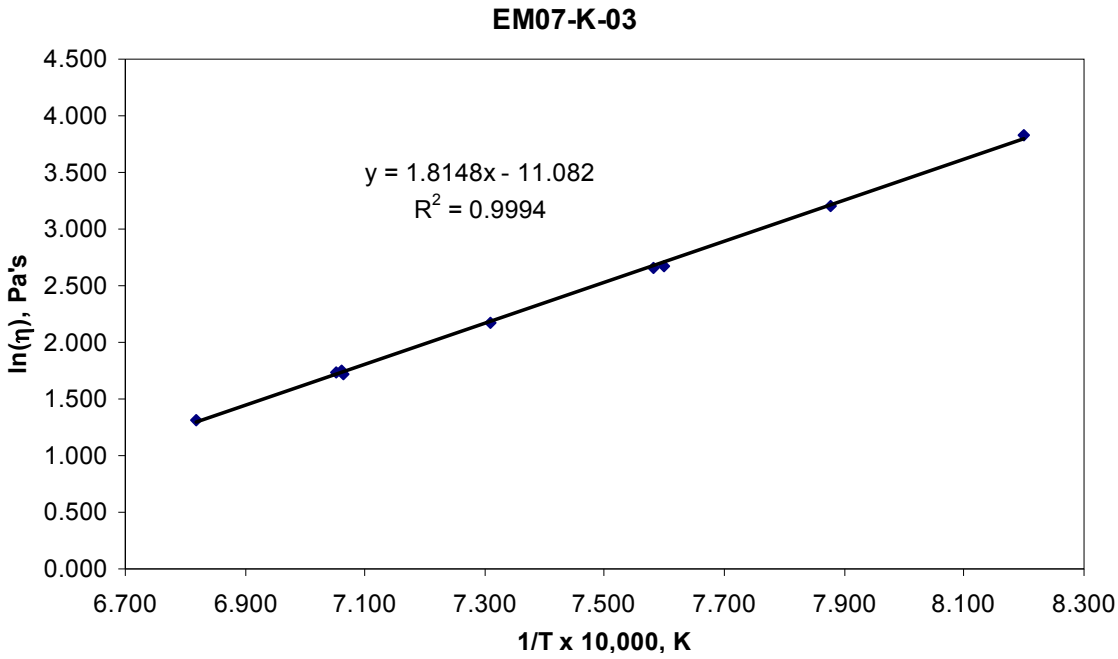

Figure A.25. Viscosity Trend for EM07-K-03

A.26 EM07-K-06 Viscosity Data

Table A.26. Viscosity Data for EM07-K-06

EM07-K-06

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	70.00	31.53	10.55	4.752	7.049	1.558
1100.0	1096	59.73	42.20	10.47	7.400	7.302	2.002
1050.0	1047	38.52	44.42	10.30	11.881	7.576	2.475
1000.0	997	21.35	42.78	10.15	20.347	7.874	3.013
950.0	947	12.48	45.82	10.07	36.970	8.194	3.610
1050.0	1042	37.47	44.66	10.30	12.270	7.603	2.507
1150.0	1144	70.00	32.17	10.55	4.849	7.059	1.579
1200.0	1194	70.00	21.99	10.55	3.315	6.815	1.198
1150.0	1145	70.00	32.73	10.55	4.933	7.050	1.596

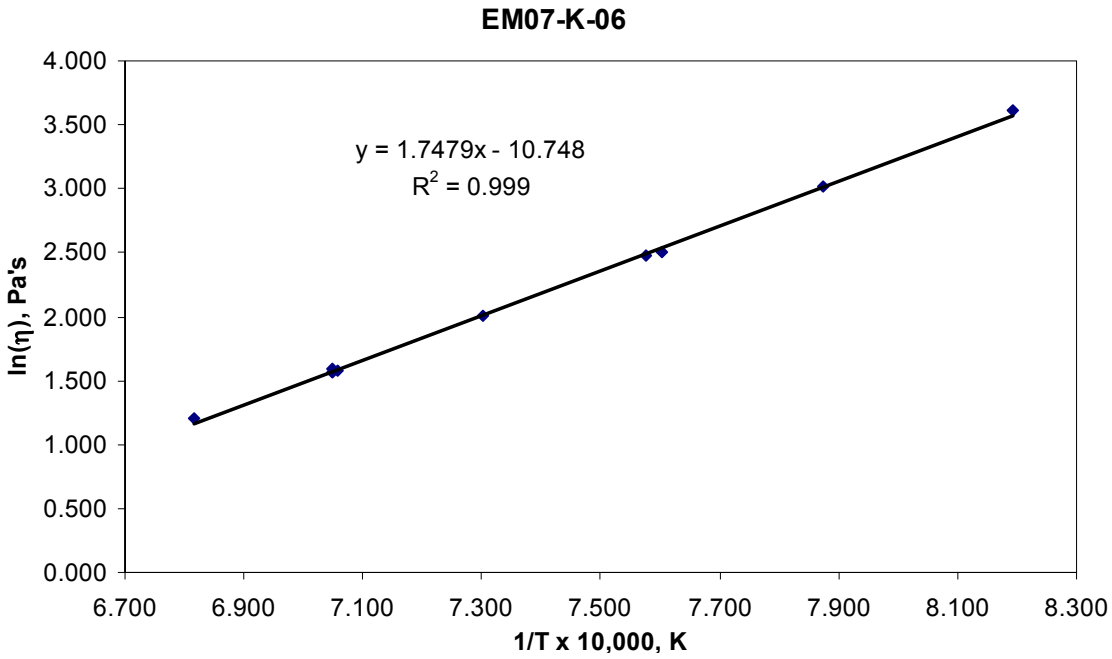

Figure A.26. Viscosity Trend for EM07-K-06

A.27 EM07-Li-015 Viscosity Data

Table A.27. Viscosity Data for EM07-Li-015

EM07-Li-015

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1138	28.67	40.01	10.22	14.260	7.084	2.657
1100.0	1091	16.35	39.40	10.11	24.352	7.329	3.193
1050.0	1042	11.35	48.88	10.06	43.321	7.606	3.769
1000.0	990	8.57	72.29	10.03	84.596	7.914	4.438
950.0	942	3.26	64.46	9.98	197.254	8.228	5.284
1050.0	1038	12.23	52.87	10.07	43.524	7.627	3.773
1150.0	1138	32.56	45.52	10.25	14.335	7.086	2.663
1200.0	1188	50.75	42.55	10.40	8.724	6.843	2.166
1150.0	1141	33.50	45.43	10.26	13.913	7.071	2.633

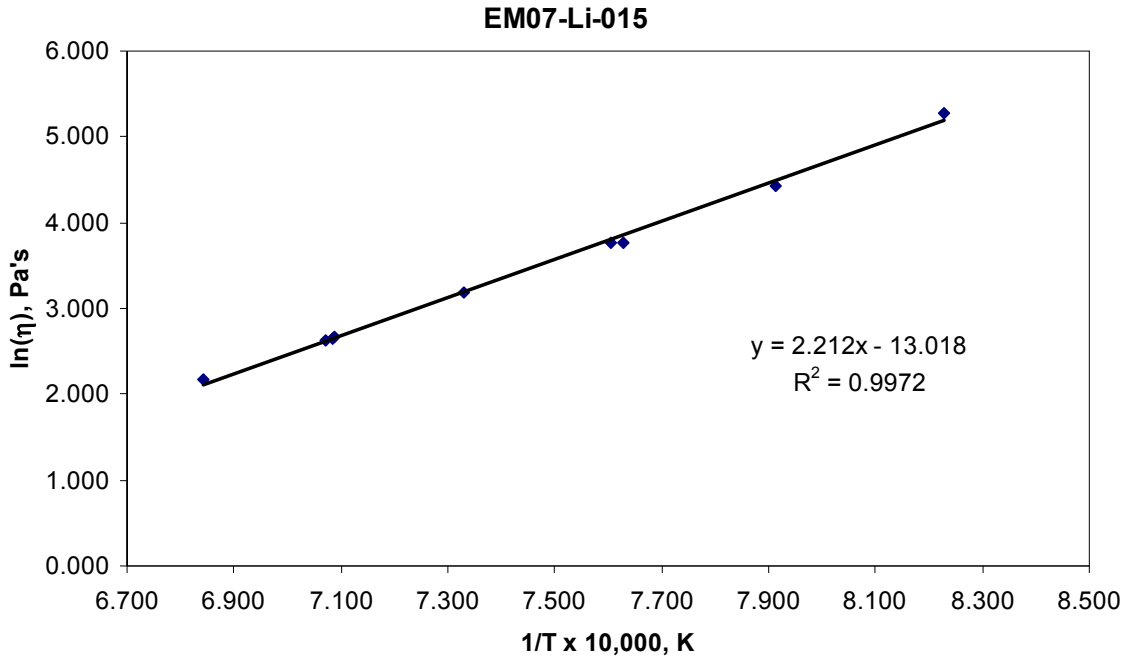

Figure A.27. Viscosity Trend for EM07-Li-015

A.28 EM07-Li-04 Viscosity Data

Table A.28. Viscosity Data for EM07-Li-04

EM07-Li-04

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1141	75.00	31.49	10.59	4.445	7.073	1.492
1100.0	1091	62.19	42.13	10.49	7.109	7.329	1.961
1050.0	1041	38.16	43.78	10.30	11.816	7.608	2.469
1000.0	992	20.97	42.39	10.15	20.516	7.903	3.021
950.0	942	12.38	48.13	10.07	39.143	8.232	3.667
1050.0	1038	38.90	44.74	10.31	11.855	7.627	2.473
1150.0	1138	75.00	32.57	10.59	4.597	7.087	1.525
1200.0	1188	75.00	21.12	10.59	2.980	6.843	1.092
1150.0	1142	75.00	31.55	10.59	4.453	7.069	1.494

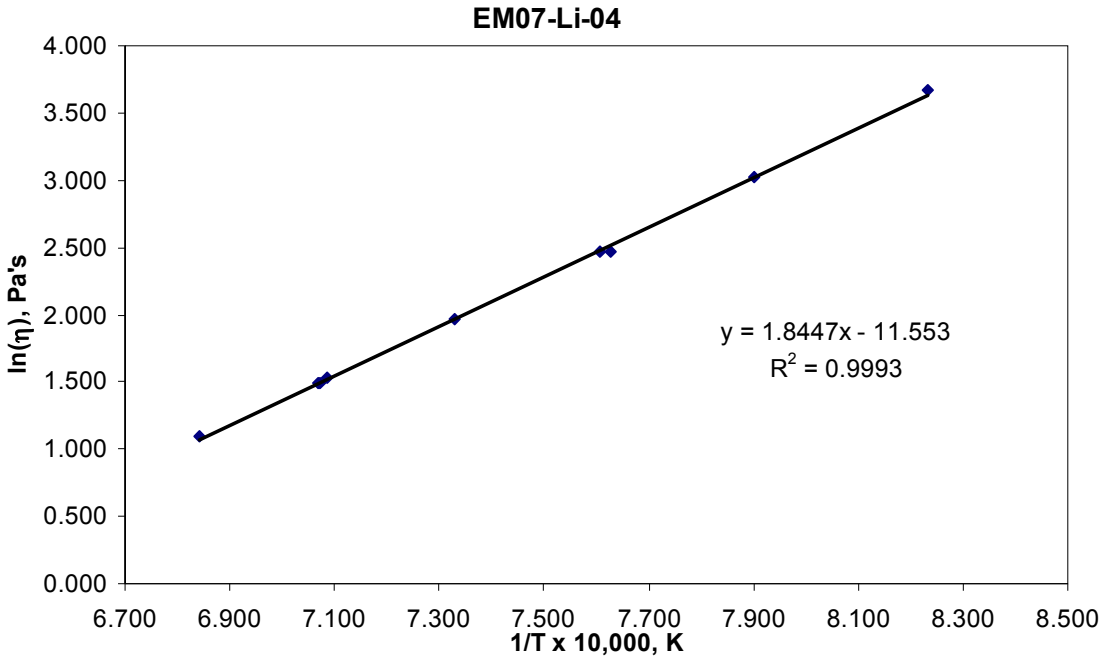

Figure A.28. Viscosity Trend for EM07-Li-04

A.29 EM07-Mn-01 Viscosity Data

Table A.29. Viscosity Data for EM07-Mn-01

EM07-Mn-01

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	48.85	40.30	10.39	8.570	7.049	2.148
1100.0	1096	28.85	39.29	10.22	13.920	7.303	2.633
1050.0	1047	16.35	38.88	10.11	24.031	7.577	3.179
1000.0	997	11.85	49.49	10.06	42.033	7.875	3.738
950.0	947	8.81	72.34	10.04	82.424	8.194	4.412
1050.0	1042	18.26	43.60	10.12	24.175	7.604	3.185
1150.0	1144	51.41	42.89	10.41	8.685	7.059	2.162
1200.0	1194	70.00	37.08	10.55	5.589	6.815	1.721
1150.0	1145	51.98	42.98	10.41	8.610	7.050	2.153

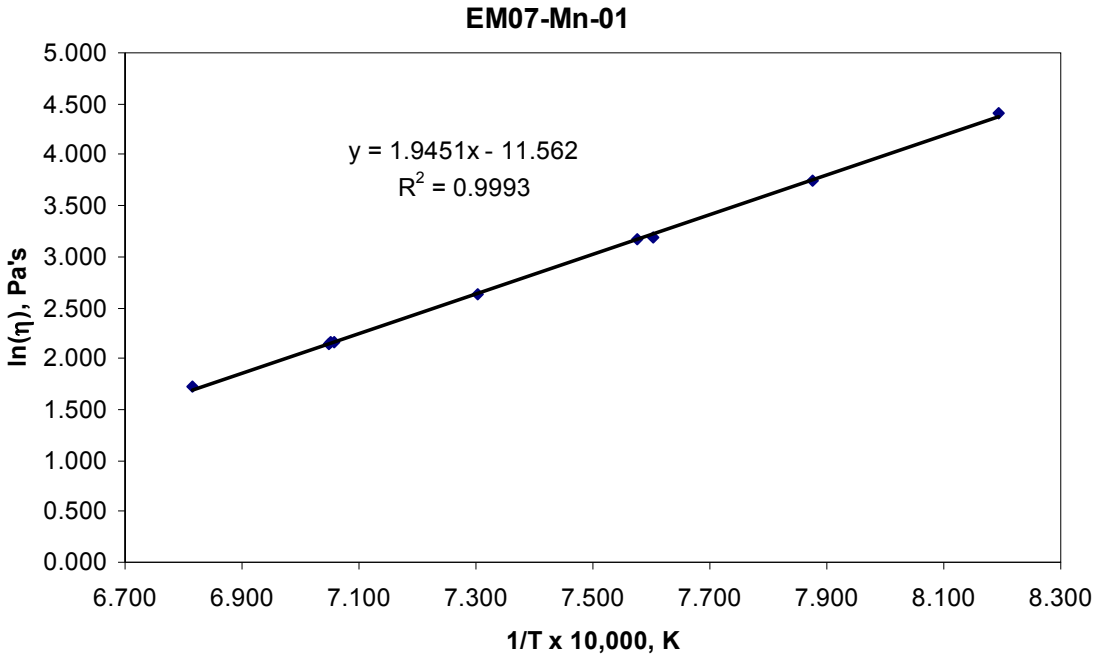

Figure A.29. Viscosity Trend for EM07-Mn-01

A.30 EM07-Mn-04 Viscosity Data

Table A.30. Viscosity Data for EM07-Mn-04

EM07-Mn-04

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1141	63.85	40.48	10.51	6.661	7.072	1.896
1100.0	1092	37.60	39.98	10.30	10.947	7.325	2.393
1050.0	1040	25.36	47.73	10.19	19.178	7.618	2.954
1000.0	991.1	11.35	39.69	10.06	35.178	7.910	3.560
950.0	949.5	12.08	79.47	10.07	66.225	8.179	4.193
1050.0	1040	25.36	47.73	10.19	19.178	7.618	2.954
1150.0	1140	64.37	42.04	10.51	6.863	7.075	1.926
1200.0	1192	75	29.57	10.59	4.174	6.826	1.429
1150.0	1143	68.73	41.94	10.54	6.433	7.064	1.861

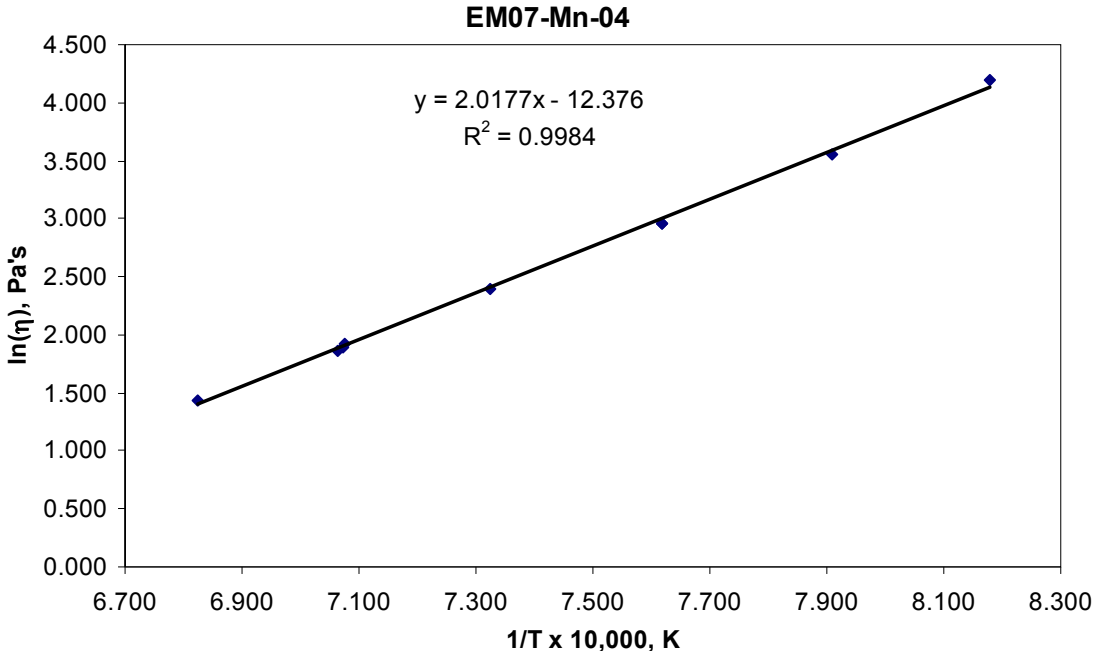

Figure A.30. Viscosity Trend for EM07-Mn-04

A.31 EM07-Na-05 Viscosity Data

Table A.31. Viscosity Data for EM07-Na-05

EM07-Na-05

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1139	2.36	61.46	9.97	259.462	7.082	5.559
1200.0	1190	7.93	72.77	10.03	92.025	6.832	4.522
1150.0	1141	2.79	65.03	9.98	232.544	7.070	5.449

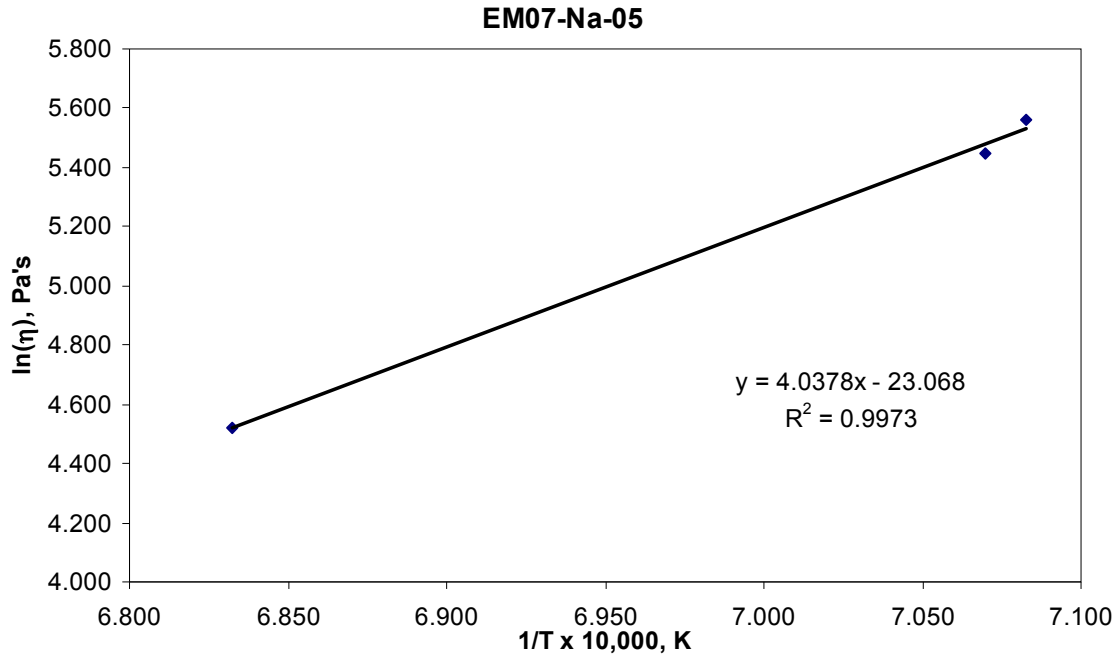

Figure A.31. Viscosity Trend for EM07-Na-05

A.32 EM07-Na-10 Viscosity Data

Table A.32. Viscosity Data for EM07-Na-10

EM07-Na-10

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1140	13.85	38.78	10.08	28.235	7.075	3.341
1100.0	1091	11.35	57.60	10.06	51.050	7.331	3.933
1050.0	1044	8.90	84.30	10.04	95.038	7.595	4.554
1000.0	996	2.93	67.33	9.98	229.083	7.882	5.434
1050.0	1040	8.13	77.90	10.03	96.141	7.617	4.566
1150.0	1139	15.20	44.73	10.10	29.718	7.080	3.392
1200.0	1189	29.98	46.12	10.23	15.738	6.837	2.756
1150.0	1141	15.98	43.59	10.10	27.565	7.073	3.317

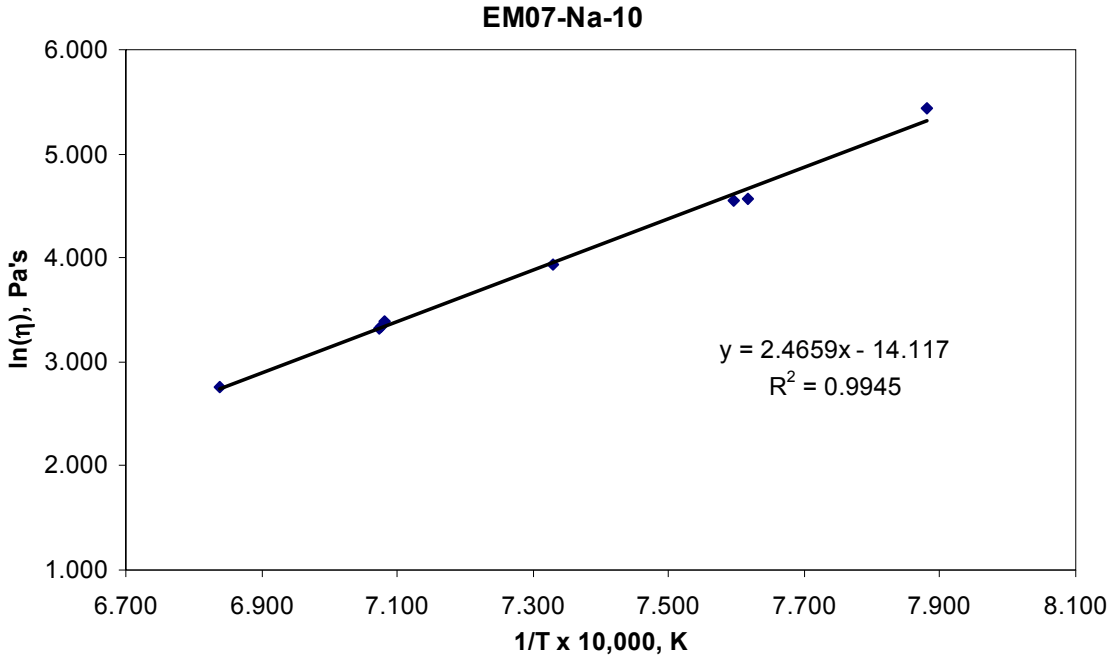

Figure A.32. Viscosity Trend for EM07-Na-10

A.33 EM07-Na-20 Viscosity Data

Table A.33. Viscosity Data for EM07-Na-20

EM07-Na-20

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1145	70.00	20.79	10.55	3.133	7.050	1.142
1100.0	1096	70.00	31.65	10.55	4.770	7.301	1.562
1050.0	1046	58.85	42.40	10.47	7.542	7.579	2.020
1000.0	996	37.34	45.14	10.29	12.443	7.878	2.521
950.0	946	19.83	42.83	10.14	21.898	8.204	3.086
1050.0	1043	58.48	42.45	10.46	7.597	7.597	2.028
1150.0	1140	70.00	21.18	10.55	3.192	7.079	1.161
1200.0	1195	70.00	14.53	10.55	2.190	6.813	0.784
1150.0	1146	70.00	21.11	10.55	3.182	7.045	1.158

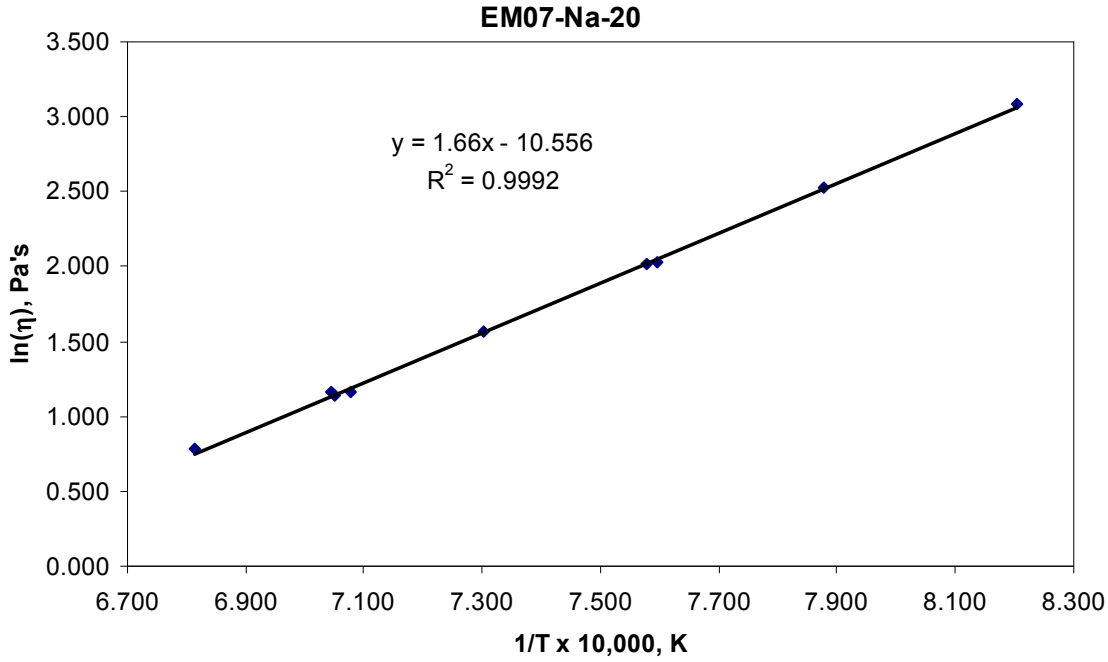

Figure A.33. Viscosity Trend for EM07-Na-20

A.34 EM07-Ni-001 Viscosity Data

Table A.34. Viscosity Data for EM07-Ni-001

EM07-Ni-001

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1144	57.60	39.99	10.46	7.260	7.055	1.982
1100.0	1095	36.35	40.95	10.29	11.586	7.308	2.450
1050.0	1046	21.21	40.38	10.15	19.327	7.583	2.961
1000.0	996	11.17	38.15	10.06	34.344	7.881	3.536
950.0	945	12.10	79.03	10.07	65.746	8.211	4.186
1050.0	1041	25.40	48.74	10.19	19.551	7.609	2.973
1150.0	1141	59.54	42.40	10.47	7.459	7.070	2.009

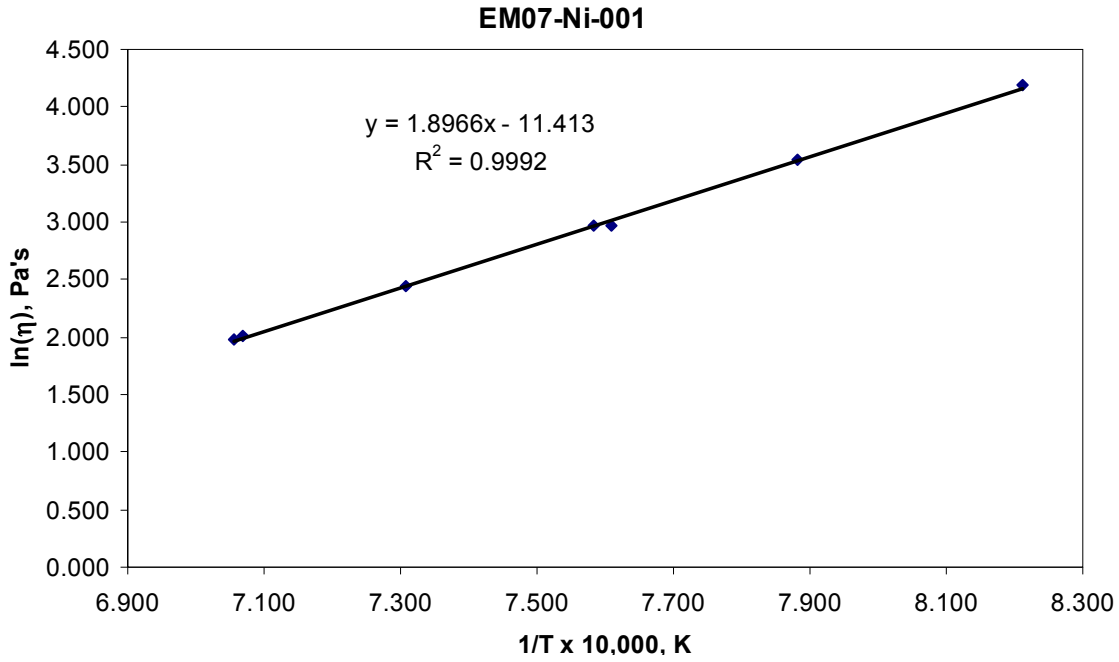

Figure A.34. Viscosity Trend for EM07-Ni-001

A.35 EM07-Ni-02 Viscosity Data

Table A.35. Viscosity Data for EM07-Ni-02

EM07-Ni-02

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	61.35	39.90	10.49	6.820	7.046	1.920
1100.0	1097	36.49	41.06	10.29	11.574	7.296	2.449
1050.0	1047	18.85	38.48	10.13	20.677	7.574	3.029
1000.0	997	11.69	46.21	10.06	39.775	7.875	3.683
950.0	948	8.86	70.50	10.04	79.837	8.192	4.380
1050.0	1046	21.92	43.13	10.16	19.985	7.583	2.995
1150.0	1146	62.14	42.21	10.49	7.128	7.044	1.964
1200.0	1196	70.00	29.39	10.55	4.430	6.805	1.488
1150.0	1147	62.55	42.33	10.50	7.103	7.041	1.960

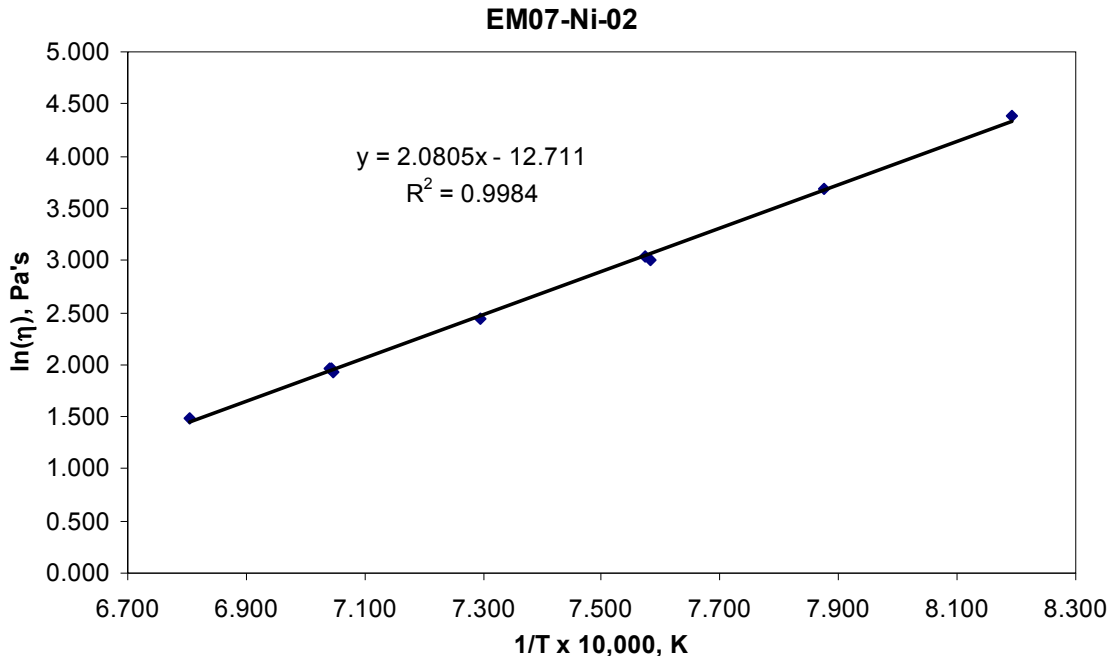

Figure A.35. Viscosity Trend for EM07-Ni-02

A.36 EM07-P-0 Viscosity Data

Table A.36. Viscosity Data for EM07-P-0

EM07-P-0

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	58.85	39.34	10.47	6.998	7.048	1.946
1100.0	1096	36.17	39.60	10.28	11.258	7.302	2.421
1050.0	1046	21.35	40.20	10.15	19.115	7.579	2.950
1000.0	996	11.35	39.02	10.06	34.582	7.878	3.543
950.0	946	11.58	76.94	10.06	66.849	8.204	4.202
1050.0	1044	25.19	47.83	10.19	19.343	7.590	2.962
1150.0	1145	62.34	42.15	10.49	7.096	7.053	1.960
1200.0	1195	70.00	30.06	10.55	4.531	6.811	1.511
1150.0	1146	63.04	42.15	10.50	7.019	7.046	1.949

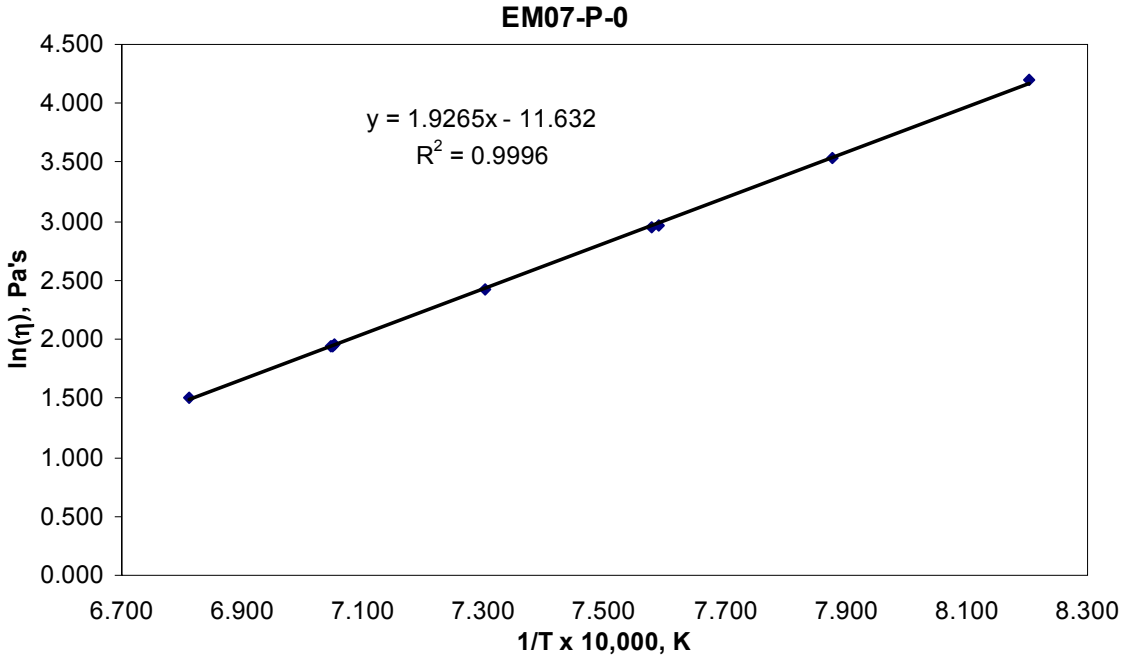

Figure A.36. Viscosity Trend for EM07-P-0

A.37 EM07-P-025 Viscosity Data

Table A.37. Viscosity Data for EM07-P-025

EM07-P-025

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	53.99	39.60	10.43	7.650	7.046	2.035
1100.0	1097	33.85	41.08	10.26	12.456	7.298	2.522
1050.0	1047	18.85	39.90	10.13	21.441	7.577	3.065
1000.0	996	11.87	45.86	10.06	38.887	7.879	3.661
950.0	945	9.06	70.89	10.04	78.576	8.209	4.364
1050.0	1045	20.25	43.01	10.14	21.541	7.586	3.070
1150.0	1146	57.61	42.80	10.46	7.771	7.048	2.050
1200.0	1196	70.00	32.72	10.55	4.931	6.807	1.596
1150.0	1147	57.53	42.30	10.46	7.689	7.042	2.040

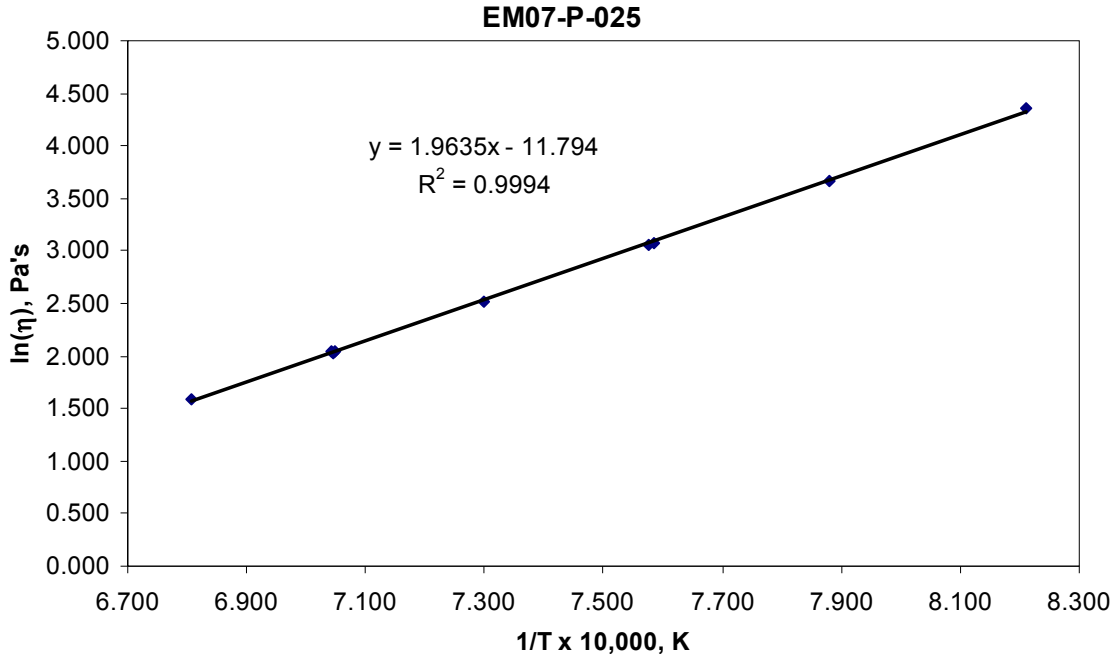

Figure A.37. Viscosity Trend for EM07-P-025

A.38 EM07-Si-30 Viscosity Data

Table A.38. Viscosity Data for EM07-Si-30

EM07-Si-30

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1143	70.00	10.86	10.55	1.636	7.061	0.492
1100.0	1096	70.00	17.66	10.55	2.662	7.306	0.979
1050.0	1046	70.00	29.13	10.55	4.390	7.579	1.479
1000.0	997	59.45	42.60	10.47	7.503	7.874	2.015
950.0	947	33.70	45.24	10.26	13.778	8.194	2.623
1050.0	1043	70.00	27.91	10.55	4.207	7.600	1.437
1150.0	1144	70.00	10.72	10.55	1.616	7.056	0.480
1200.0	1194	70.00	6.44	10.55	0.970	6.814	-0.030
1150.0	1145	70.00	10.14	10.55	1.528	7.050	0.424

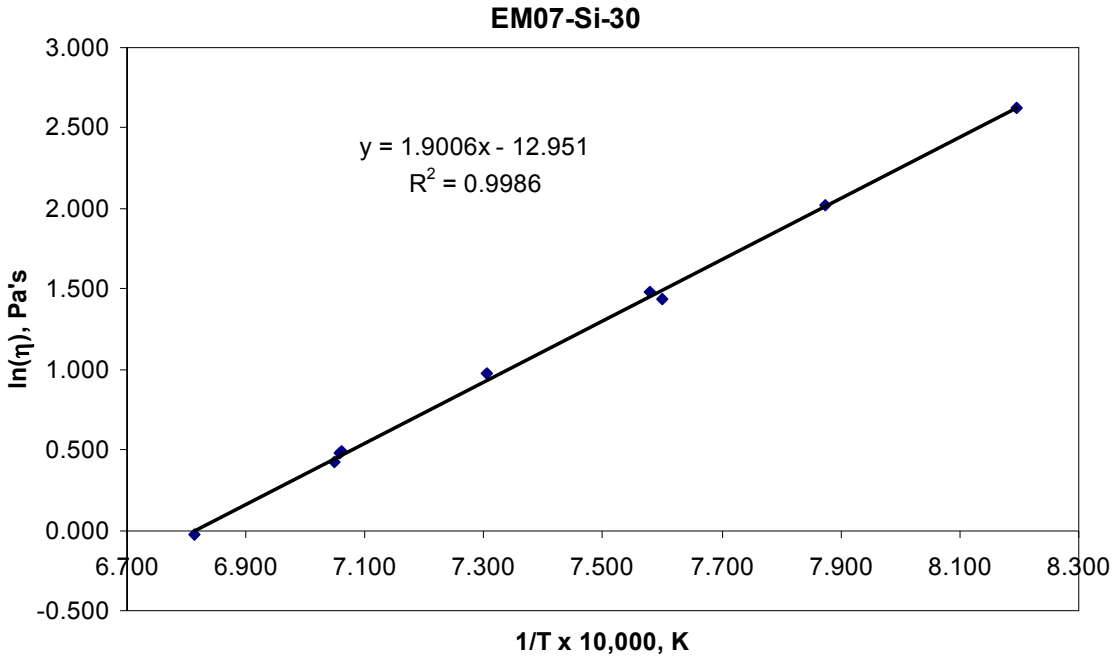

Figure A.38. Viscosity Trend for EM07-Si-30

A.39 EM07-Si-37 Viscosity Data

Table A.39. Viscosity Data for EM07-Si-37

EM07-Si-37

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1141	75.00	23.81	10.59	3.361	7.071	1.212
1100.0	1092	75.00	38.84	10.59	5.482	7.328	1.701
1050.0	1041	48.53	43.50	10.39	9.310	7.607	2.231
1000.0	991	29.22	47.00	10.22	16.445	7.909	2.800
950.0	940	14.30	43.77	10.09	30.874	8.240	3.430
1050.0	1038	48.65	43.18	10.39	9.222	7.627	2.222
1150.0	1139	75.00	24.30	10.59	3.430	7.083	1.233
1200.0	1190	75.00	15.48	10.59	2.185	6.835	0.781
1150.0	1141	75.00	23.89	10.59	3.372	7.071	1.215

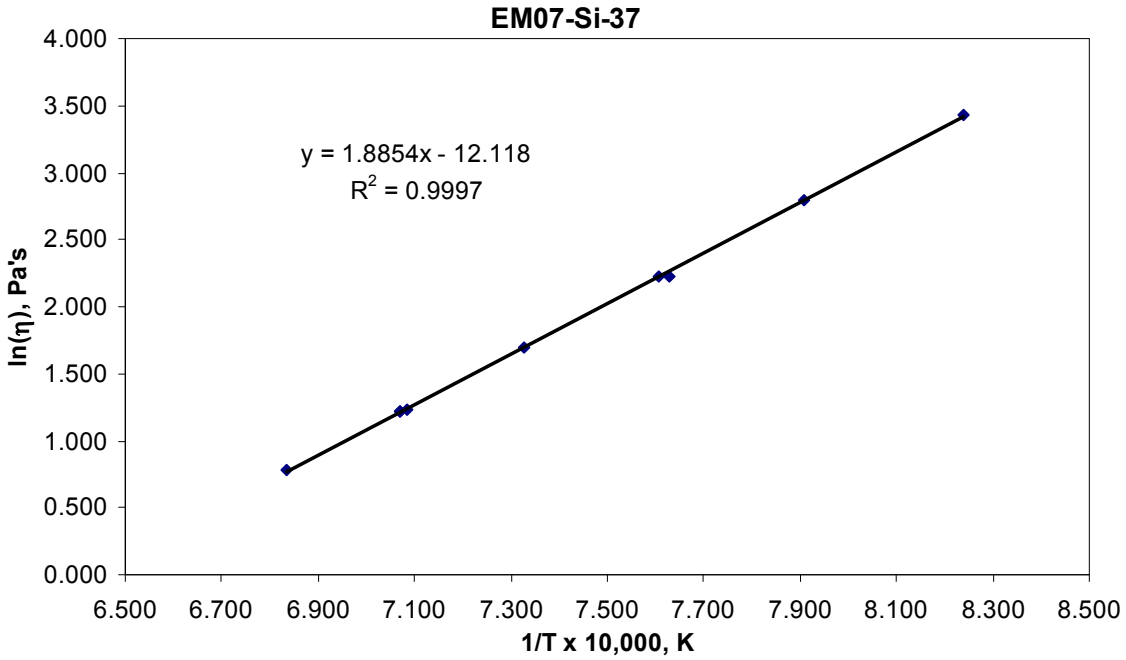

Figure A.39. Viscosity Trend for EM07-Si-37

A.40 EM07-Si-50 Viscosity Data

Table A.40. Viscosity Data for EM07-Si-50

EM07-Si-50

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1146	22.60	40.20	10.16	18.078	7.046	2.895
1100.0	1097	13.85	41.86	10.08	30.475	7.300	3.417
1050.0	1047	11.35	60.79	10.06	53.878	7.574	3.987
1000.0	996	6.75	71.37	10.02	105.908	7.877	4.663
950.0	946	2.44	62.34	9.97	254.607	8.204	5.540
1050.0	1042	11.96	64.26	10.07	54.081	7.603	3.990
1150.0	1144	26.68	48.09	10.20	18.387	7.054	2.912
1200.0	1195	39.39	44.05	10.31	11.532	6.811	2.445
1150.0	1146	26.78	47.57	10.20	18.124	7.045	2.897

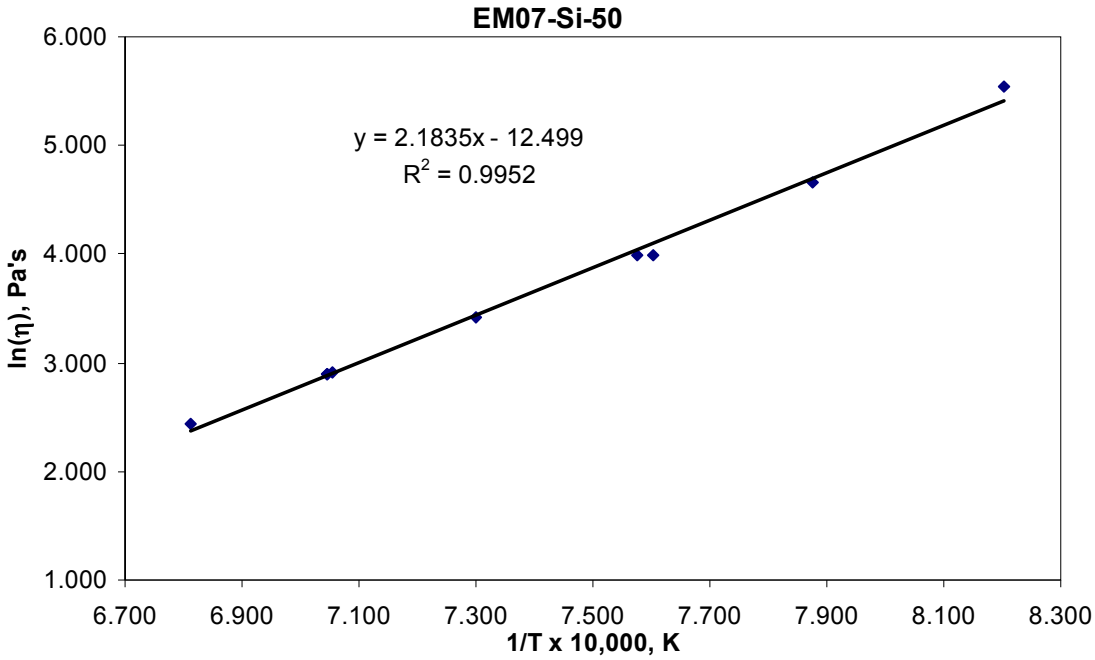

Figure A.40. Viscosity Trend for EM07-Si-50

A.41 EM07-Zr-001 Viscosity Data

Table A.41. Viscosity Data for EM07-Zr-001

EM07-Zr-001

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1137	58.85	40.79	10.47	7.255	7.092	1.982
1100.0	1090	36.35	40.02	10.29	11.325	7.334	2.427
1050.0	1042	21.17	39.09	10.15	18.745	7.606	2.931
1000.0	992	11.35	36.97	10.06	32.763	7.905	3.489
950.0	942	12.10	78.80	10.07	65.560	8.228	4.183
1050.0	1037	25.64	48.02	10.19	19.086	7.630	2.949
1150.0	1139	60.61	42.73	10.48	7.389	7.081	2.000
1200.0	1190	75.00	33.99	10.59	4.798	6.833	1.568
1150.0	1142	61.27	43.00	10.49	7.359	7.065	1.996

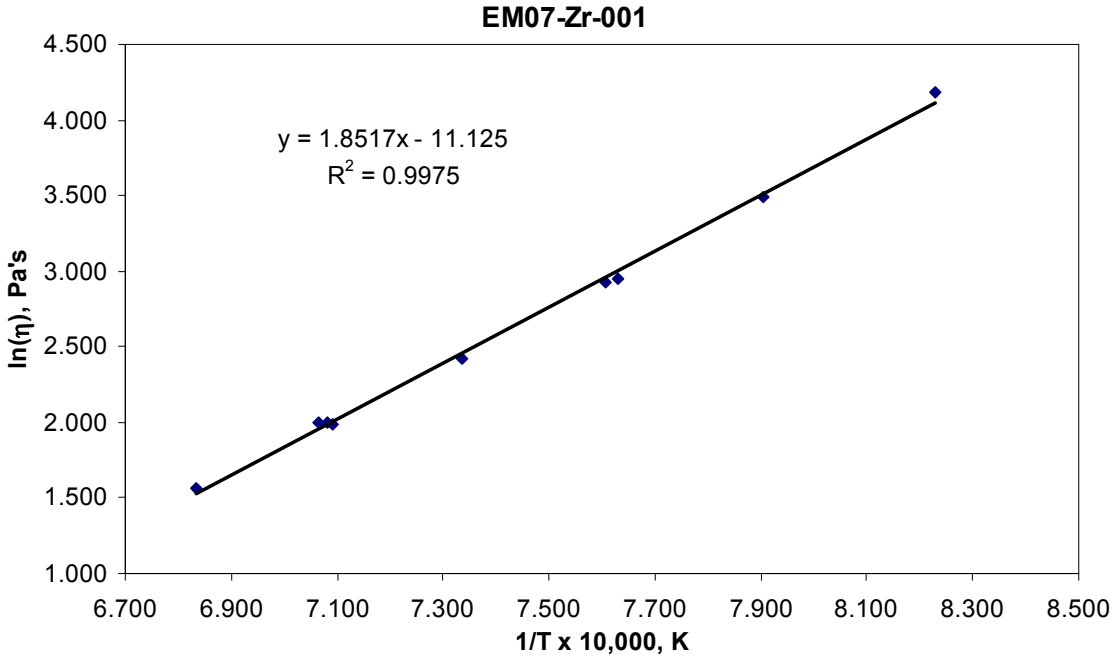

Figure A.41. Viscosity Trend for EM07-Zr-001

A.42 EM07-Zr-05 Viscosity Data

Table A.42. Viscosity Data for EM07-Zr-05

EM07-Zr-05

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1141	51.48	42.07	10.41	8.508	7.072	2.141
1100.0	1092	31.13	43.26	10.24	14.232	7.323	2.655
1050.0	1042	16.82	42.26	10.11	25.411	7.602	3.235
1000.0	992	12.44	60.35	10.07	48.852	7.906	3.889
950.0	942	7.17	73.95	10.02	103.394	8.229	4.639
1050.0	1039	16.52	42.65	10.11	26.097	7.620	3.262
1150.0	1138	51.67	42.63	10.41	8.589	7.084	2.151
1200.0	1191	84.24	41.17	10.65	5.204	6.829	1.649
1150.0	1137	53.11	43.09	10.42	8.457	7.091	2.135

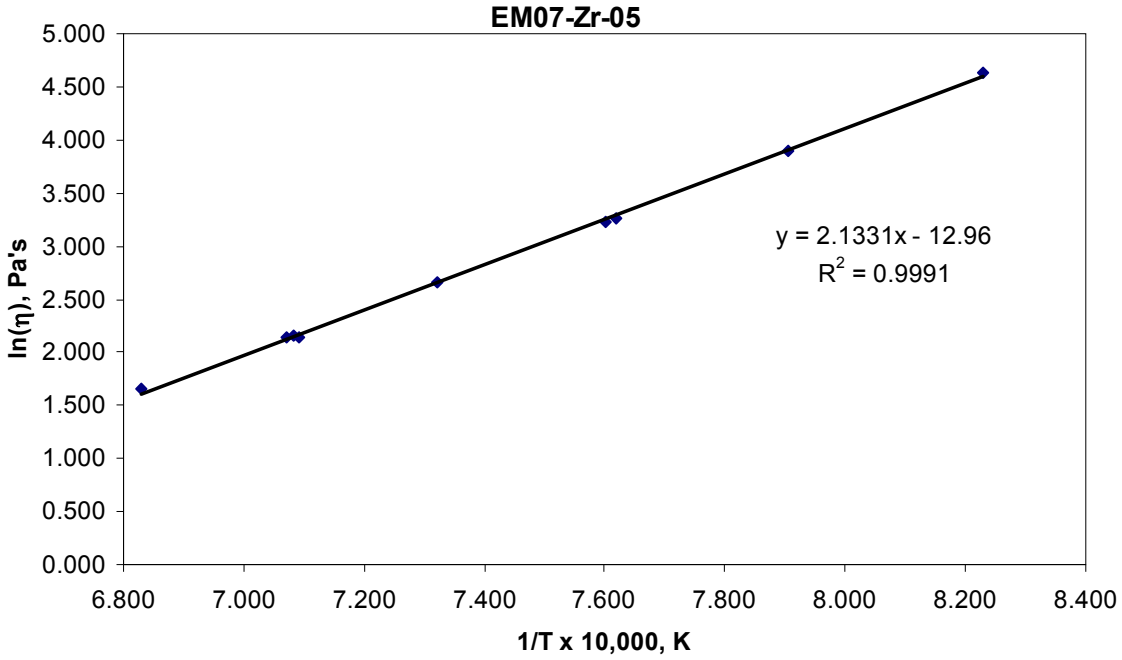

Figure A.42. Viscosity Trend for EM07-Zr-05

A.43 EM07-NM-0025 Viscosity Data

Table A.43. Viscosity Data for EM07-NM-0025

EM07-NM-025

speed	speed^2	intercept
0.01	-0.00002	9.9485

Data collected

Setpoint, C	Temperature,	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1145	57.60	39.96	10.46	7.255	7.050	1.982
1100.0	1097	36.49	41.19	10.29	11.612	7.298	2.452
1050.0	1047	21.17	40.83	10.15	19.575	7.574	2.974
1000.0	997	11.49	39.97	10.06	35.001	7.875	3.555
950.0	947	11.58	78.08	10.06	67.845	8.194	4.217
1050.0	1042	21.55	42.40	10.15	19.978	7.603	2.995
1150.0	1144	58.96	42.06	10.47	7.467	7.058	2.011
1200.0	1194	70.00	31.84	10.55	4.799	6.816	1.568
1150.0	1145	61.71	42.18	10.49	7.170	7.050	1.970

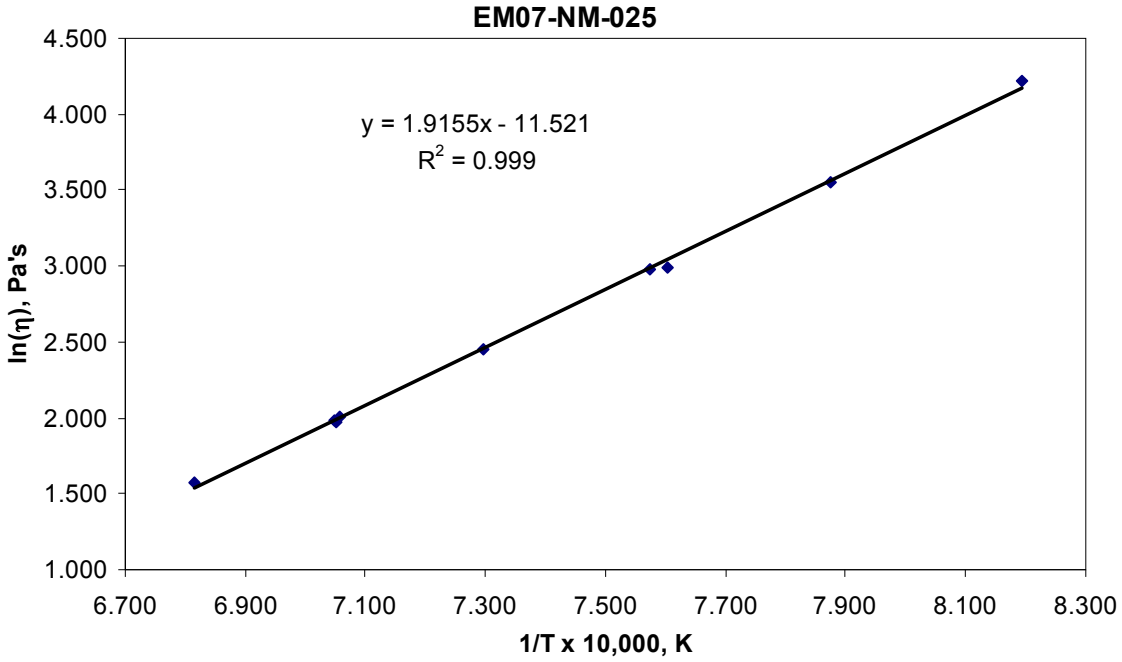

Figure A.43. Viscosity Trend for EM07-NM-0025

A.44 EM07-Val-1 Viscosity Data

Table A.44. Viscosity Data for EM07-Val-1

EM07-Val-1

speed	speed^2	intercept
-0.1110	0.00170	13.749

Data collected

Setpoint, C	Temperature, C	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1116	18.711	9.82	12.267	6.436	7.198	1.862
1100.0	1070	13.433	10.37	12.565	9.699	7.447	2.272
1050.0	1018	11.350	16.07	12.708	17.989	7.743	2.890
1000.0	971	11.350	27.44	12.708	30.723	8.035	3.425
950.0	920	11.489	55.14	12.698	60.943	8.380	4.110
1050.0	1018	11.350	16.94	12.708	18.971	7.742	2.943
1150.0	1117	19.824	10.73	12.217	6.612	7.191	1.889
1200.0	1166	31.190	11.34	11.941	4.341	6.948	1.468
1150.0	1117	19.274	10.70	12.241	6.795	7.193	1.916

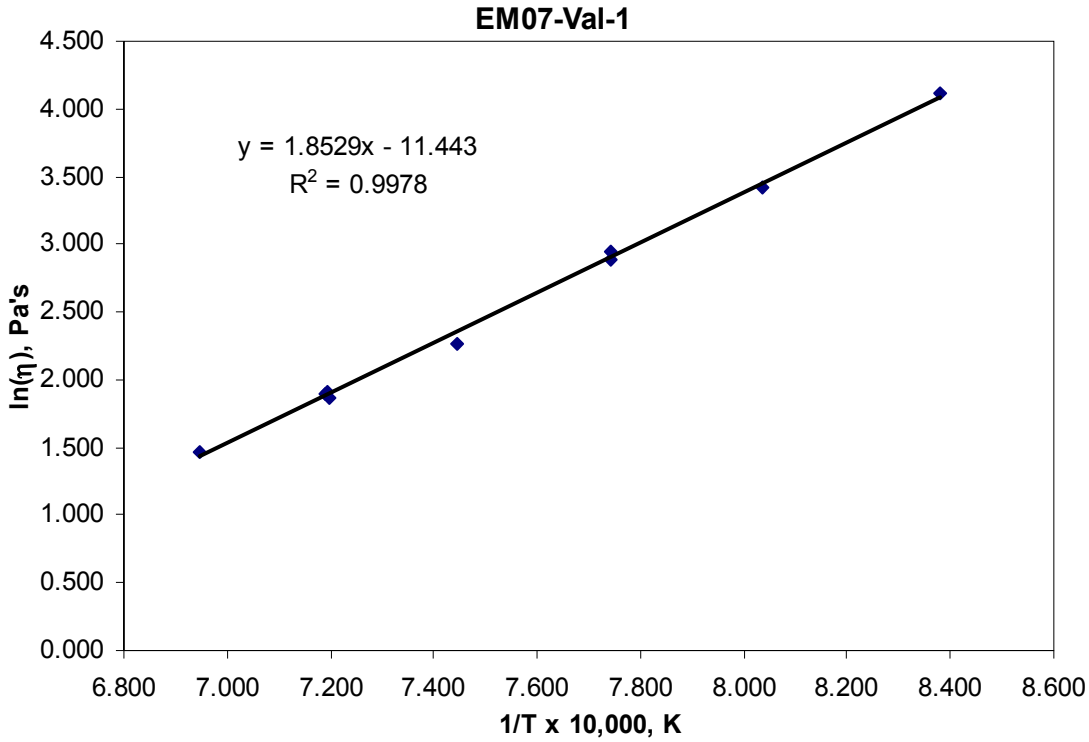

Figure A.44. Viscosity Trend for EM07-Val-1

A.45 EM07-Val-2 Viscosity Data

Table A.45. Viscosity Data for EM07-Val-2

EM07-Val-2

speed	speed^2	intercept
-0.1110	0.00170	13.749

Data collected

Setpoint, C	Temperature, C	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1111	13.055	10.20	12.590	9.836	7.224	2.286
1100.0	1063	11.590	15.83	12.691	17.332	7.481	2.853
1050.0	1015	11.729	27.88	12.681	30.149	7.761	3.406
1000.0	967	11.476	49.10	12.699	54.327	8.064	3.995
950.0	917	8.590	72.75	12.921	109.431	8.403	4.695
1050.0	1016	12.260	28.53	12.644	29.424	7.756	3.382
1150.0	1112	14.060	11.15	12.524	9.929	7.218	2.295
1200.0	1161	25.020	11.60	12.036	5.580	6.971	1.719
1150.0	1112	15.950	11.93	12.411	9.282	7.219	2.228

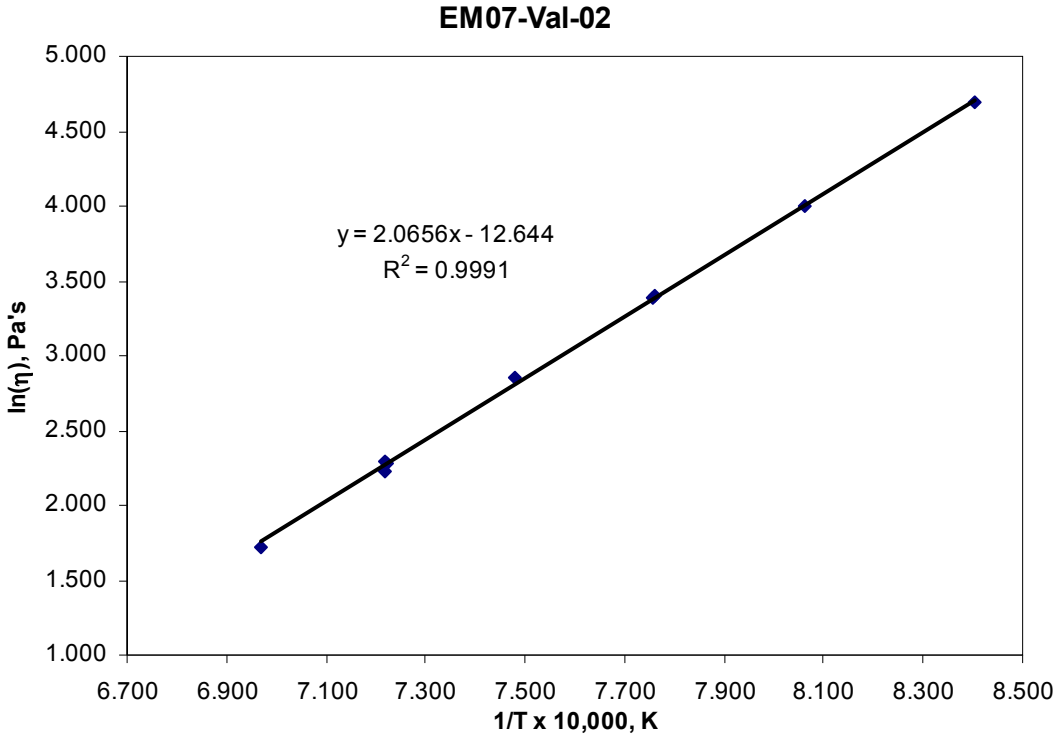

Figure A.45. Viscosity Trend for EM07-Val-2

A.46 EM07-Val-3 Viscosity Data

Table A.46. Viscosity Data for EM07-Val-3

EM07-Val-3

speed	speed^2	intercept
-0.1110	0.00170	13.749

Data collected

Setpoint, C	Temperature, C	Speed, rpm	Torque, %	S.F.	Viscosity, Pa's	1/T x 10000, K	Ln(η), Pa's
1150.0	1117	12.191	11.28	12.648	11.703	7.191	2.460
1100.0	1068	12.370	19.40	12.636	19.813	7.456	2.986
1050.0	1018	12.191	34.10	12.648	35.381	7.743	3.566
1000.0	969	12.484	64.28	12.628	65.028	8.048	4.175
950.0	920	6.269	70.38	13.120	147.300	8.379	4.992
1050.0	1021	11.610	32.94	12.689	35.999	7.730	3.583
1150.0	1119	11.610	11.84	12.689	12.946	7.181	2.561
1200.0	1167	17.236	10.96	12.341	7.847	6.944	2.060
1150.0	1118	11.930	11.94	12.667	12.678	7.188	2.540

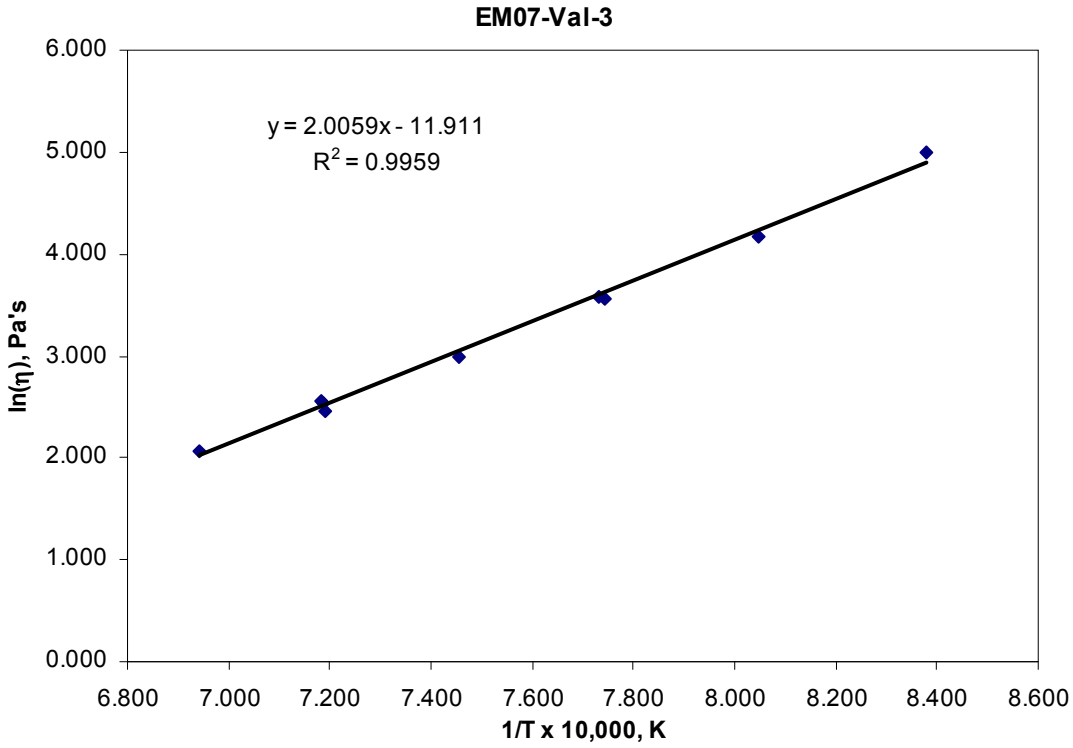

Figure A.46. Viscosity Trend for EM07-Val-3

Appendix B: XRD of Canister Centerline Cooling (CCC) Treated Glasses

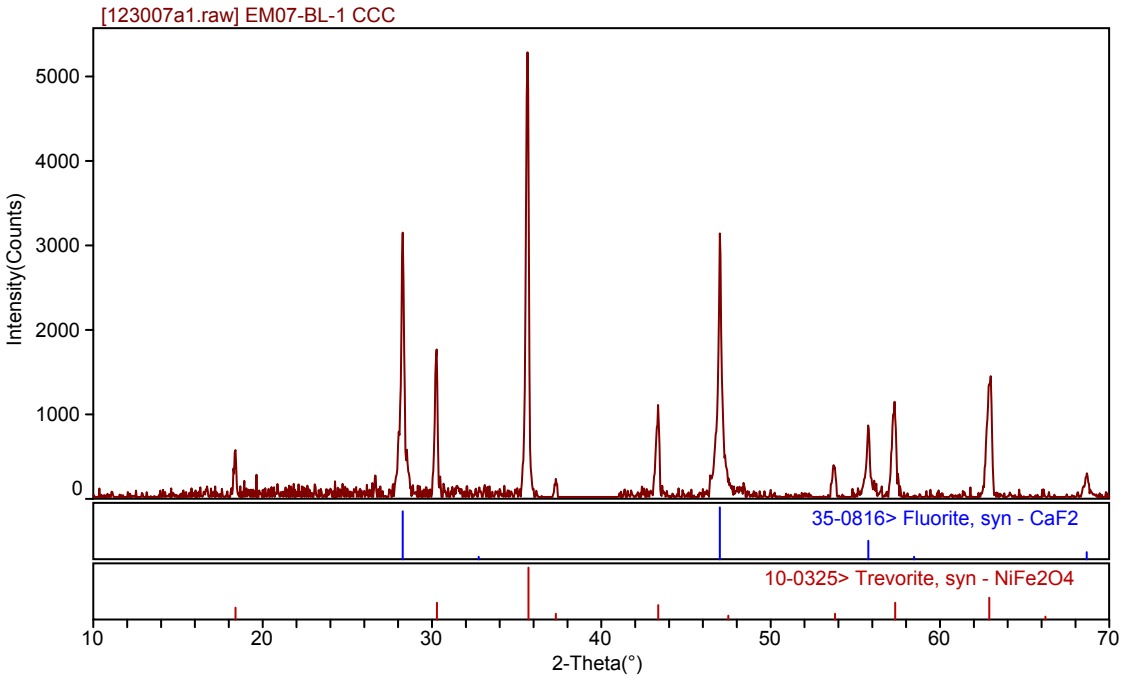

Figure B.1. XRD Spectrum of CCC Treated EM07-BL-1

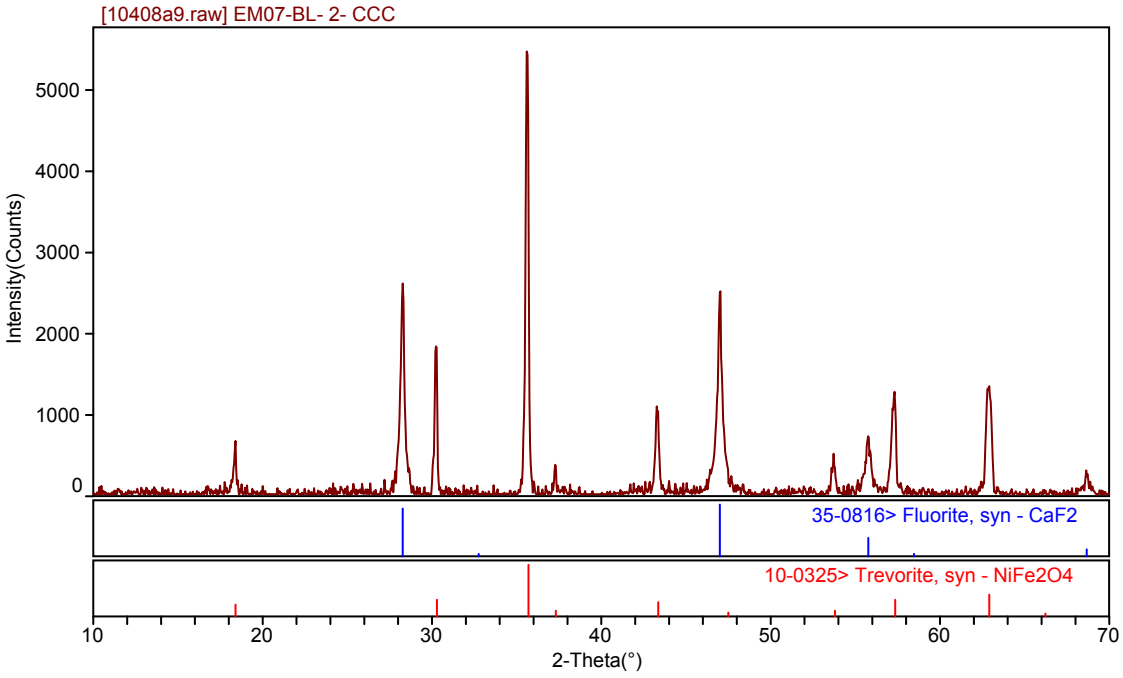

Figure B.2. XRD Spectrum of CCC Treated EM07-BL-2

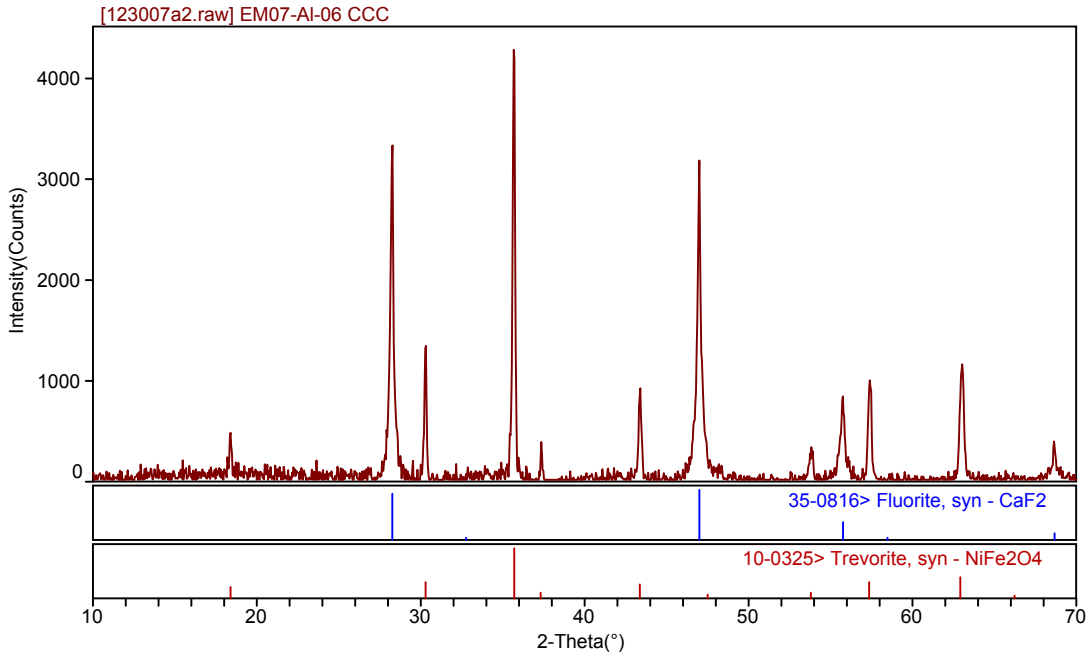

Figure B.3. XRD Spectrum of CCC Treated EM07-Al-06

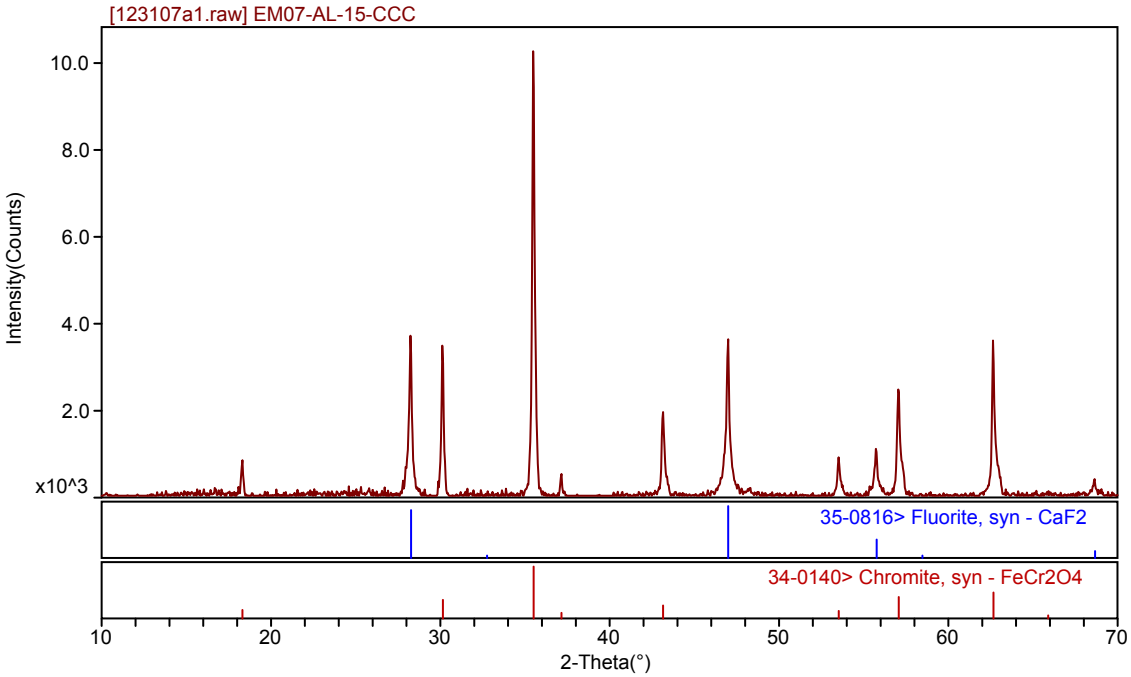

Figure B.4. XRD Spectrum of CCC Treated EM07-Al-15

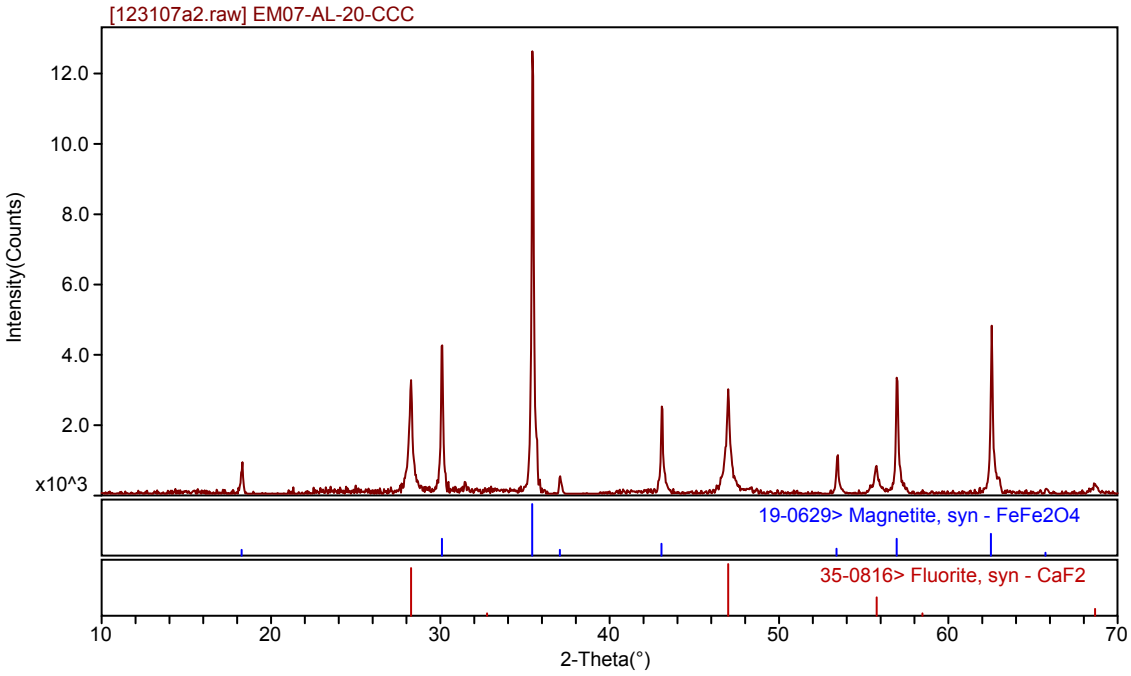

Figure B.5. XRD Spectrum of CCC Treated EM07-Al-20

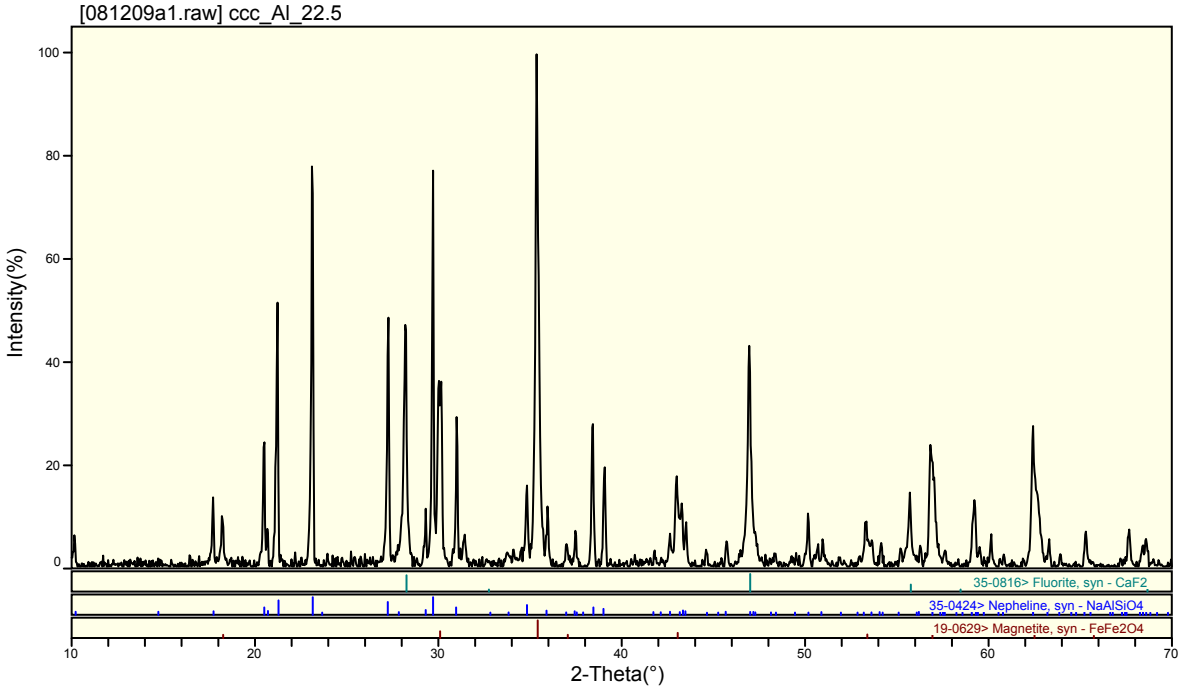

Figure B.6. XRD Spectrum of CCC Treated EM07-Al-22.5

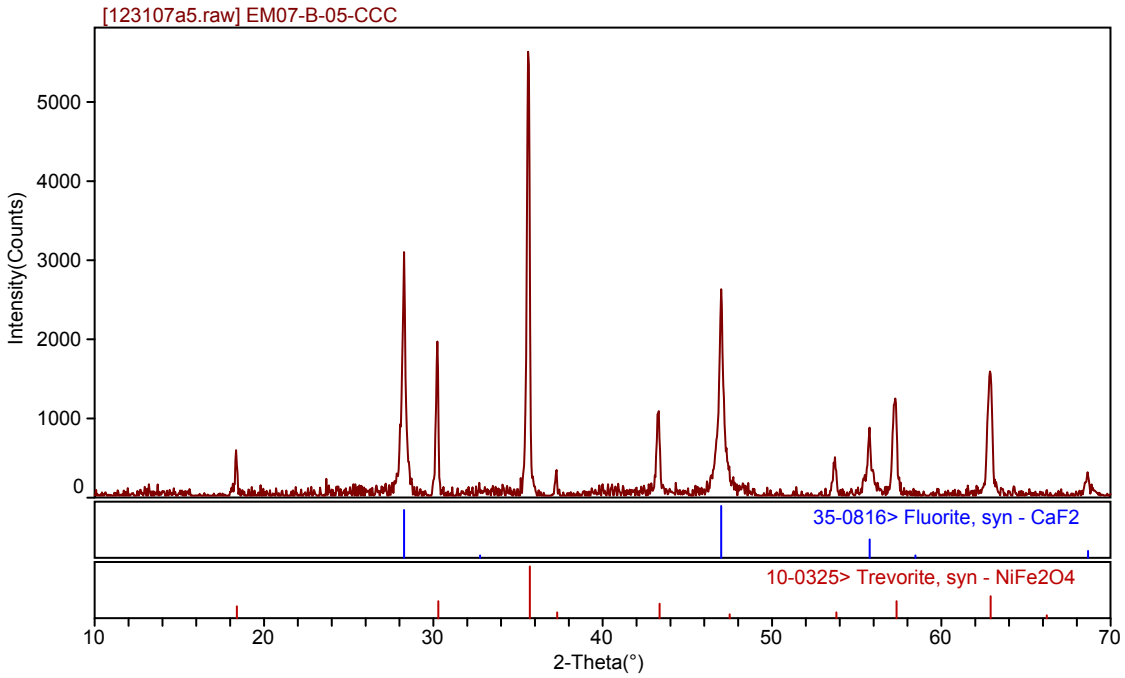

Figure B.7. XRD Spectrum of CCC Treated EM07-B-05

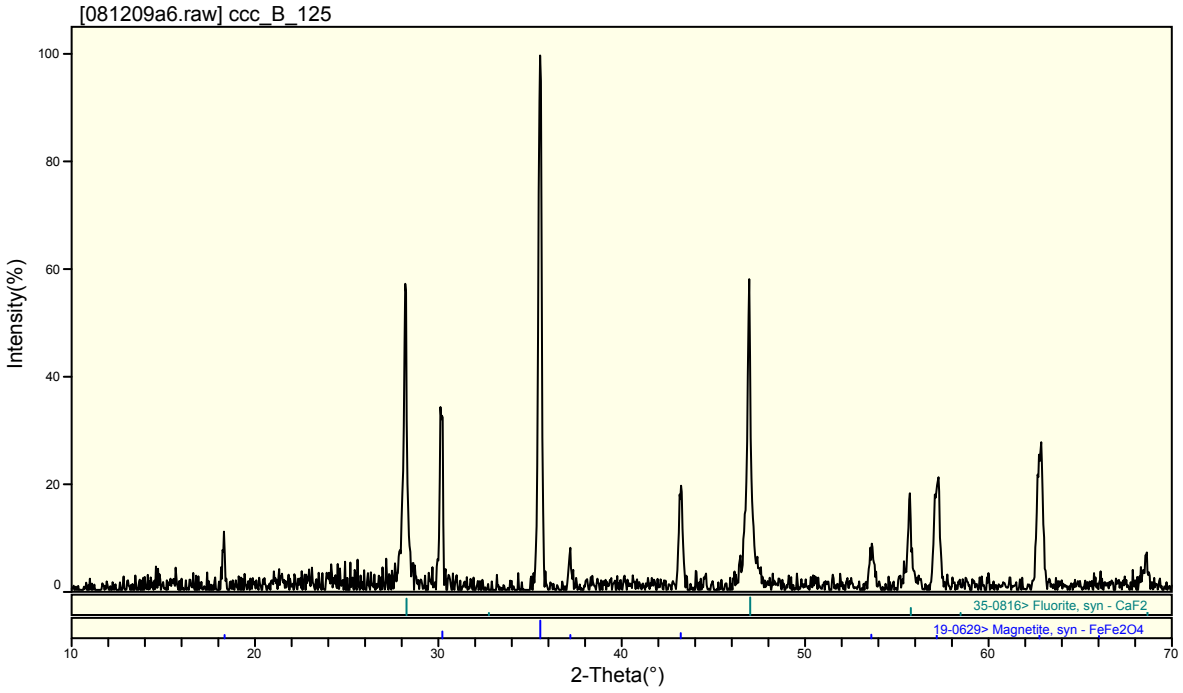

Figure B.8. XRD Spectrum of CCC Treated EM07-B-125

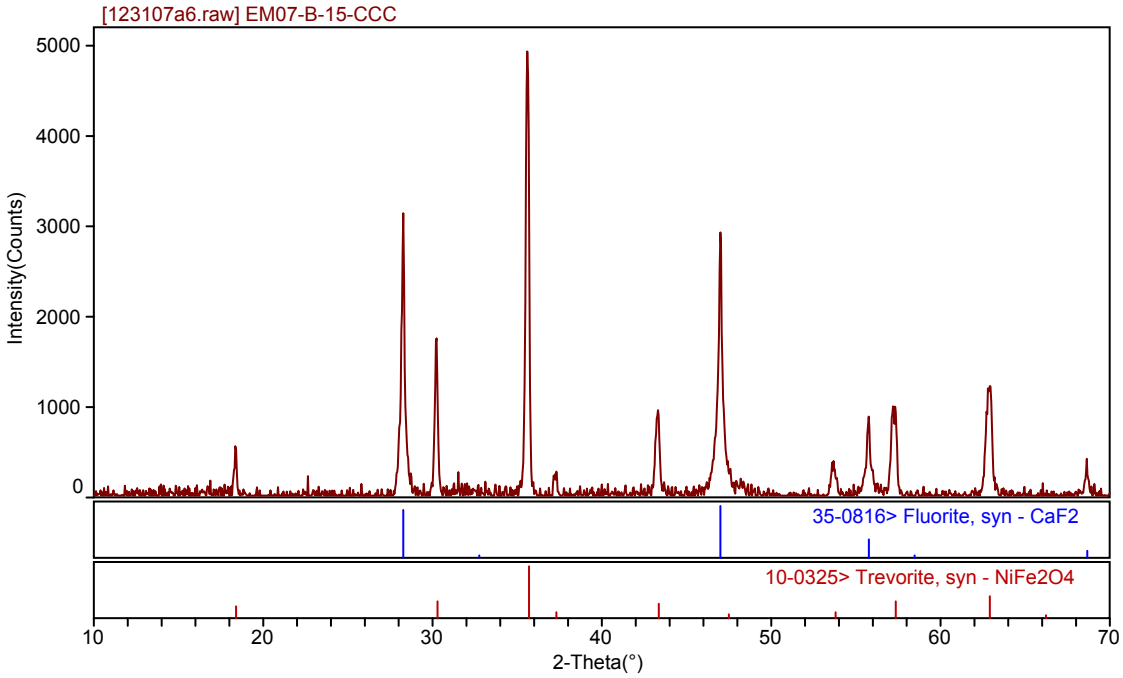

Figure B.9. XRD Spectrum of CCC Treated EM07-B-15

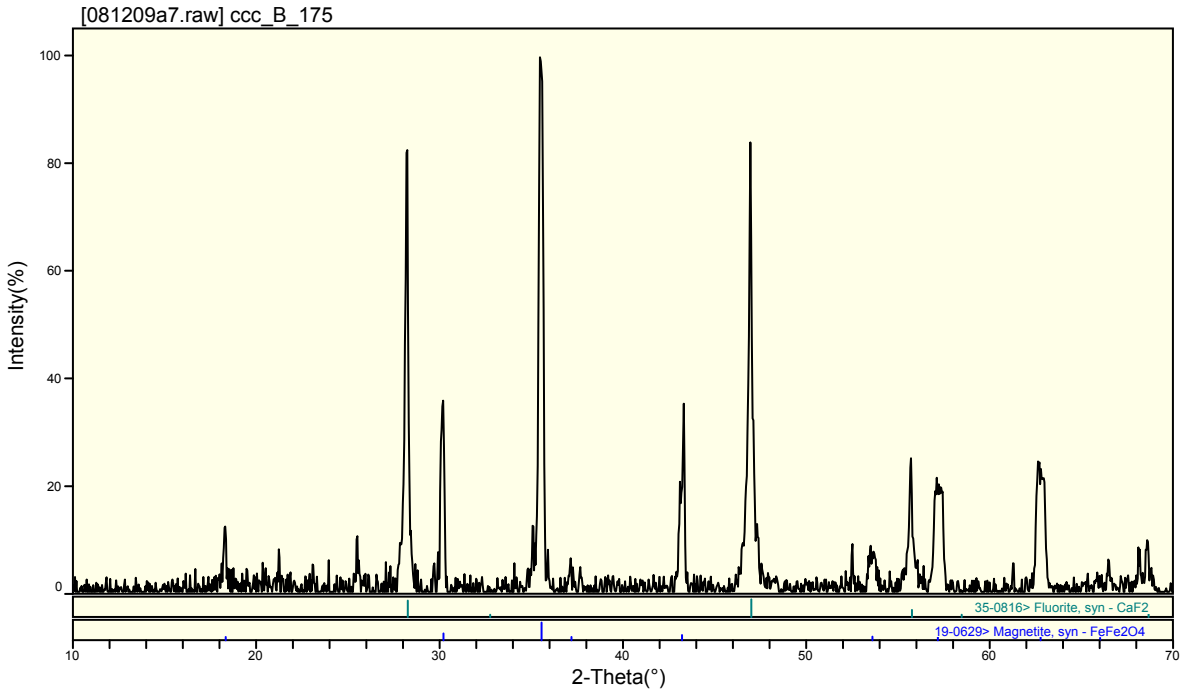

Figure B.10. XRD Spectrum of CCC Treated EM07-B-175

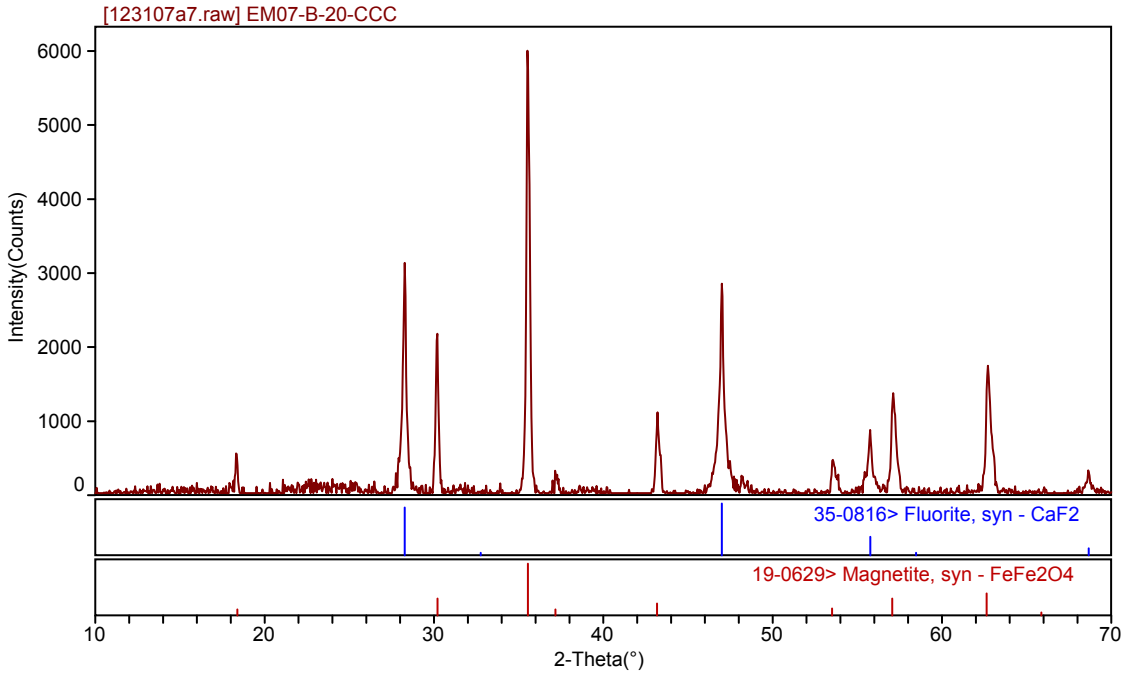

Figure B.11. XRD Spectrum of CCC Treated EM07-B-20

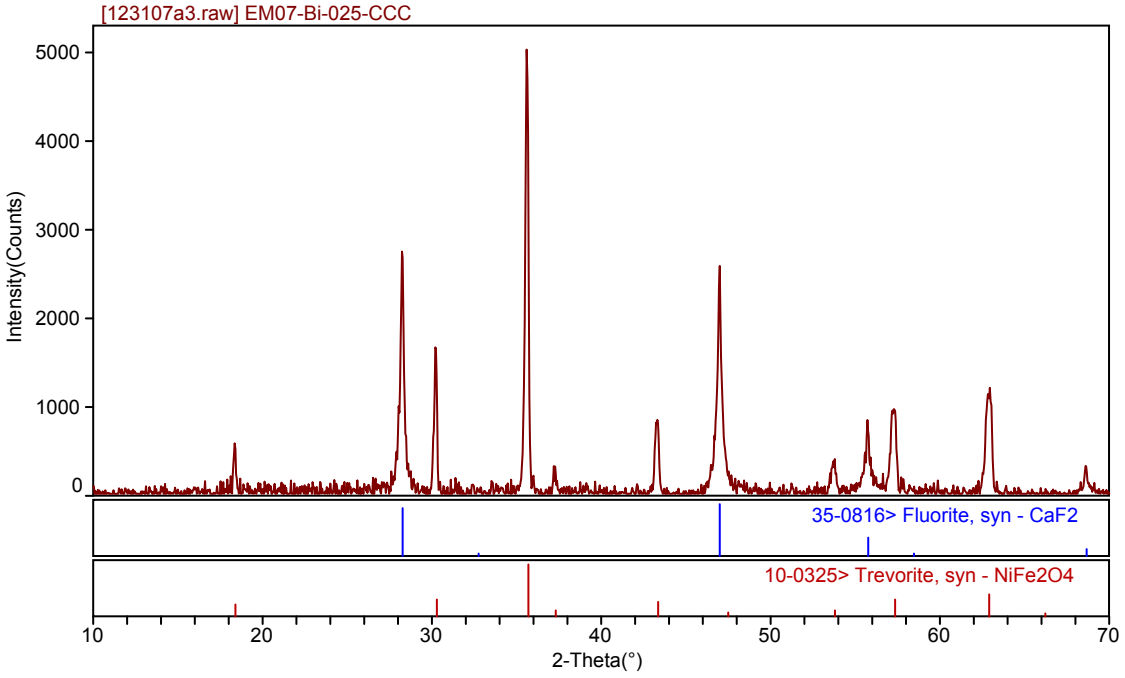

Figure B.12. XRD Spectrum of CCC Treated EM07-Bi-025

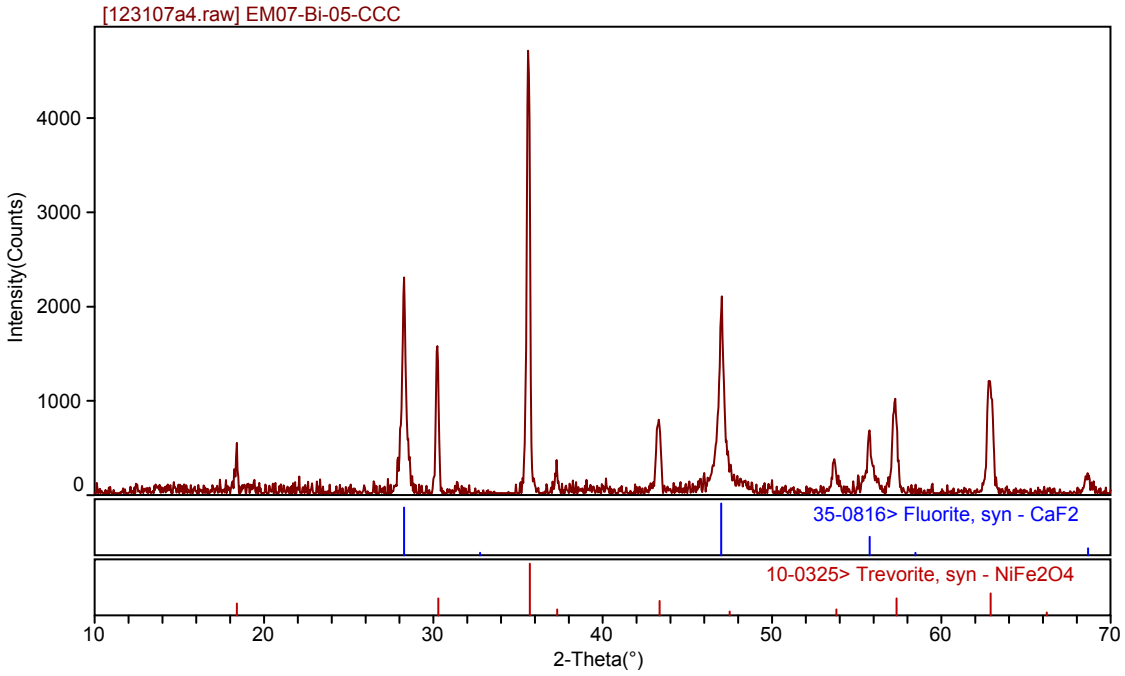

Figure B.13. XRD Spectrum of CCC Treated EM07-Bi-05

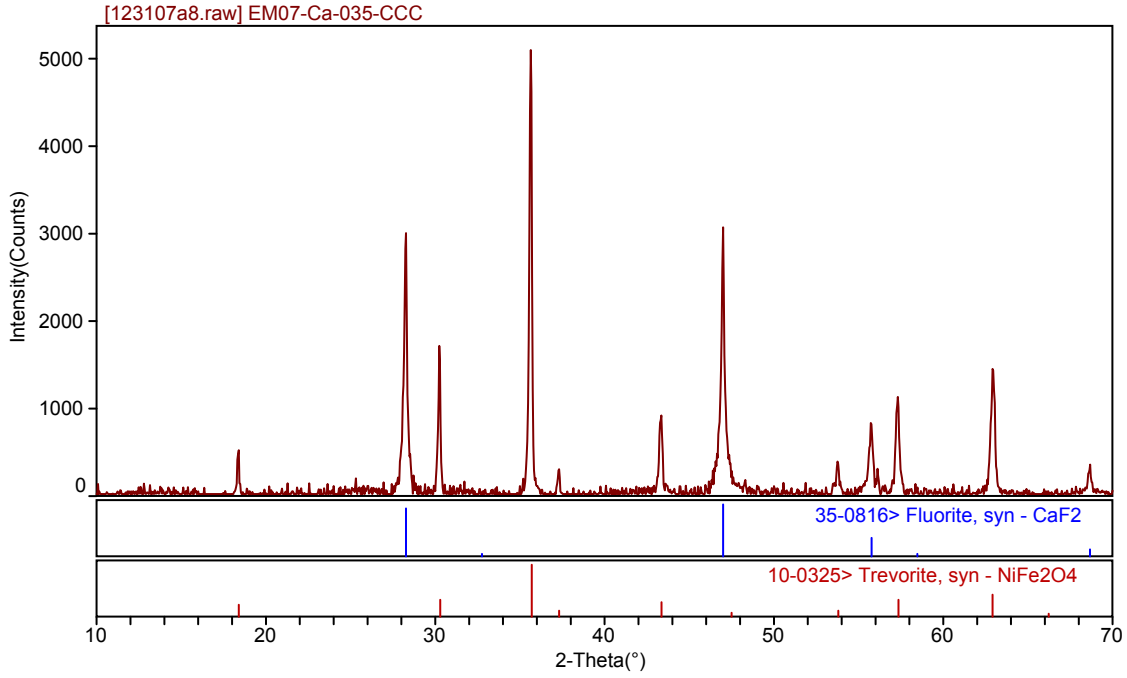

Figure B.14. XRD Spectrum of CCC Treated EM07-Ca-035

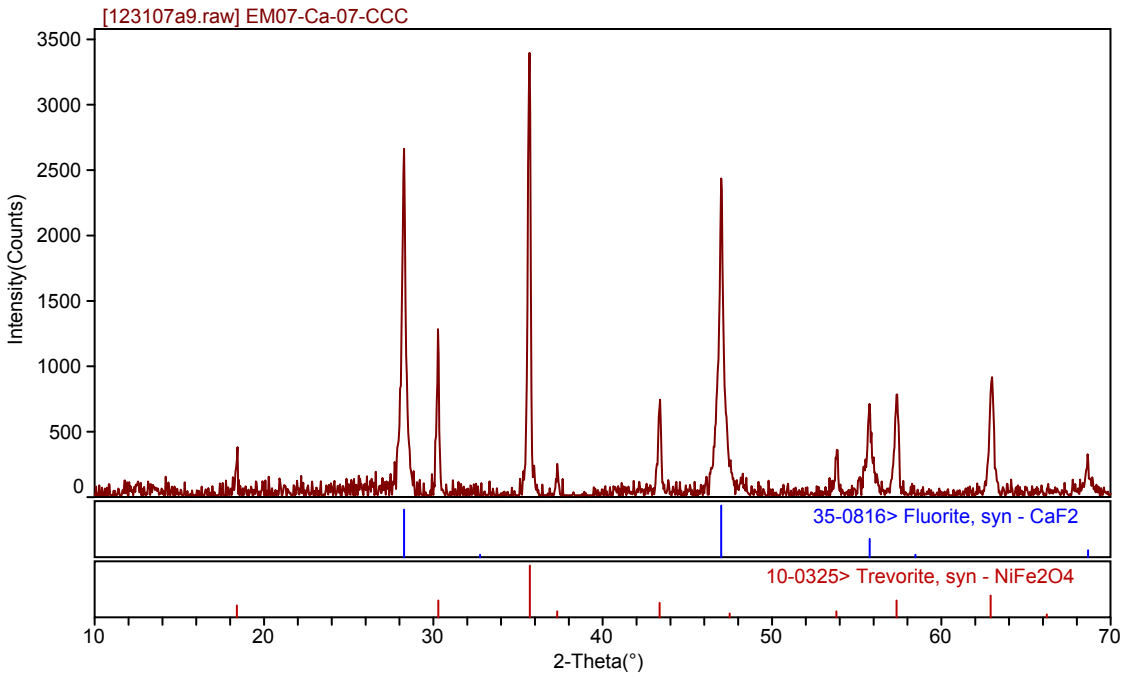

Figure B.15. XRD Spectrum of CCC Treated EM07-Ca-07

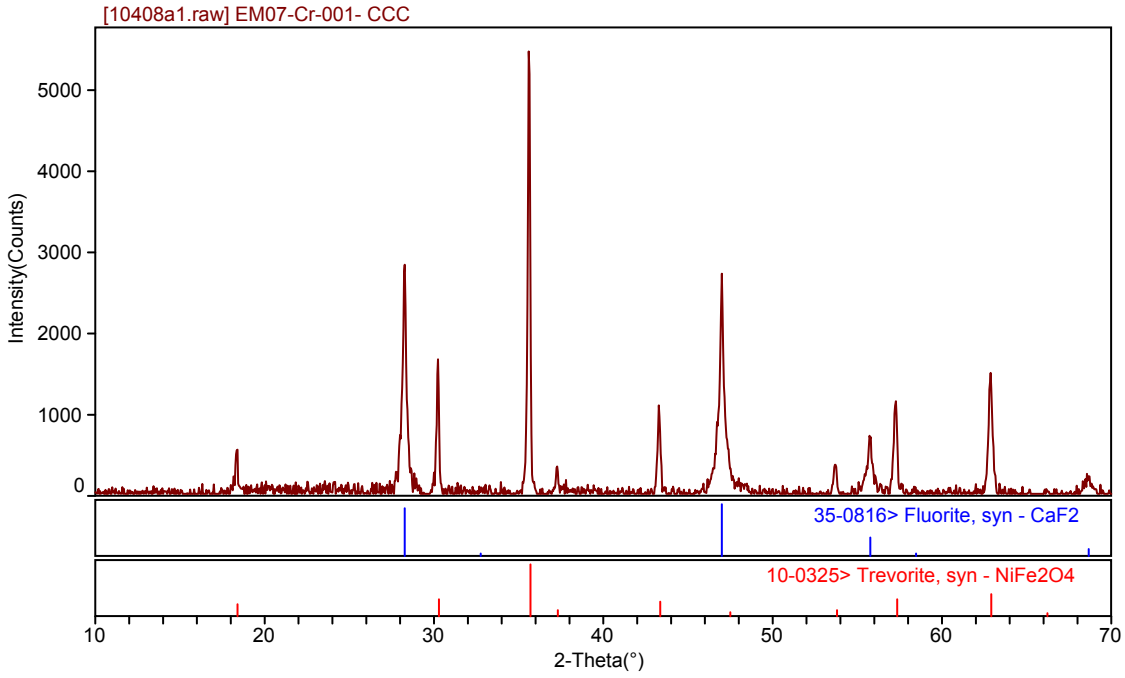

Figure B.16. XRD Spectrum of CCC Treated EM07-Cr-001

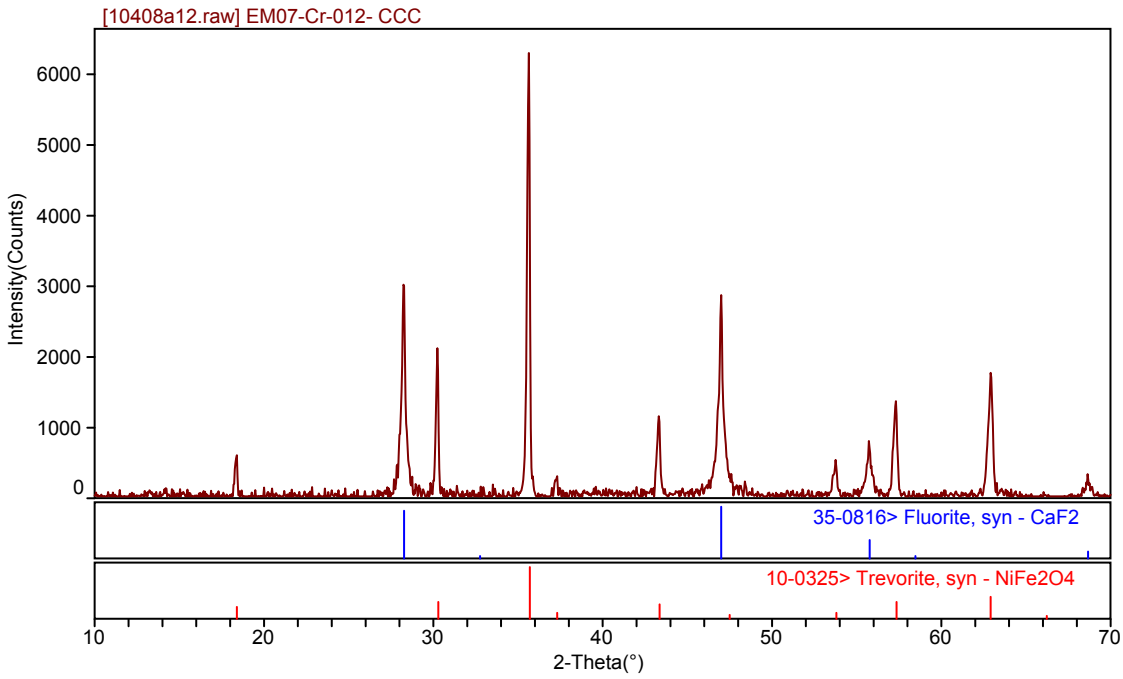

Figure B.17. XRD Spectrum of CCC Treated EM07-Cr-012

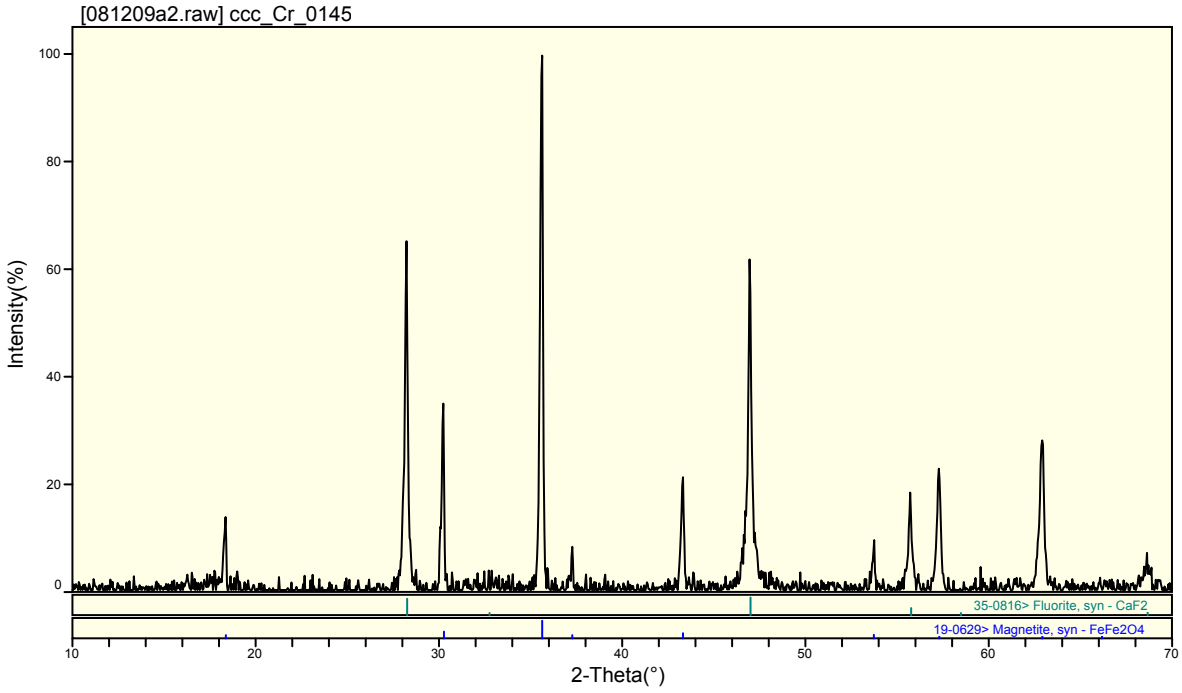

Figure B.18. XRD Spectrum of CCC Treated EM07-Cr-0145

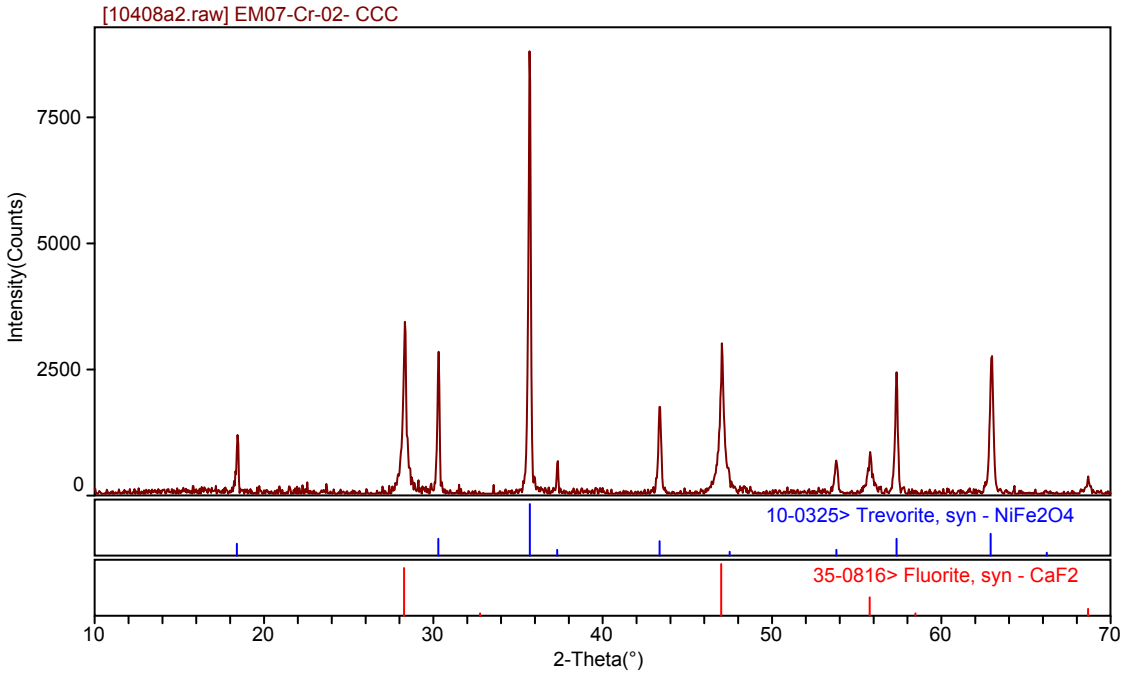

Figure B.19. XRD Spectrum of CCC Treated EM07-Cr-02

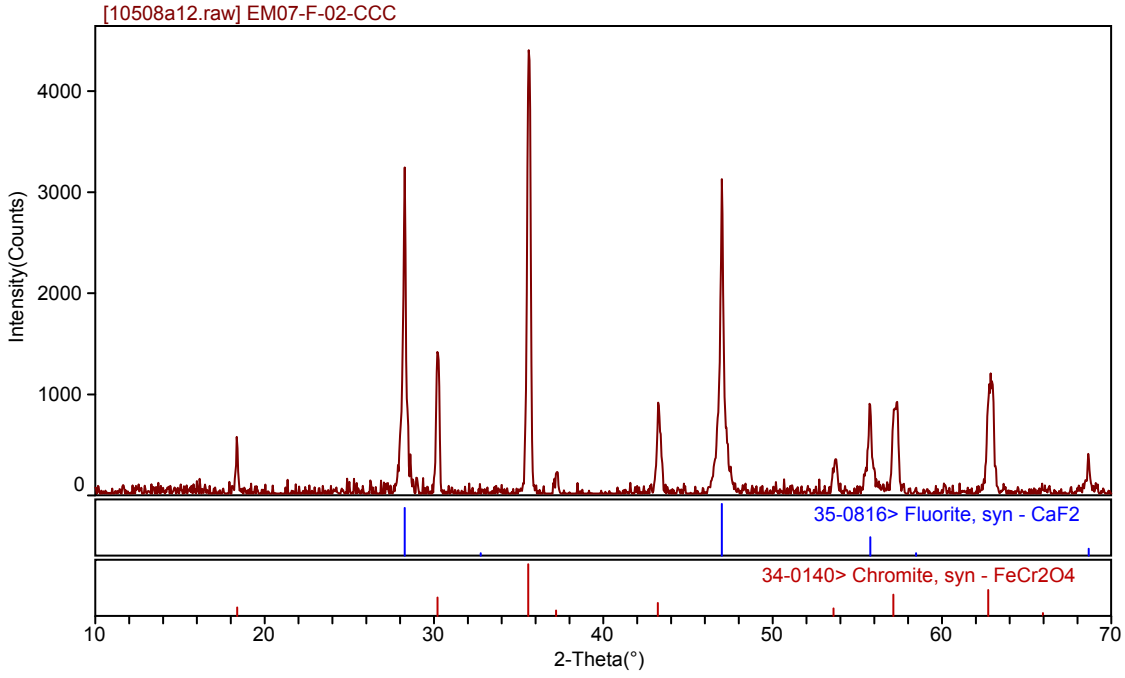

Figure B.20. XRD Spectrum of CCC Treated EM07-F-02

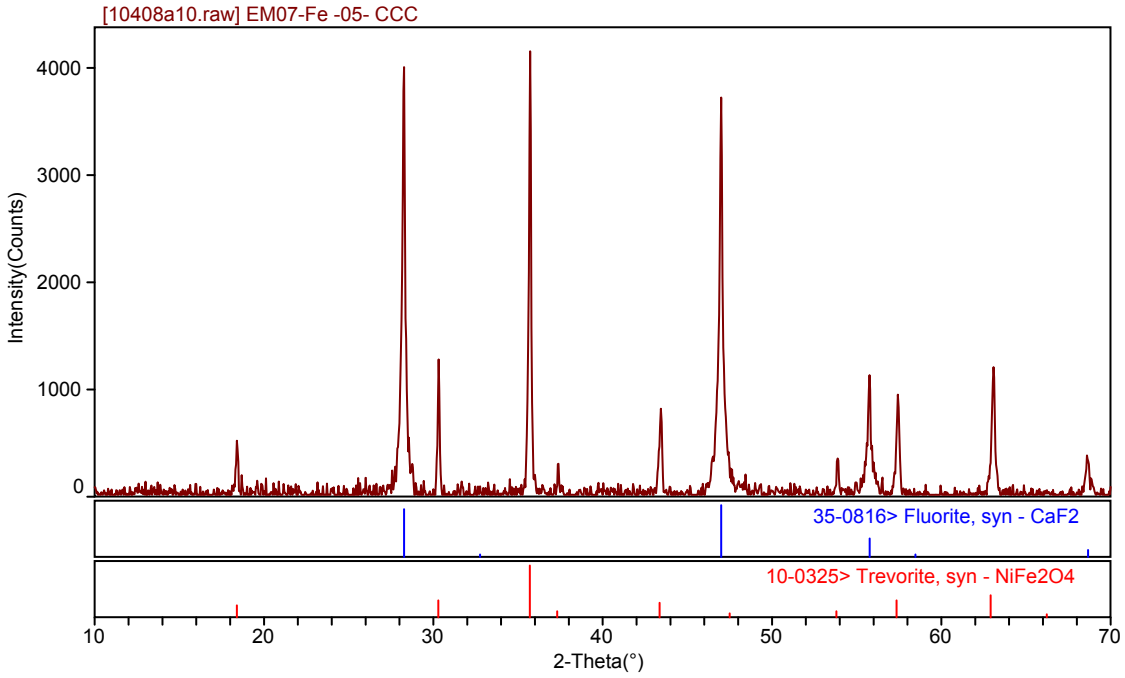

Figure B.21. XRD Spectrum of CCC Treated EM07-Fe-05

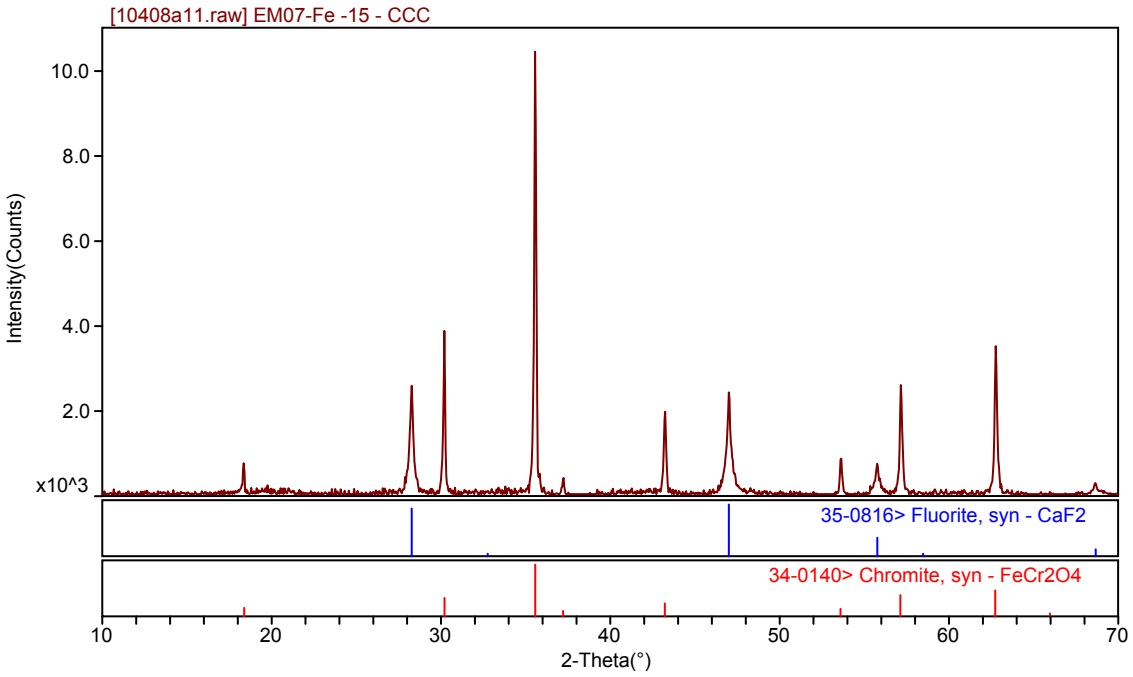

Figure B.22. XRD Spectrum of CCC Treated EM07-Fe-15

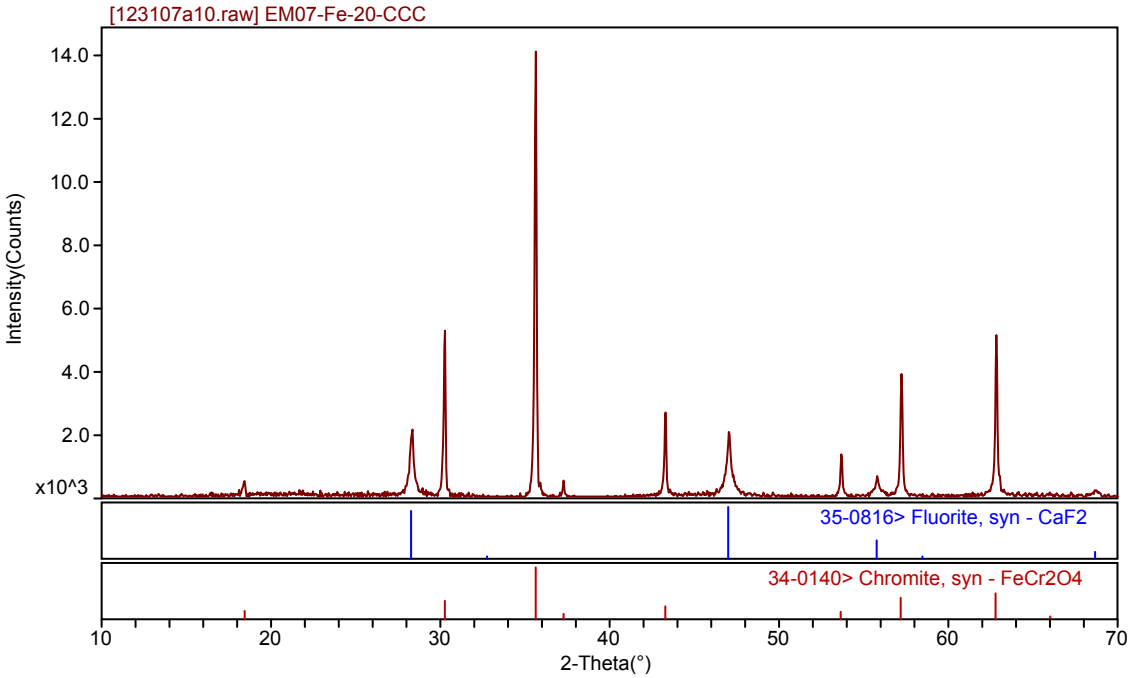

Figure B.23. XRD Spectrum of CCC Treated EM07-Fe-20

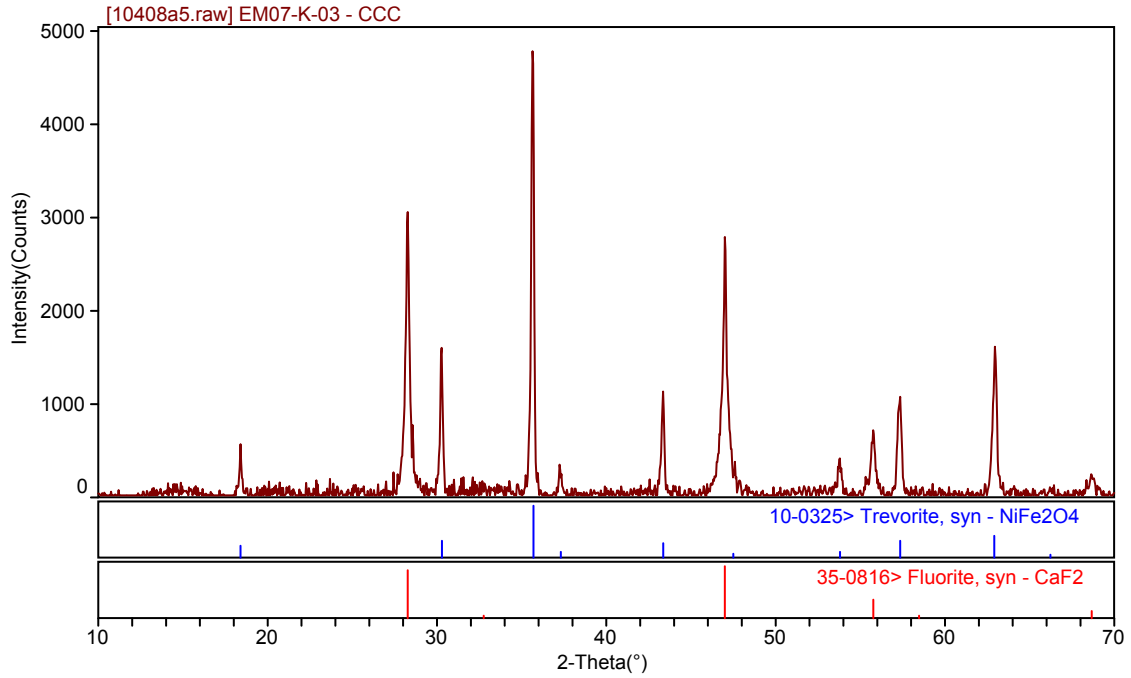

Figure B.24. XRD Spectrum of CCC Treated EM07-K-03

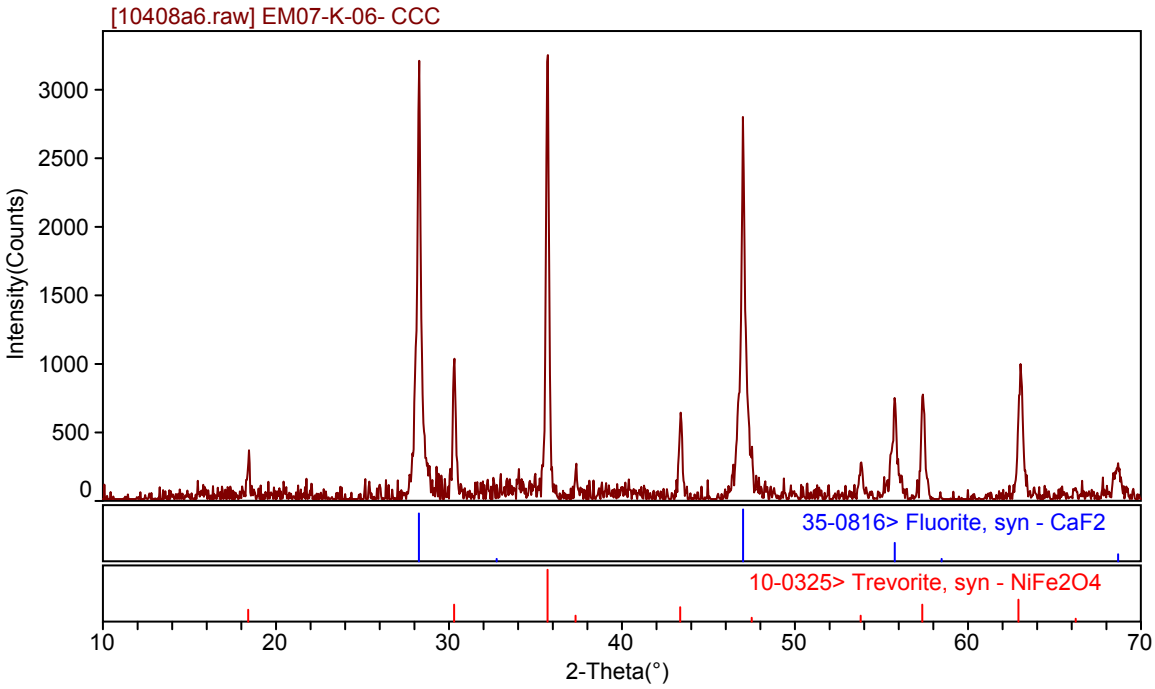

Figure B.25. XRD Spectrum of CCC Treated EM07-K-06

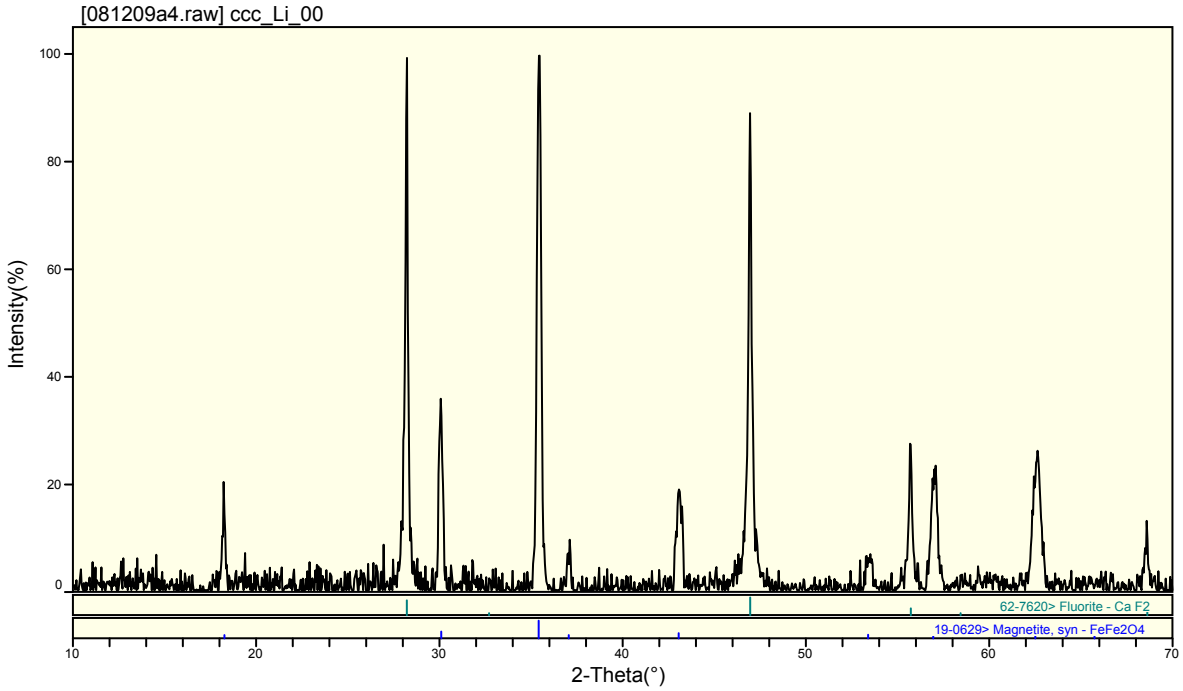

Figure B.26. XRD Spectrum of CCC Treated EM07-Li-00

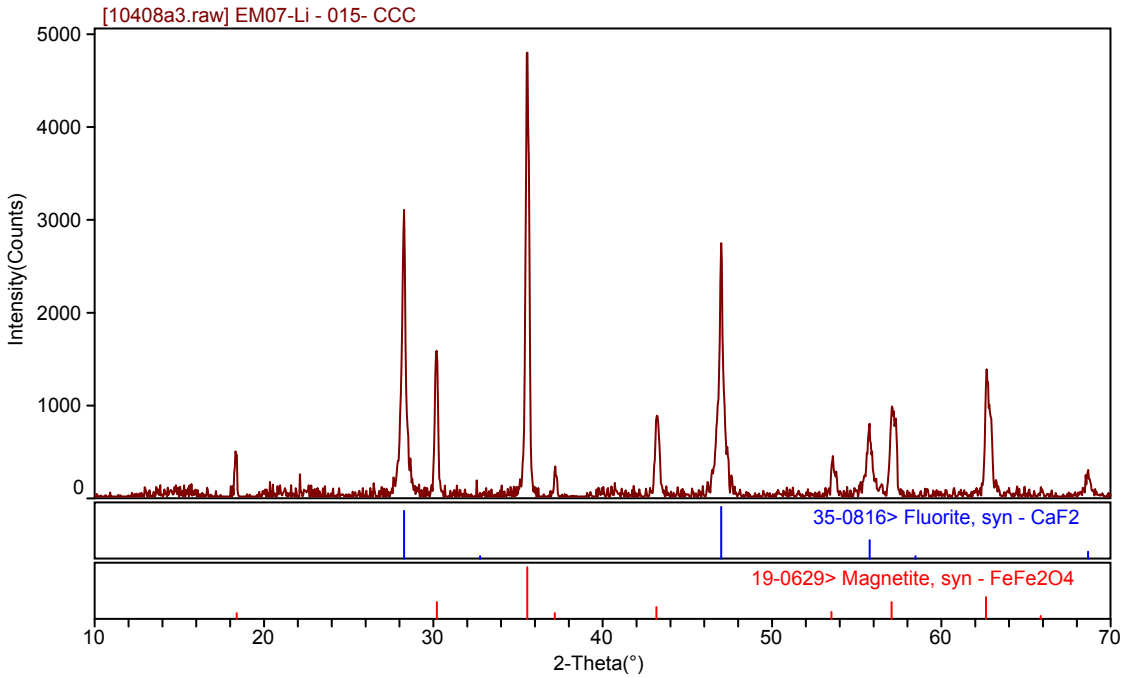

Figure B.27. XRD Spectrum of CCC Treated EM07-Li-015

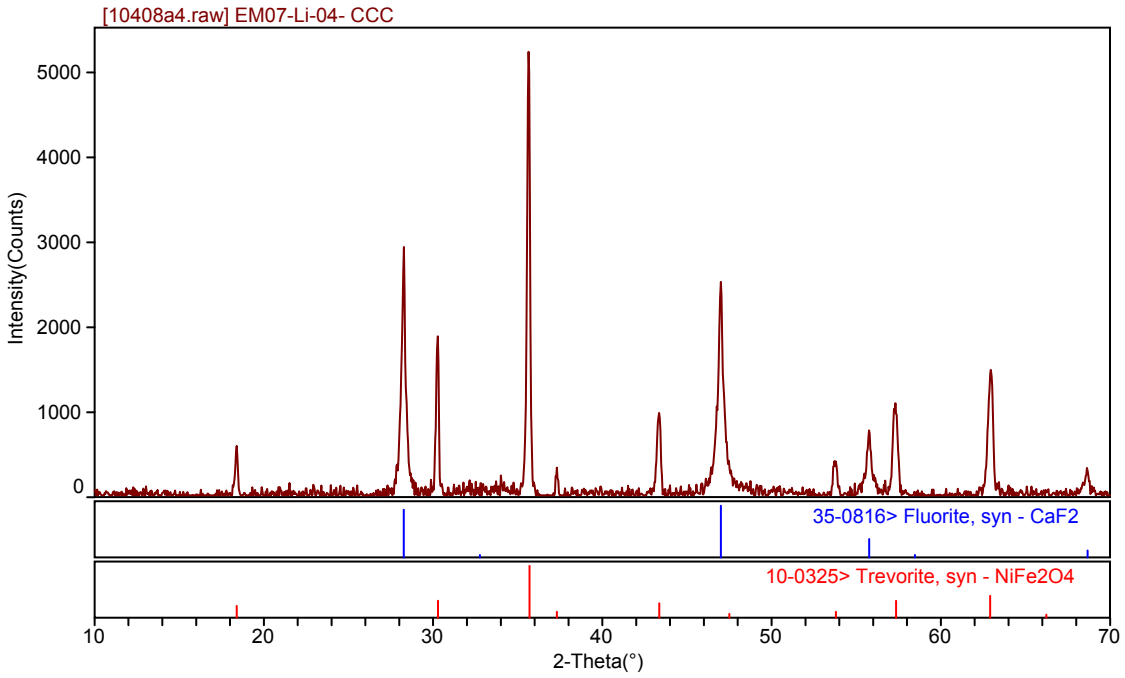

Figure B.28. XRD Spectrum of CCC Treated EM07-Li-04

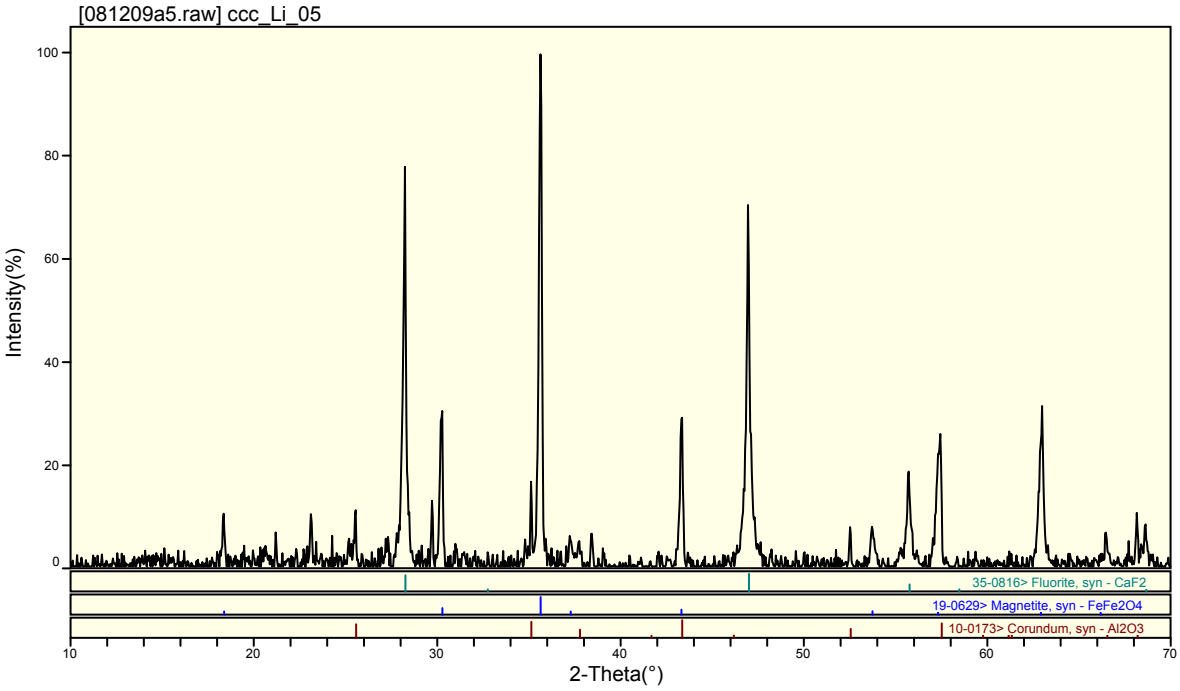

Figure B.29. XRD Spectrum of CCC Treated EM07-Li-05

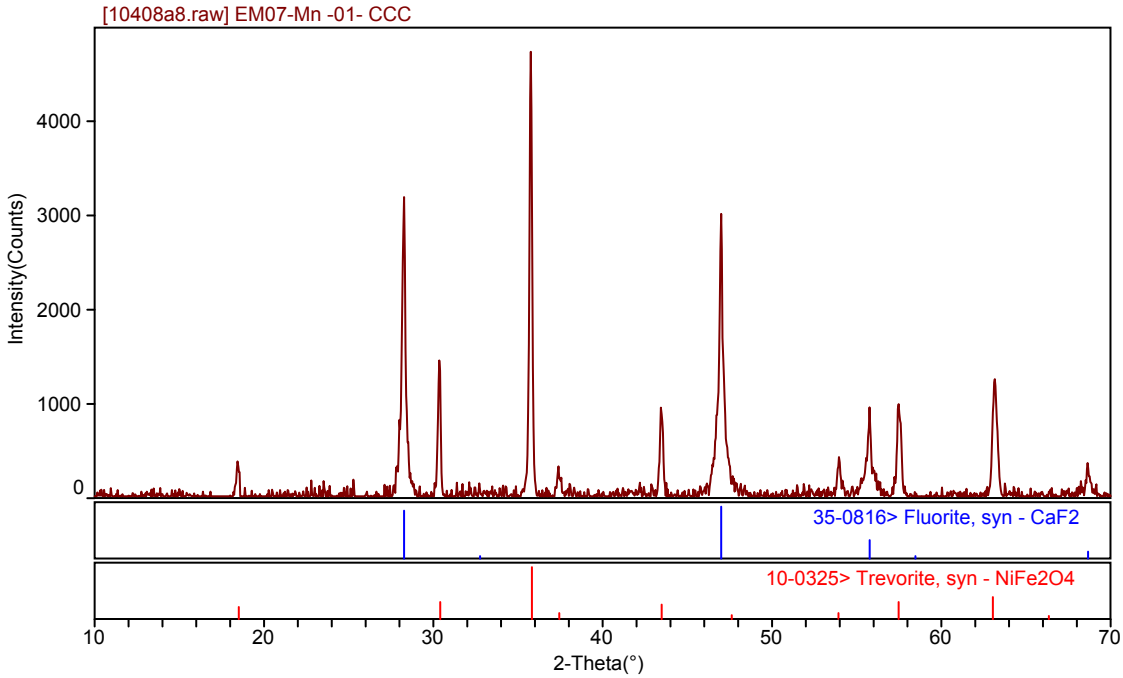

Figure B.30. XRD Spectrum of CCC Treated EM07-Mn-01

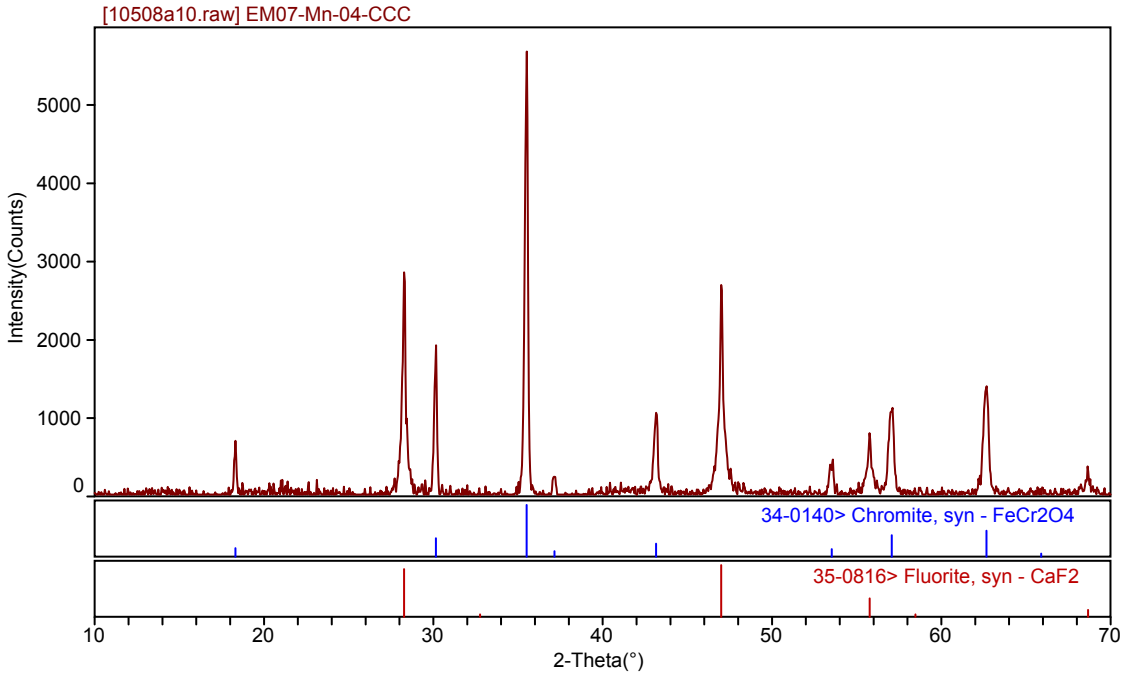

Figure B.31. XRD Spectrum of CCC Treated EM07-Mn-04

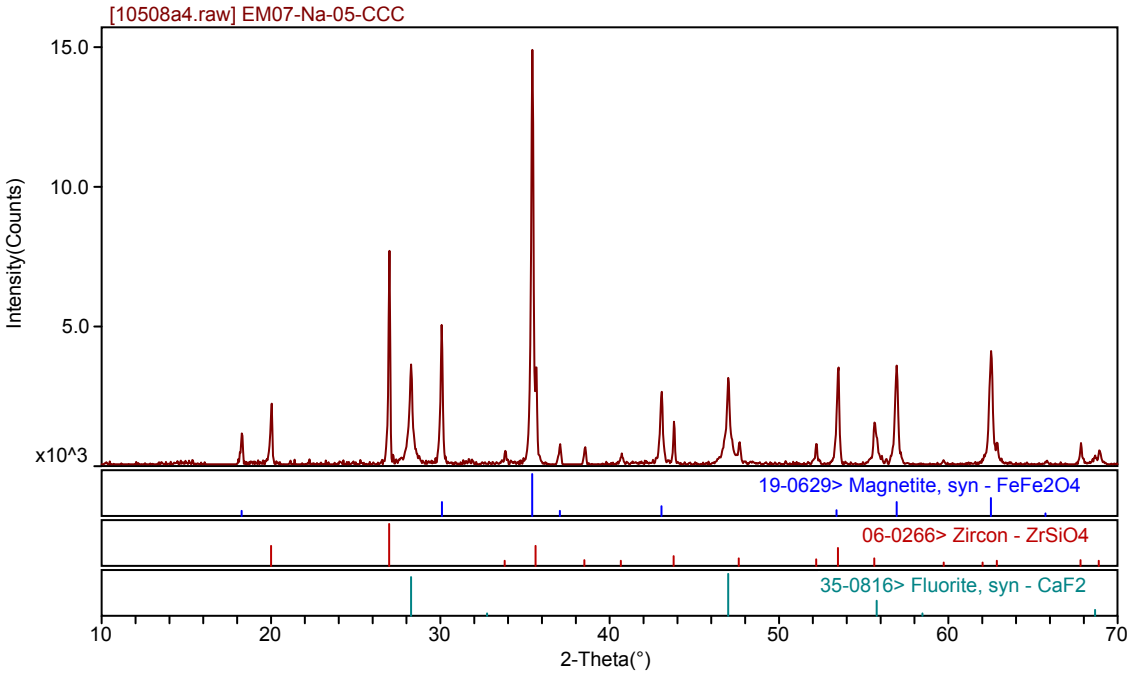

Figure B.32. XRD Spectrum of CCC Treated EM07-Na-05

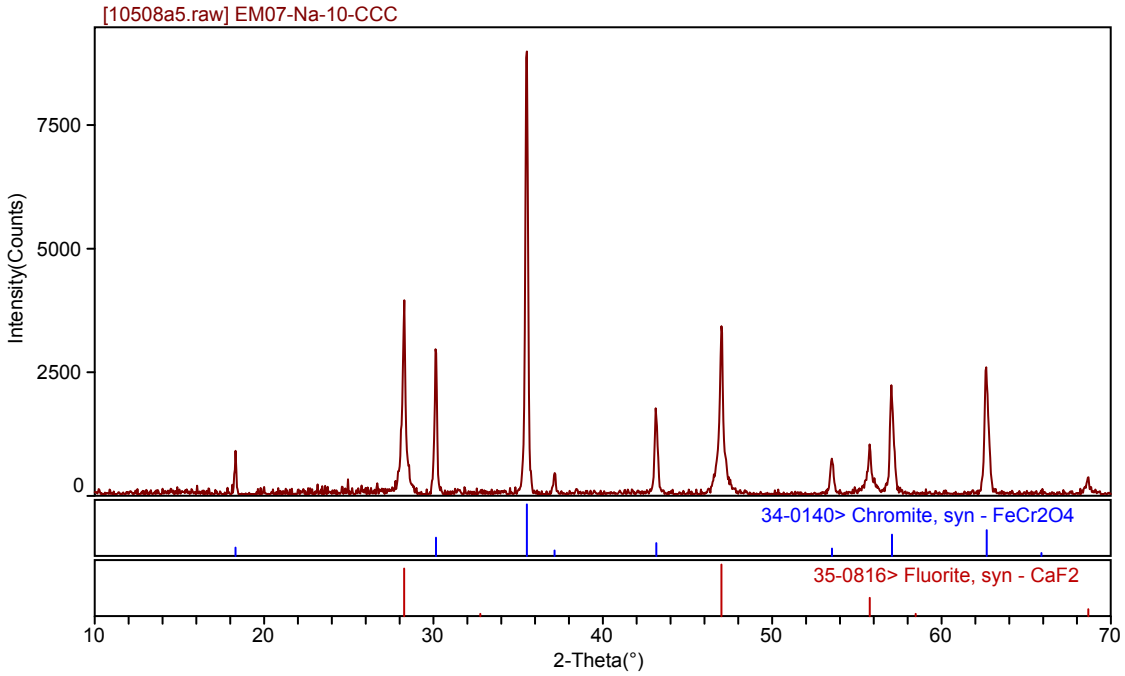

Figure B.33. XRD Spectrum of CCC Treated EM07-Na-10

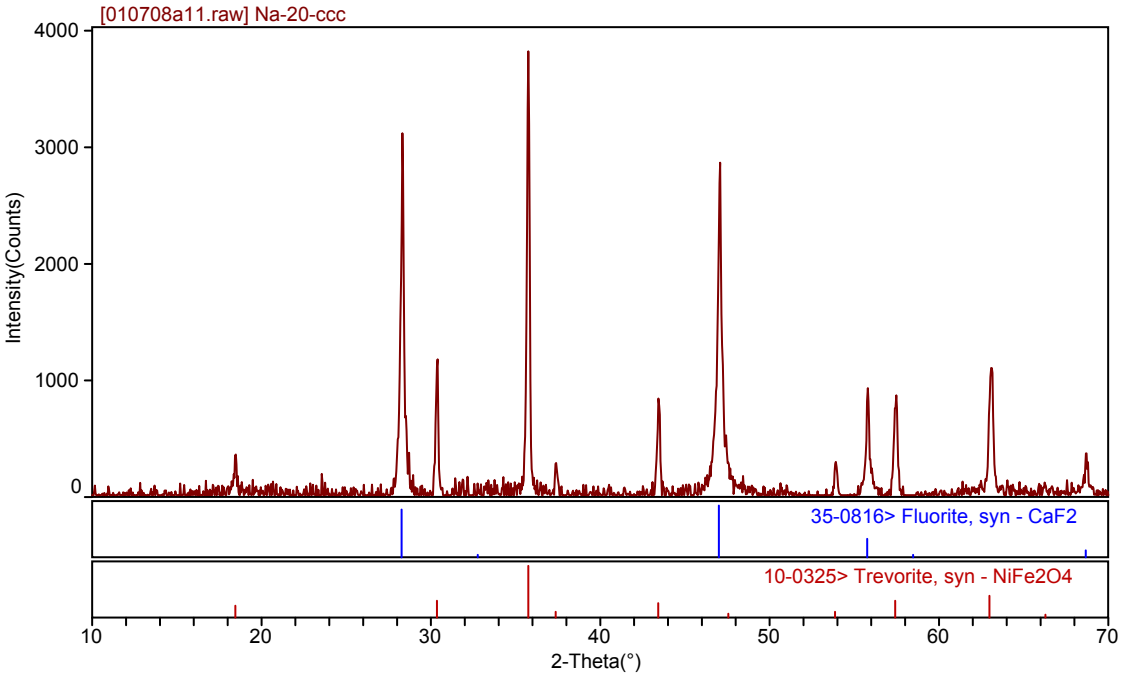

Figure B.34. XRD Spectrum of CCC Treated EM07-Na-20

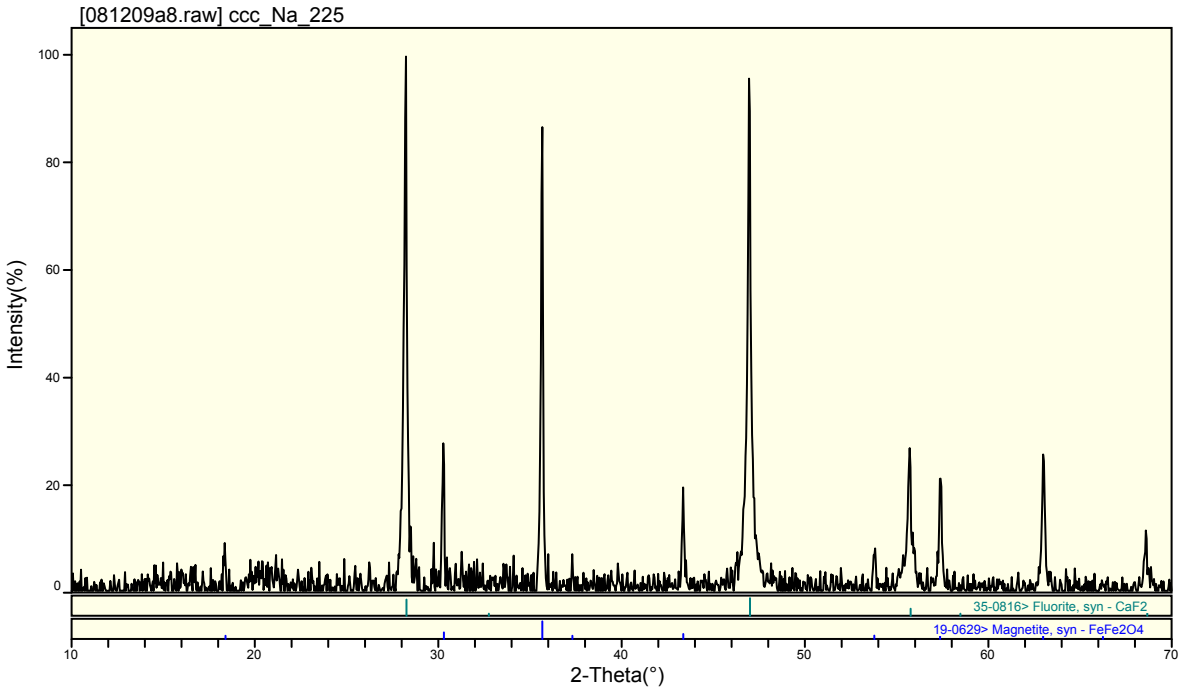

Figure B.35. XRD Spectrum of CCC Treated EM07-Na-225

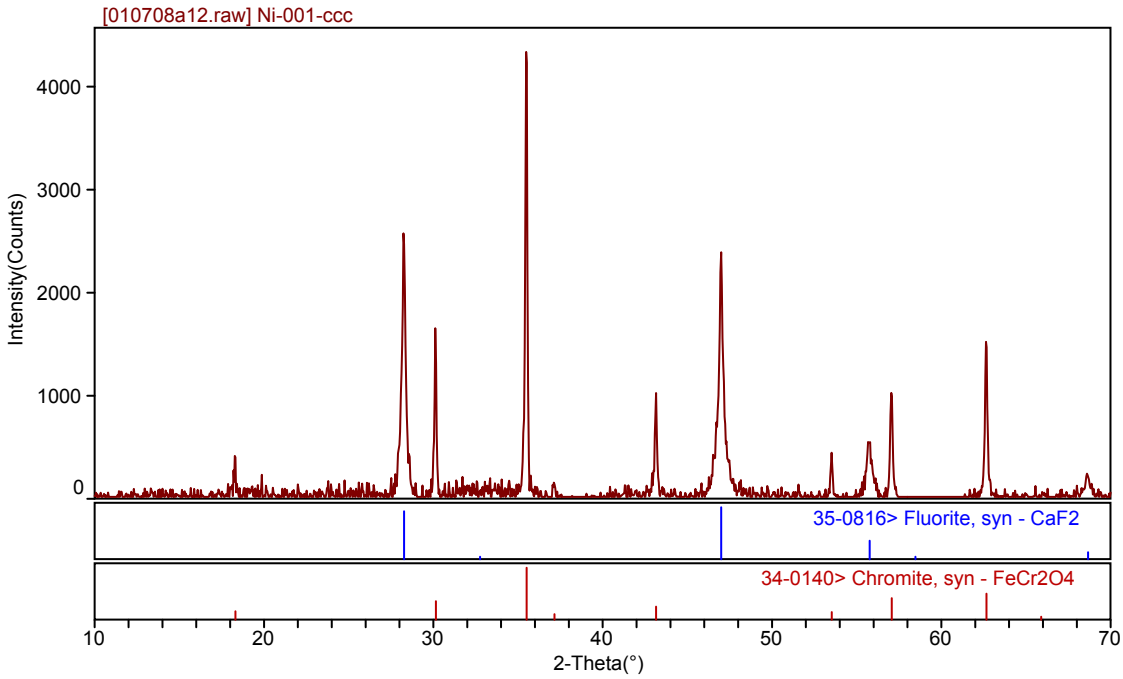

Figure B.36. XRD Spectrum of CCC Treated EM07-Ni-001

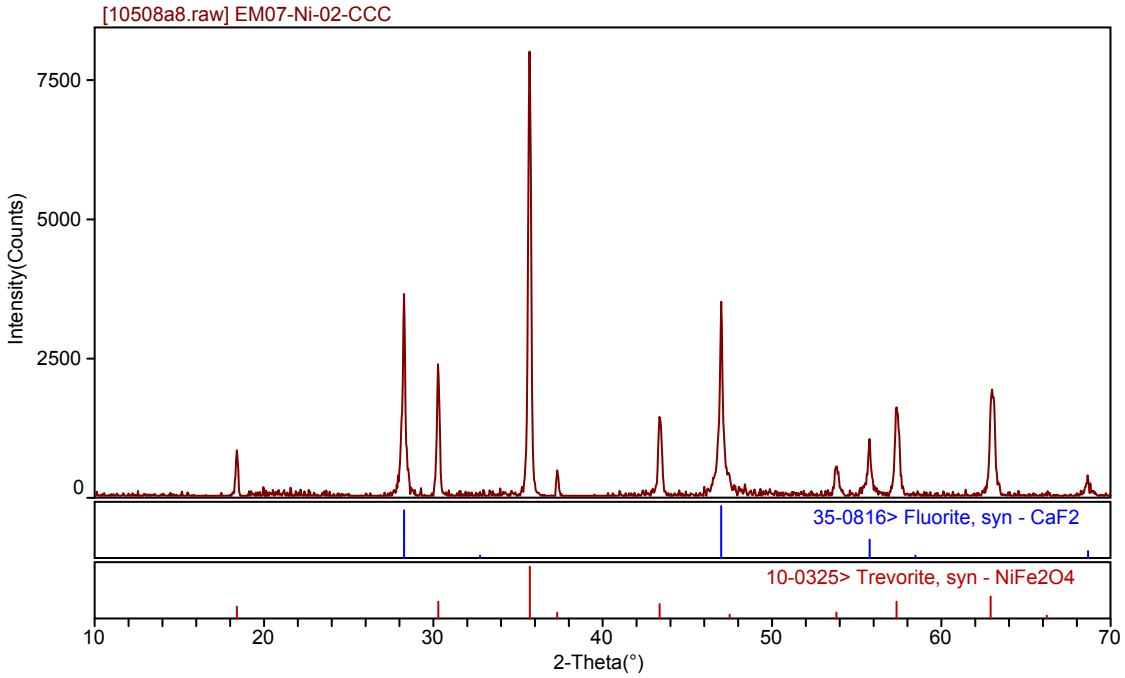

Figure B.37. XRD Spectrum of CCC Treated EM07-Ni-02

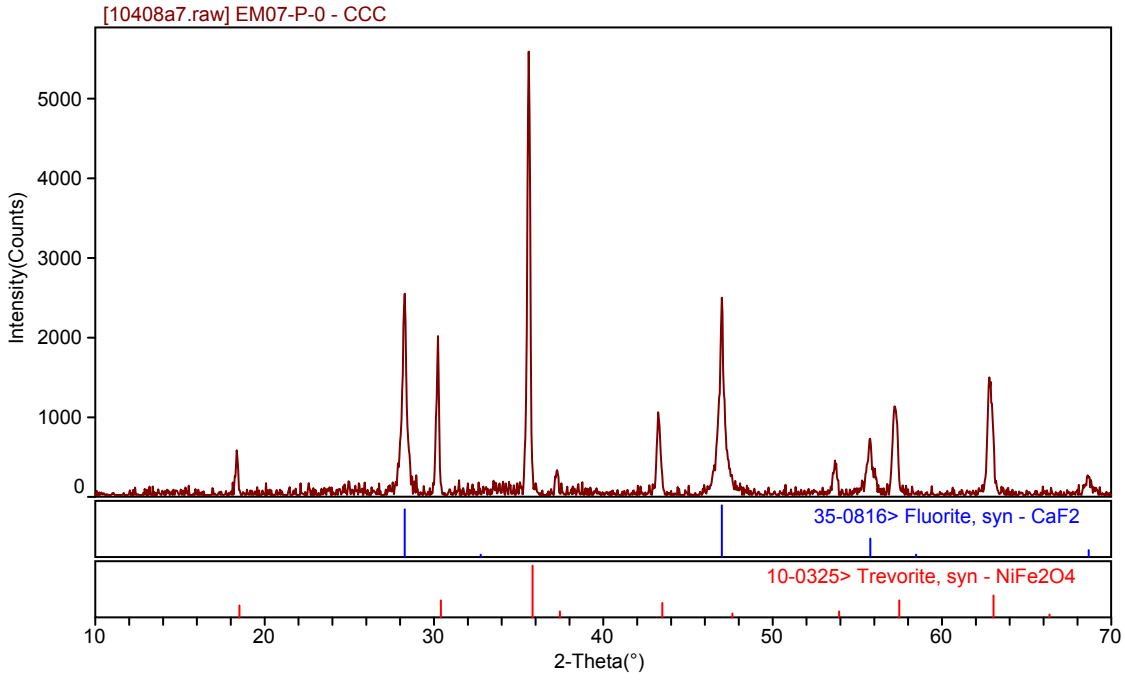

Figure B.38. XRD Spectrum of CCC Treated EM07-P-0

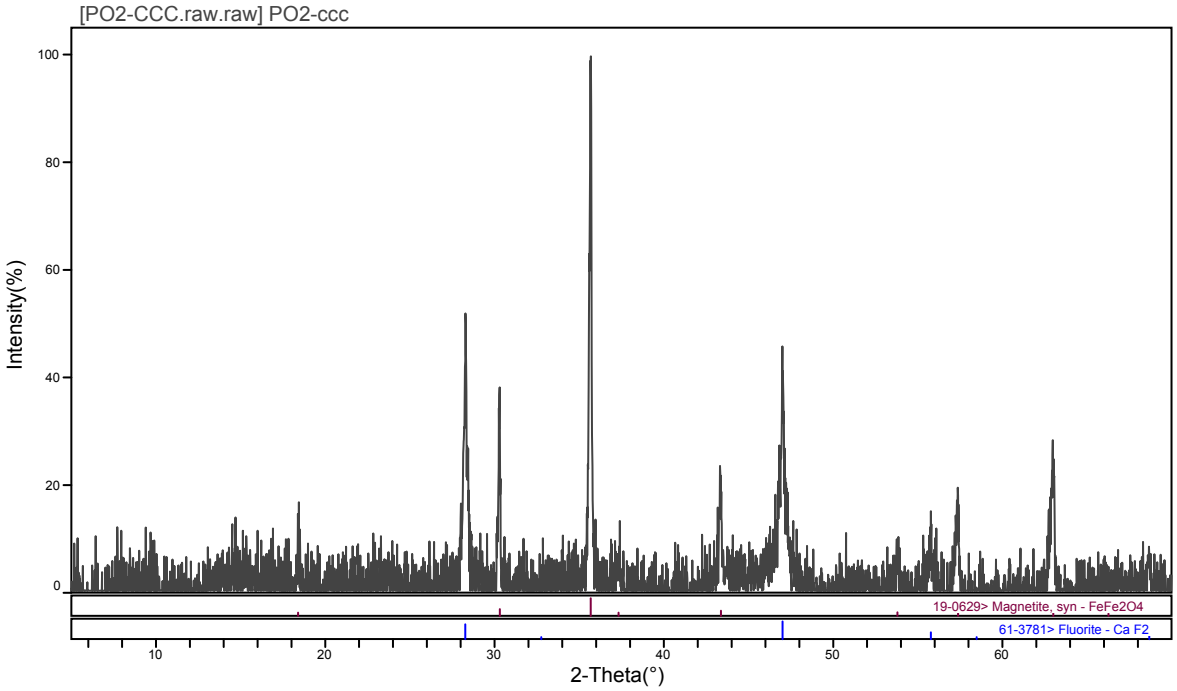

Figure B.39. XRD Spectrum of CCC Treated EM07-P-02

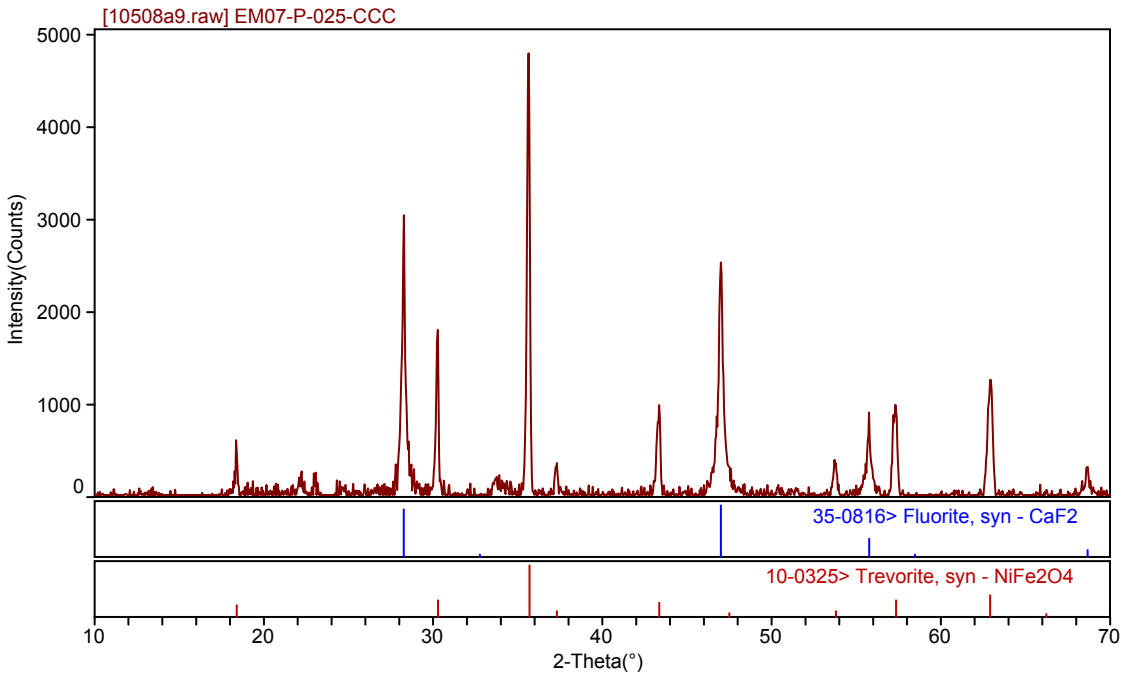

Figure B.40. XRD Spectrum of CCC Treated EM07-P-025

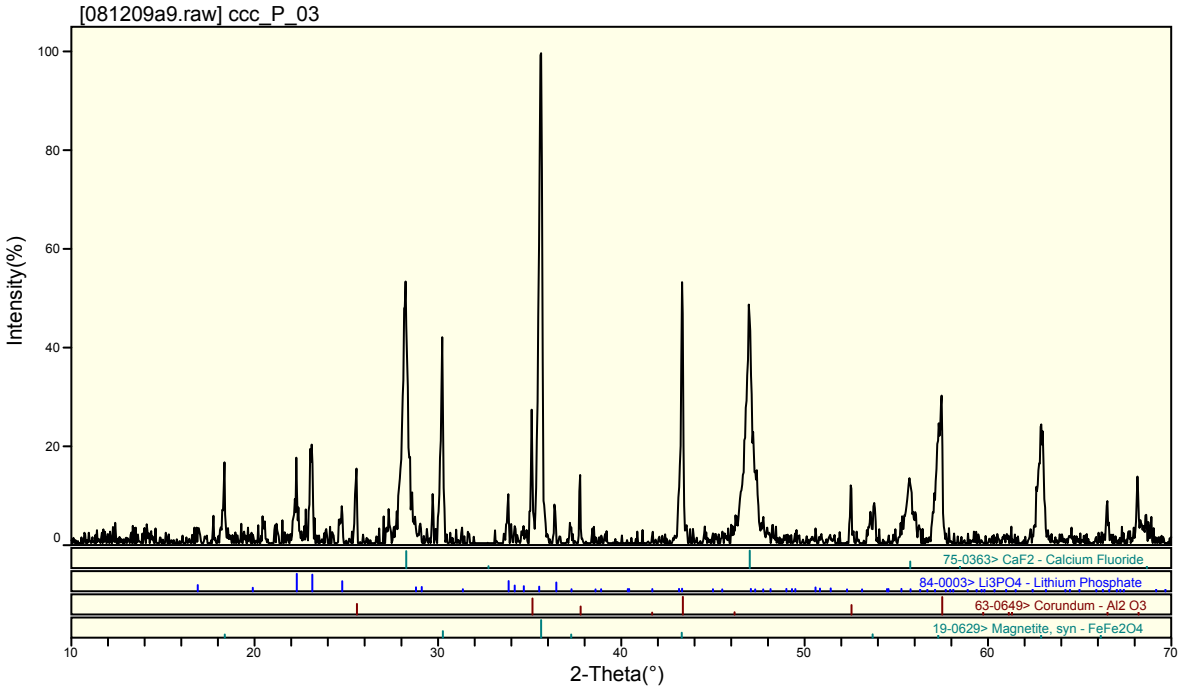

Figure B.41. XRD Spectrum of CCC Treated EM07-P-03

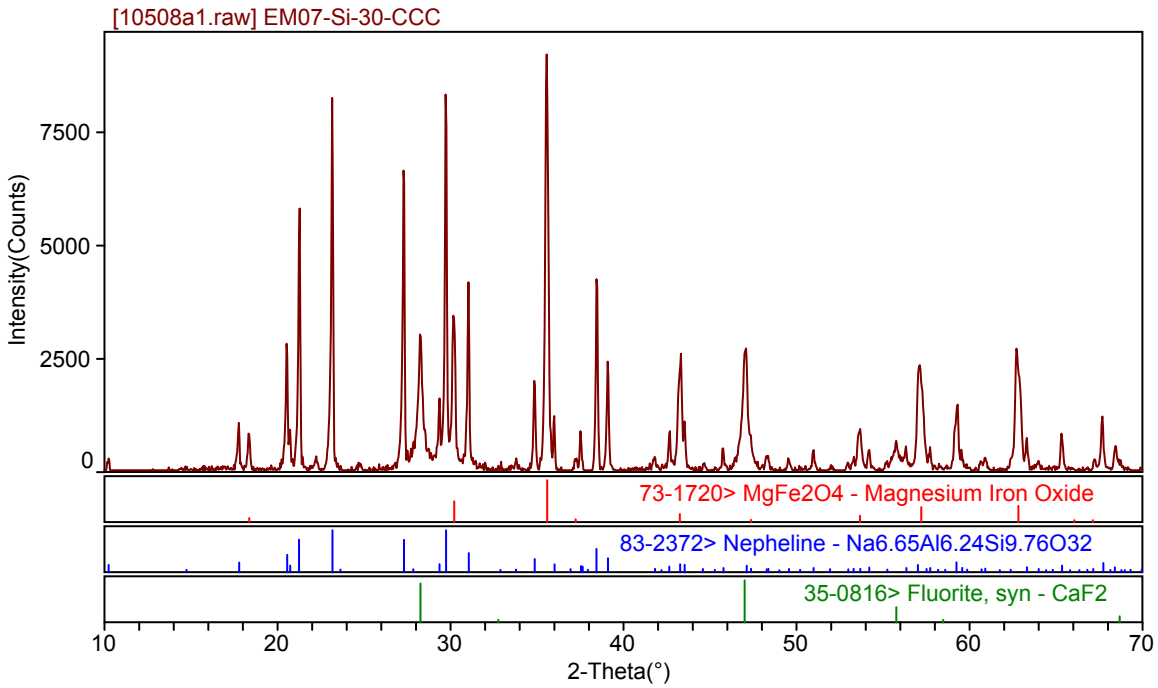

Figure B.42. XRD Spectrum of CCC Treated EM07-Si-30

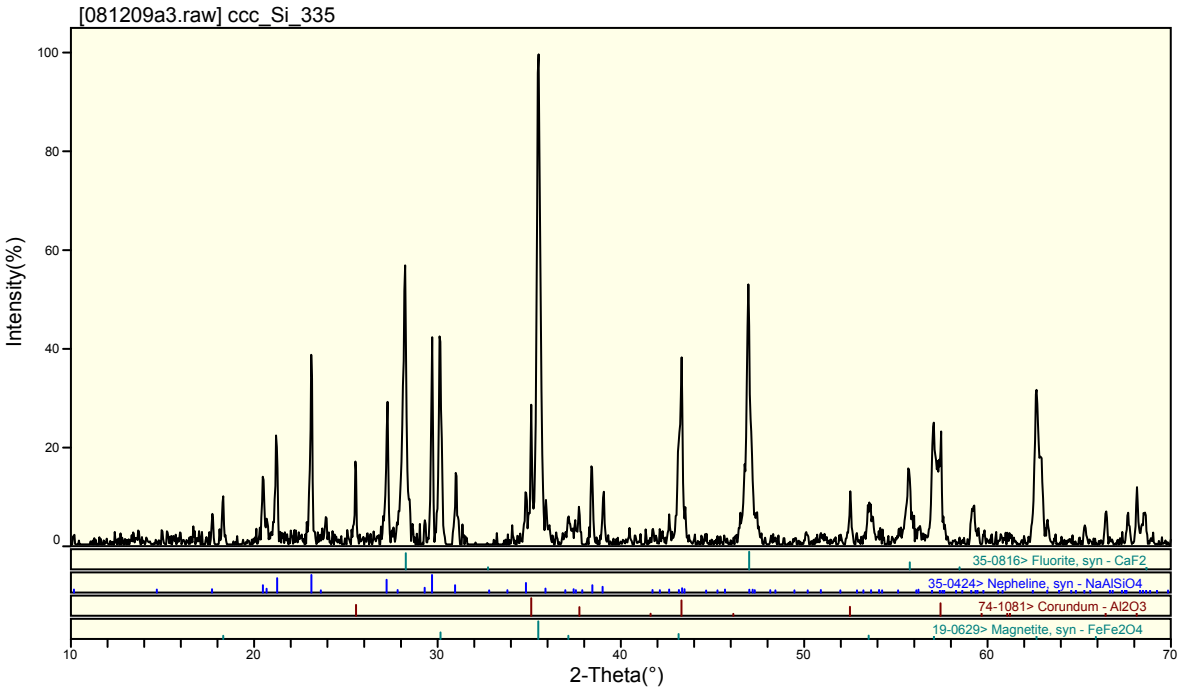

Figure B.43. XRD Spectrum of CCC Treated EM07-Si-335

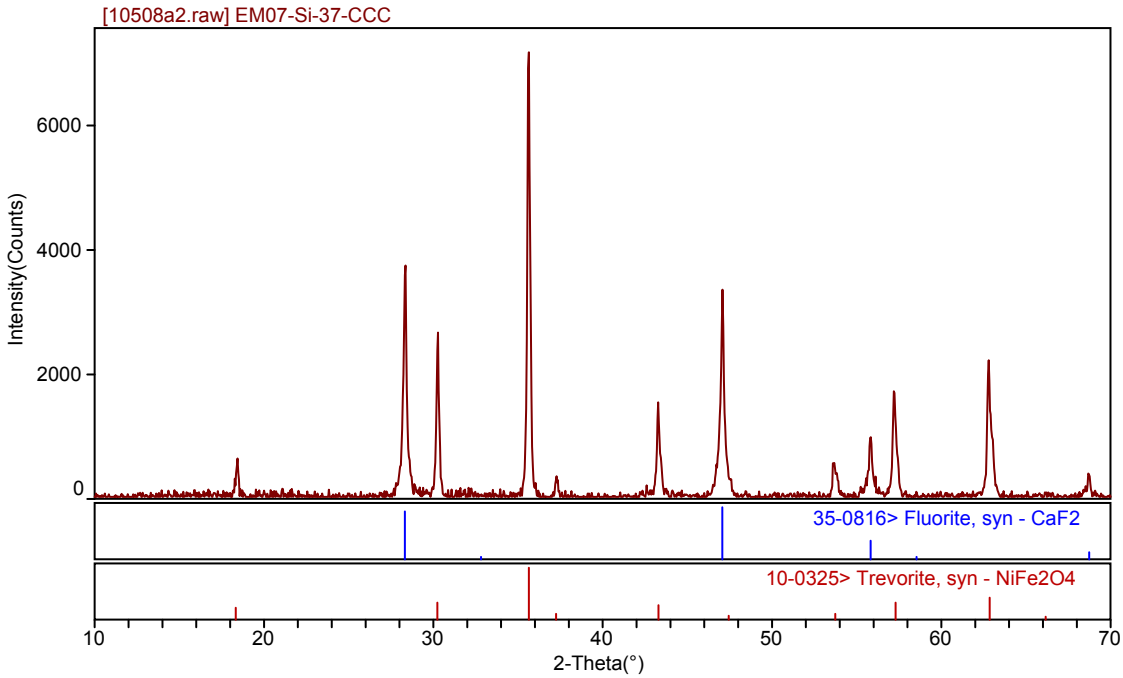

Figure B.44. XRD Spectrum of CCC Treated EM07-Si-37

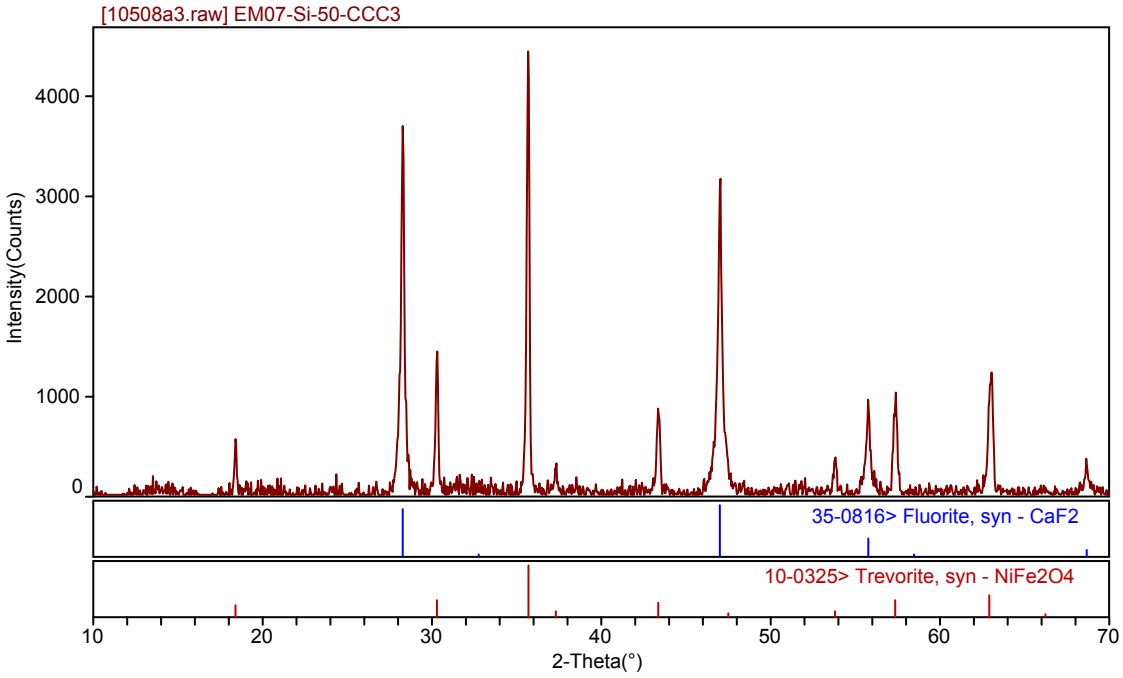

Figure B.45. XRD Spectrum of CCC Treated EM07-Si-50

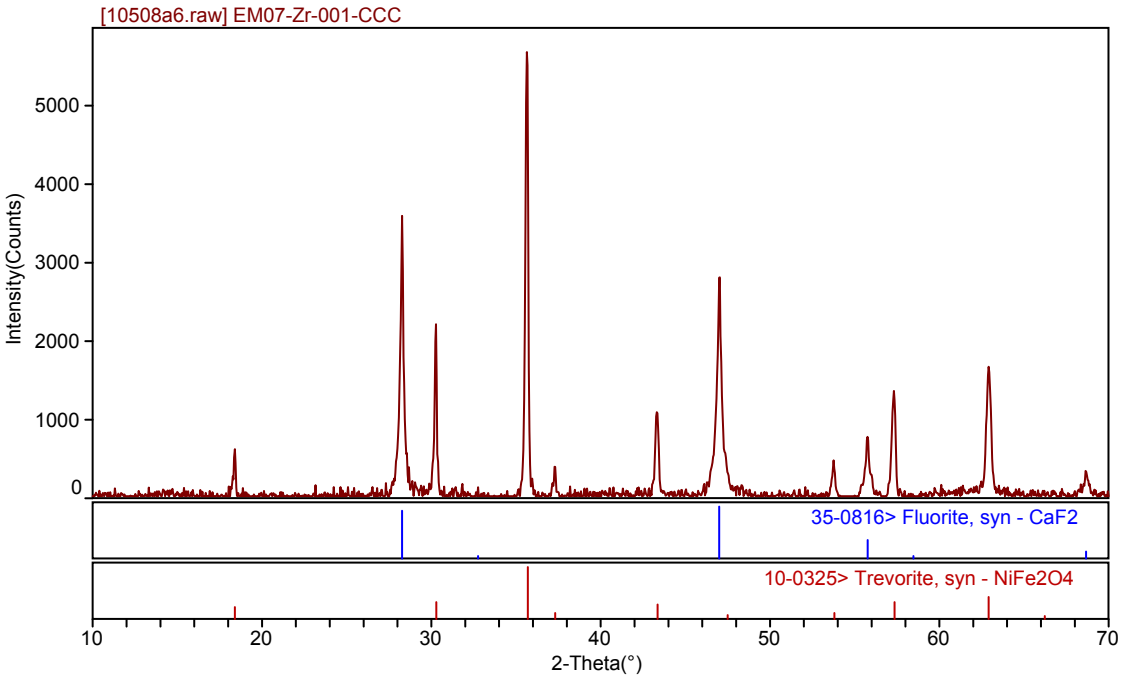

Figure B.46. XRD Spectrum of CCC Treated EM07-Zr-001

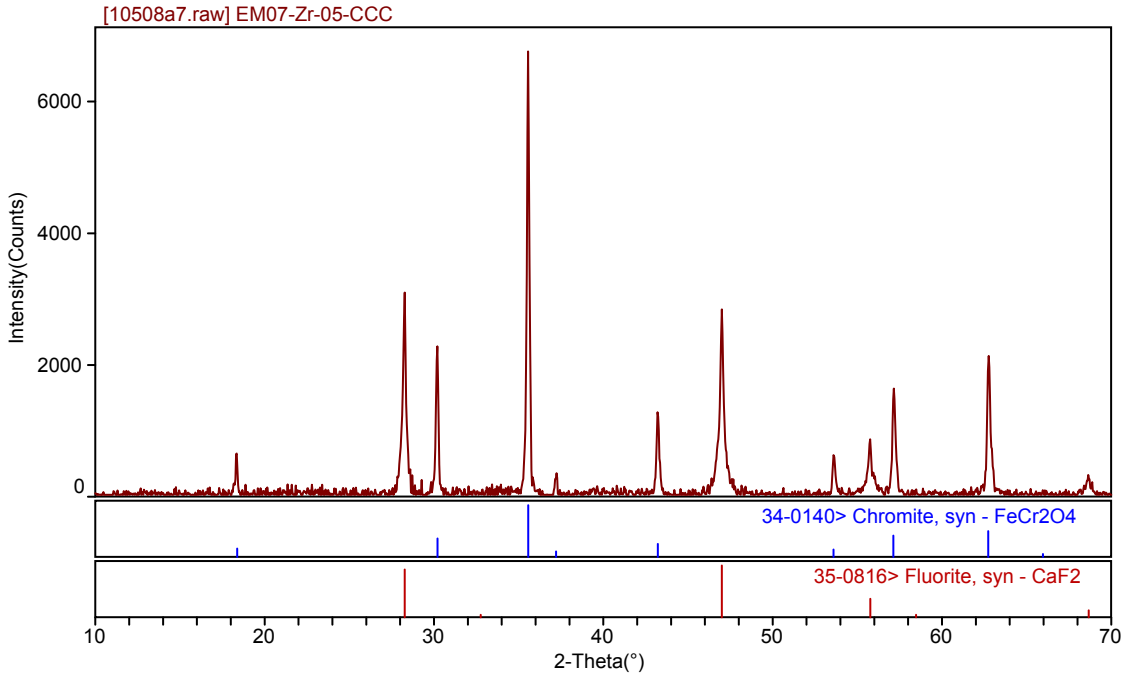

Figure B.47. XRD Spectrum of CCC Treated EM07-Zr-05

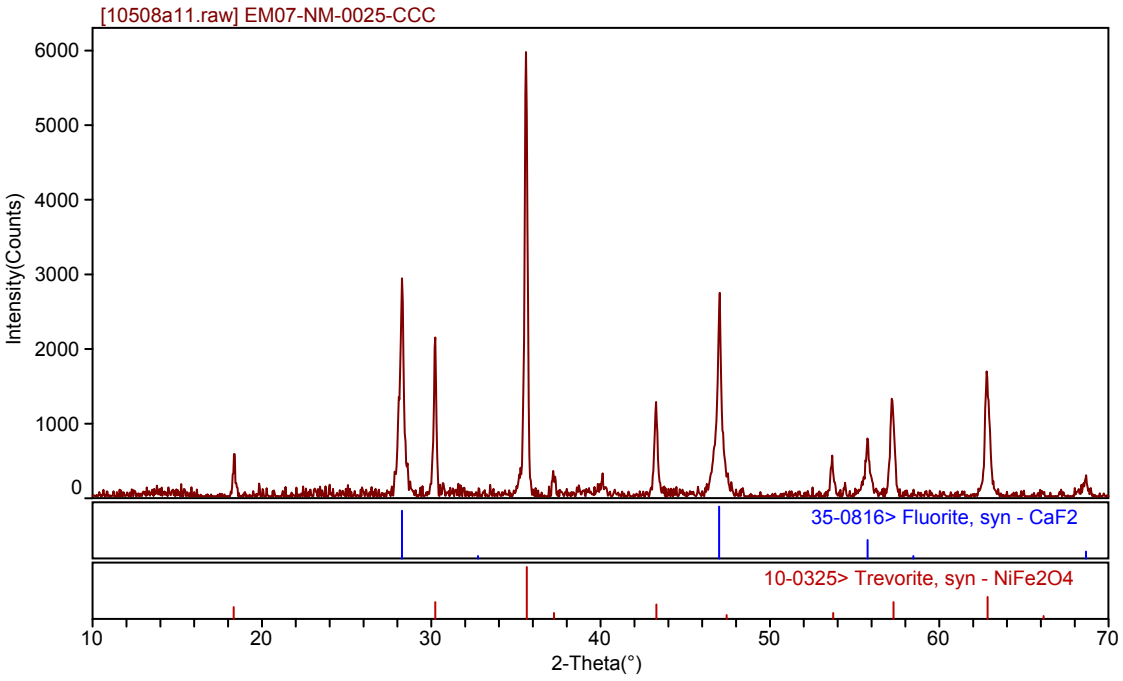

Figure B.48. XRD Spectrum of CCC Treated EM07-NM-0025

* * QUANTITATIVE PHASE ANALYSIS:

Title: EM07-Al-225-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	20.1	(1.1)	369
2: Magnetite	25.0	(0.6)	253
3: Sodium potassium calcium alumini	54.9	(1.6)	344

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=4.01, K*RHO(M)/U(M): 2690.92

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	369
2: Magnetite	6.2	(6.6)	253
3: Sodium potassium calcium alumini	13.7	(14.4)	344
Total weight %:	24.9	(21.0)	

Title: EM07-B-125-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	54.9	(1.6)	401
2: Magnetite	45.1	(0.8)	296

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=10.99, K*RHO(M)/U(M): 2256.56

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	401
2: Magnetite	4.1	(4.3)	296
Total weight %:	9.1	(4.3)	

Title: EM07-B-175-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	57.6	(2.0)	352
2: Magnetite	42.4	(0.9)	233

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=11.53, K*RHO(M)/U(M): 2916.04

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	352
2: Magnetite	3.7	(3.9)	233
Total weight %:	8.7	(3.9)	

Title: EM07-Bi-05-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	55.8	(1.6)	238
2: Chromite	44.2	(0.8)	279

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=11.16, K*RHO(M)/U(M): 4011.71

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	238
2: Chromite	4.0	(4.2)	279
Total weight %:	9.0	(4.2)	

Title: EM07-Ca-07-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	64.8	(1.4)	198
2: Nickel diiron(III) oxide	35.2	(0.7)	320

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=12.96, K*RHO(M)/U(M): 3597.38

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	198
2: Nickel diiron(III) oxide	2.7	(2.9)	320
Total weight %:	7.7	(2.9)	

Title: EM07-Cr-0145-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	58.9	(1.7)	388
2: Magnetite	41.1	(0.8)	410

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=11.78, K*RHO(M)/U(M): 2732.78

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	388
2: Magnetite	3.5	(3.7)	410
Total weight %:	8.5	(3.7)	

Title: EM07-Fe-05-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	70.2	(1.1)	299
2: Chromite	29.8	(0.5)	424

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=14.04, K*RHO(M)/U(M): 4727.23

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	299
2: Chromite	2.1	(2.2)	424
Total weight %:	7.1	(2.2)	

Title: EM07-Fe-15-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	41.6	(0.8)	277
2: Chromite	58.4	(0.6)	565

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=8.32, K*RHO(M)/U(M): 3410.45

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	277
2: Chromite	7.0	(7.4)	565
Total weight %:	12.0	(7.4)	

Title: EM07-Fe-20-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	38.9	(1.5)	262
2: Chromite	61.1	(1.0)	631

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=7.77, K*RHO(M)/U(M): 4059.83

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	262
2: Chromite	7.9	(8.3)	631
Total weight %:	12.9	(8.3)	

Title: EM07-K-06-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.

Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	65.5	(1.7)	209
2: Magnetite	34.5	(0.9)	398

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase:1,wgt:5.00%,Wgt.Scale=13.11, K*RHO(M)/U(M): 4738.41

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	209
2: Magnetite	2.6	(2.8)	398
Total weight %:	7.6	(2.8)	

Title: EM07-Li-00-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	55.9	(1.3)	463
2: Magnetite	44.1	(0.7)	216

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=11.19, K*RHO(M)/U(M): 2124.97

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	463
2: Magnetite	3.9	(4.1)	216
Total weight %:	8.9	(4.1)	

Title: EM07-Li-05-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	57.0	(2.4)	369
2: Iron diiron(III) oxide	27.5	(0.7)	348
4: Aluminium oxide - $-alpha	15.5	(0.9)	787

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=11.40, K*RHO(M)/U(M): 3018.40

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	369
2: Iron diiron(III) oxide	2.4	(2.5)	348
4: Aluminium oxide - $-alpha	1.4	(1.4)	787
Total weight %:	8.8	(4.0)	

Title: EM07-Na-05-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	33.7	(1.2)	237
2: Magnetite	51.5	(0.8)	450
3: Zirconium silicate	14.8	(0.3)	467

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=6.75, K*RHO(M)/U(M): 5032.67

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	237
2: Magnetite	7.6	(8.0)	450
3: Zirconium silicate	2.2	(2.3)	467
Total weight %:	14.8	(10.3)	

Title: EM07-NM-0025-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	52.4	(1.5)	233
2: Magnetite	47.6	(0.9)	353

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=10.48, K*RHO(M)/U(M): 4446.20

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	233
2: Magnetite	4.5	(4.8)	353
Total weight %:	9.5	(4.8)	

Title: EM07-P-O2-CCC

Range: 9.99249 - 69.9915, Inc: 0.0297172, Time: 57.6, NPts: 2020.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	53.9	(2.2)	126
2: Magnetite	46.1	(1.5)	349

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=10.78, K*RHO(M)/U(M): 639.98

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	126
2: Magnetite	4.3	(4.5)	349
Total weight %:	9.3	(4.5)	

Title: EM07-P-03-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	35.8	(1.2)	191
2: Magnetite	25.3	(0.7)	264
4: Dialuminium trioxide	17.8	(1.2)	121
5: Lithium phosphate - $-gamma	21.1	(1.7)	3

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=7.15, K*RHO(M)/U(M): 2184.68

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	191
2: Magnetite	3.5	(3.7)	264
4: Dialuminium trioxide	2.5	(2.6)	121
5: Lithium phosphate - $-gamma	3.0	(3.1)	3
Total weight %:	14.0	(9.4)	

Title: EM07-Si-30-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	12.5	(0.4)	208
2: Sodium alumosilicate *	65.7	(0.9)	449
3: Diiron(III) magnesium oxide	21.9	(0.3)	302

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=2.50, K*RHO(M)/U(M): 3936.93

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	208
2: Sodium alumosilicate *	26.3	(27.7)	449
3: Diiron(III) magnesium oxide	8.8	(9.2)	302
Total weight %:	40.0	(36.9)	

Title: ccc Si 335

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	24.8	(0.8)	332
2: Iron diiron(III) oxide	25.6	(0.5)	367
3: Sodium potassium aluminium silic	35.5	(1.0)	190
4: Aluminium oxide - $-alpha	14.2	(0.5)	656

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=4.96, K*RHO(M)/U(M): 2337.98

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	332
2: Iron diiron(III) oxide	5.2	(5.4)	367
3: Sodium potassium aluminium silic	7.2	(7.5)	190
4: Aluminium oxide - $-alpha	2.9	(3.0)	656
Total weight %:	20.2	(16.0)	

Title: EM07-Si-37-CCC

Range: 10 - 70, Inc: 0.04, Time: 4, NPts: 1501.
Quantitative results based on all phases used in the refinement.
The sum of the weight fractions is normalized to 1.0

Phases	wt%	(ESD)	Size(A)
1: Fluorite(CaF2)	47.2	(1.4)	335
2: Nickel iron oxide (1.4/1.7/4)	52.8	(1.0)	303

Quantitative results scaled to the internal standard.
The values in () are calculated excluding the internal standard.
Internal Std Phase: 1, wgt: 5.00%, Wgt.Scale=9.43, K*RHO(M)/U(M): 4492.28

Phases	wt%	(No Std)	Size(A)
1: Fluorite(CaF2)	5.0	(0.0)	335
2: Nickel iron oxide (1.4/1.7/4)	5.6	(5.9)	303
Total weight %:	10.6	(5.9)	

Appendix C: Electrical Conductivity Data

C.1 EM07-BL-1 Electrical Conductivity Data

Table C.1. Electrical Conductivity Data for EM07-BL-1

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1181	45.20	0.00069	3.81
1181	45.89	0.00069	3.83
1082	33.04	0.00074	3.50
1082	33.08	0.00074	3.50
983	21.81	0.00080	3.08
983	21.86	0.00080	3.08
883	12.71	0.00086	2.54
883	12.73	0.00086	2.54

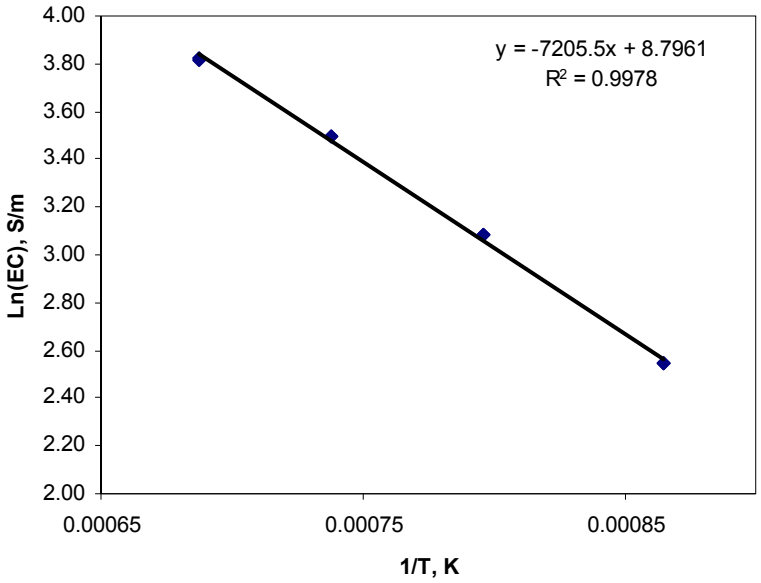

Figure C.1. Electrical Conductivity Trend for EM07-BL-1 over Inverse Temperature

C.2 EM07-BL-2 Electrical Conductivity Data

Table C.2. Electrical Conductivity Data for EM07-BL-2

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	45.45	0.00069	3.82
1180	45.47	0.00069	3.82
1081	33.44	0.00074	3.51
1081	33.45	0.00074	3.51
983	22.53	0.00080	3.11
983	22.57	0.00080	3.12
882	13.29	0.00087	2.59
882	13.35	0.00087	2.59

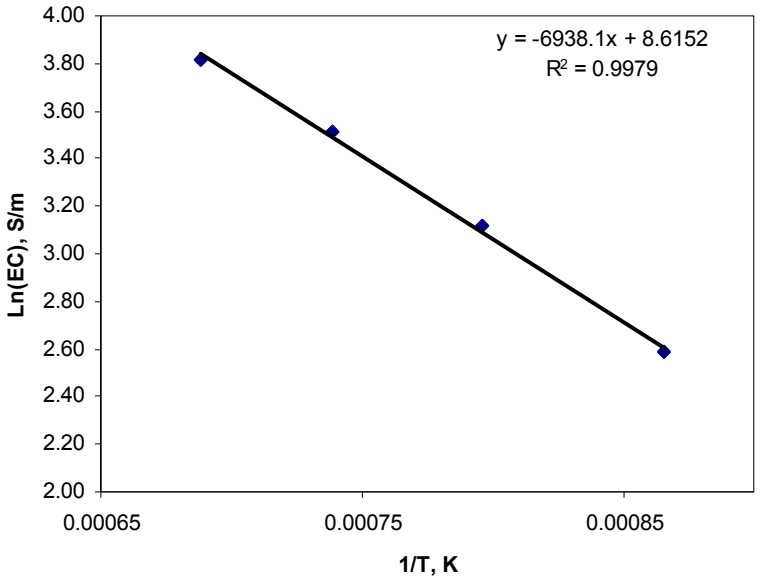

Figure C.2. Electrical Conductivity Trend for EM07-BL-2 over Inverse Temperature

C.3 EM07-Al-06 Electrical Conductivity Data

Table C.3. Electrical Conductivity Data for EM07-Al-06

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	54.47	0.00069	4.00
1180	54.53	0.00069	4.00
1081	40.66	0.00074	3.71
1081	40.68	0.00074	3.71
983	27.51	0.00080	3.31
983	27.54	0.00080	3.32
882	16.21	0.00087	2.79
882	16.27	0.00087	2.79

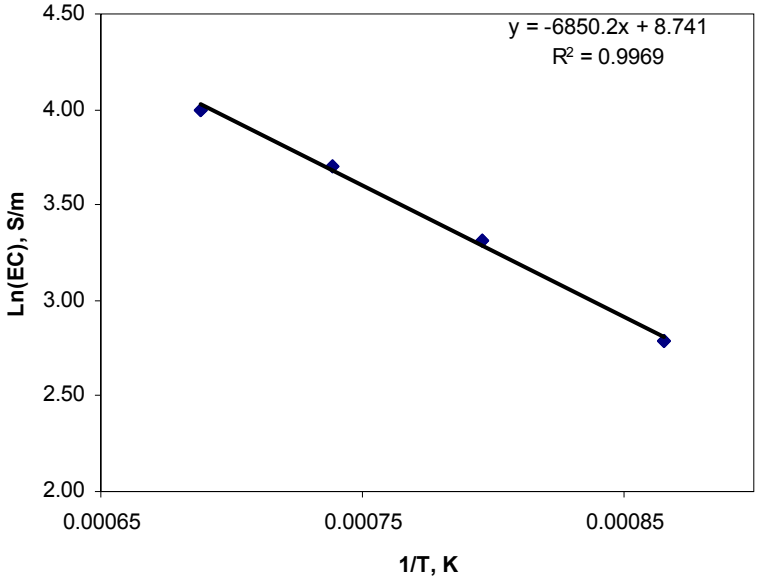

Figure C.3. Electrical Conductivity Trend for EM07-Al-06 over Inverse Temperature

C.4 EM07-Al-15 Electrical Conductivity Data

Table C.4. Electrical Conductivity Data for EM07-Al-15

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	36.92	0.00069	3.61
1180	36.92	0.00069	3.61
1081	25.36	0.00074	3.23
1081	25.80	0.00074	3.25
988	17.74	0.00079	2.88
988	17.82	0.00079	2.88
882	9.91	0.00087	2.29
882	9.93	0.00087	2.30

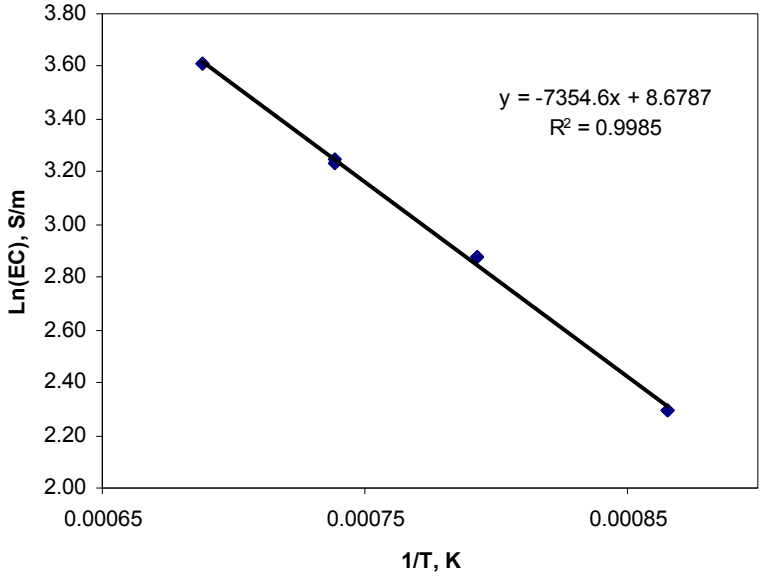

Figure C.4. Electrical Conductivity Trend for EM07-Al-15 over Inverse Temperature

C.5 EM07-Al-20 Electrical Conductivity Data

Table C.5. Electrical Conductivity Data for EM07-Al-20

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1184	41.95	0.00069	3.74
1184	41.97	0.00069	3.74
1085	30.00	0.00074	3.40
1085	30.06	0.00074	3.40
986	19.85	0.00079	2.99
986	19.86	0.00079	2.99
887	11.56	0.00086	2.45
887	11.59	0.00086	2.45

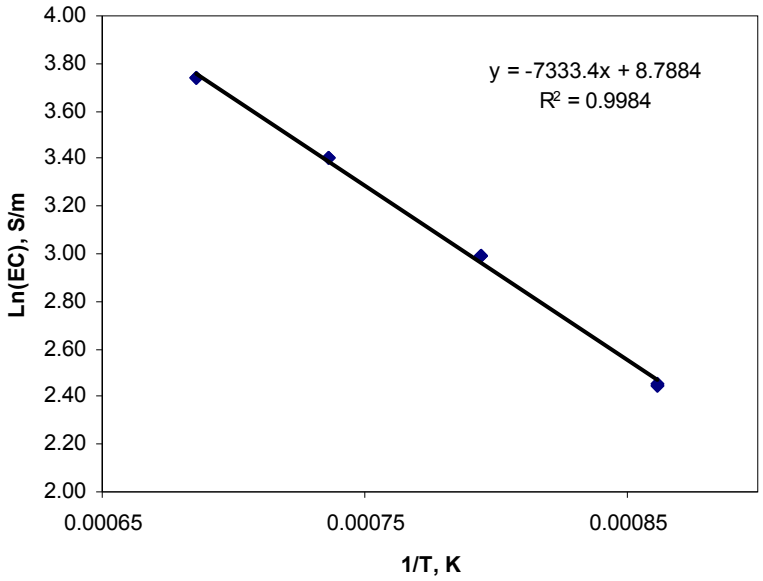

Figure C.5. Electrical Conductivity Trend for EM07-Al-20 over Inverse Temperature

C.6 EM07-B-05 Electrical Conductivity Data

Table C.6. Electrical Conductivity Data for EM07-B-05

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1186	43.75	0.00069	3.78
1186	43.51	0.00069	3.77
1088	31.38	0.00073	3.45
1088	31.40	0.00073	3.45
990	21.06	0.00079	3.05
990	21.08	0.00079	3.05
891	12.61	0.00086	2.53
891	12.65	0.00086	2.54

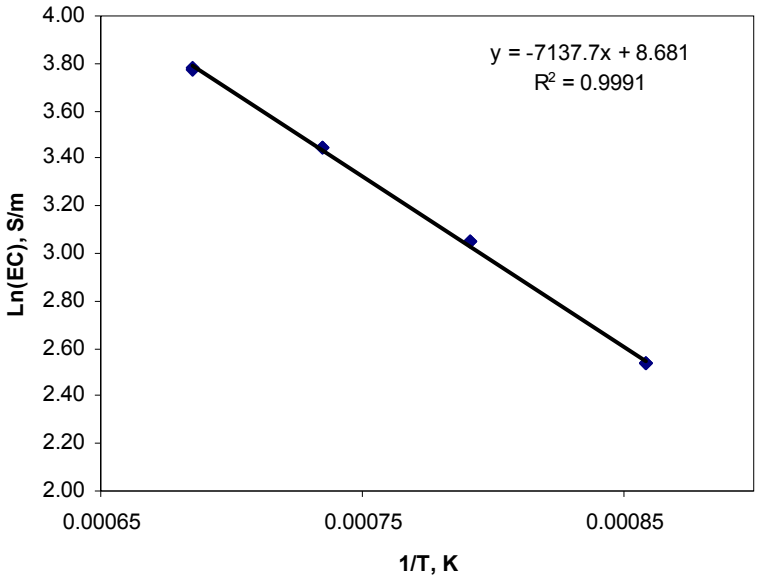

Figure C.6. Electrical Conductivity Trend for EM07-B-05 over Inverse Temperature

C.7 EM07-B-15 Electrical Conductivity Data

Table C.7. Electrical Conductivity Data for EM07-B-15

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	42.30	0.00069	3.74
1180	42.43	0.00069	3.75
1081	31.02	0.00074	3.43
1081	31.05	0.00074	3.44
983	20.63	0.00080	3.03
983	20.67	0.00080	3.03
882	11.86	0.00087	2.47
882	11.92	0.00087	2.48

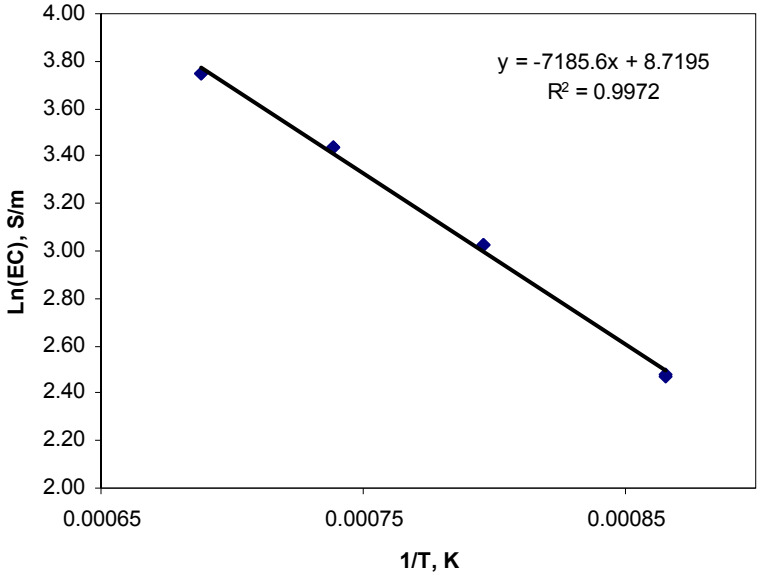

Figure C.8. Electrical Conductivity Trend for EM07-B-15 over Inverse Temperature

C.8 EM07-B-20 Electrical Conductivity Data

Table C.8. Electrical Conductivity Data for EM07-B-20

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	33.00	0.00069	3.50
1180	32.84	0.00069	3.49
1081	22.51	0.00074	3.11
1081	22.59	0.00074	3.12
983	14.37	0.00080	2.67
983	14.50	0.00080	2.67
882	8.01	0.00087	2.08
882	8.06	0.00087	2.09

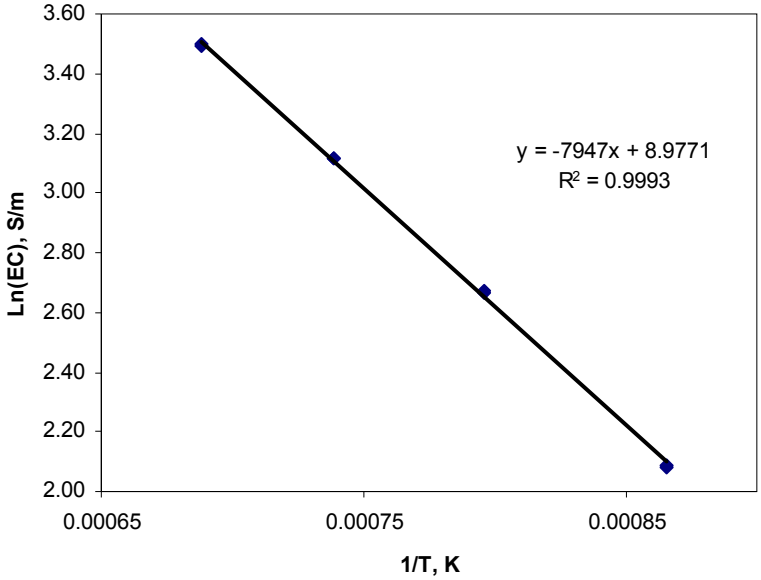

Figure C.8. Electrical Conductivity Trend for EM07-B-20 over Inverse Temperature

C.9 EM07-Bi-025 Rebatch Electrical Conductivity Data

Table C.9. Electrical Conductivity Data for EM07-Bi-025

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	43.10	0.00069	3.76
1180	43.10	0.00069	3.76
1081	31.77	0.00074	3.46
1081	32.00	0.00074	3.47
983	21.67	0.00080	3.08
983	21.74	0.00080	3.08
882	12.84	0.00087	2.55
882	12.88	0.00087	2.56

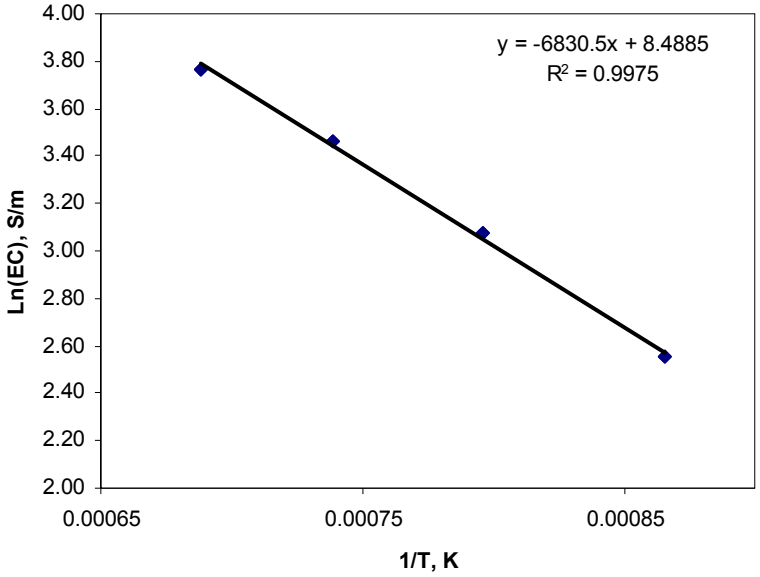

Figure C.9. Electrical Conductivity Trend for EM07-Bi-025 over Inverse Temperature

C.10 EM07-Bi-05 Rebatch Electrical Conductivity Data

Table C.10. Electrical Conductivity Data for EM07-Bi-05

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	44.18	0.00069	3.79
1180	44.26	0.00069	3.79
1081	32.63	0.00074	3.49
1081	32.64	0.00074	3.49
983	22.02	0.00080	3.09
983	22.05	0.00080	3.09
882	12.99	0.00087	2.56
882	13.04	0.00087	2.57

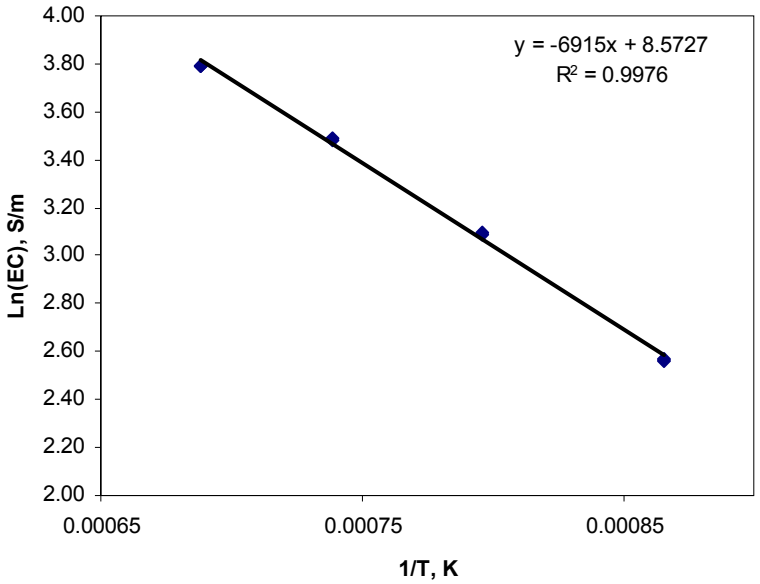

Figure C.10. Electrical Conductivity Trend for EM07-Bi-05 over Inverse Temperature

C.11 EM07-Ca-035 Electrical Conductivity Data

Table C.11. Electrical Conductivity Data for EM07-Ca-035

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	41.55	0.00069	3.73
1180	41.56	0.00069	3.73
1081	29.65	0.00074	3.39
1081	29.66	0.00074	3.39
983	19.17	0.00080	2.95
983	19.20	0.00080	2.95
882	10.69	0.00087	2.37
882	10.74	0.00087	2.37

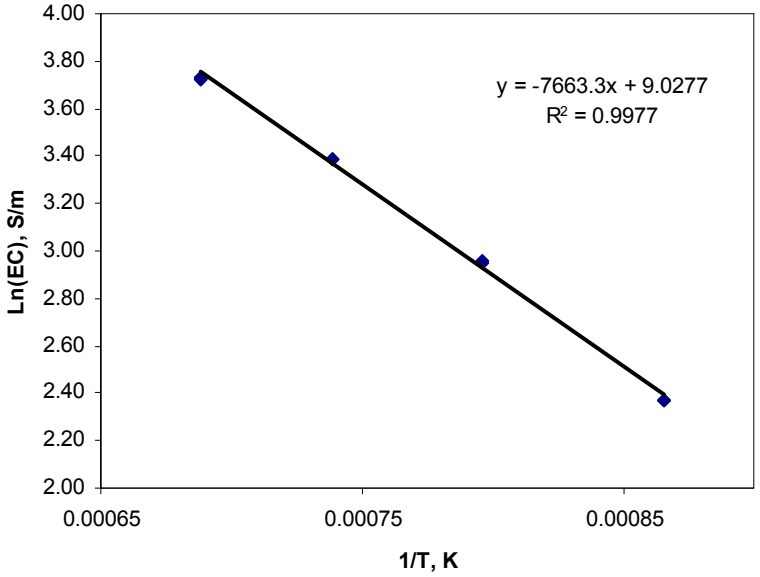

Figure C.11. Electrical Conductivity Trend for EM07-Ca-035 over Inverse Temperature

C.12 EM07-Ca-07 Electrical Conductivity Data

Table C.12. Electrical Conductivity Data for EM07-Ca-07

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1184	37.66	0.00069	3.63
1184	37.69	0.00069	3.63
1085	25.49	0.00074	3.24
1085	25.51	0.00074	3.24
987	15.59	0.00079	2.75
987	15.62	0.00079	2.75
885	7.93	0.00086	2.07
885	7.98	0.00086	2.08

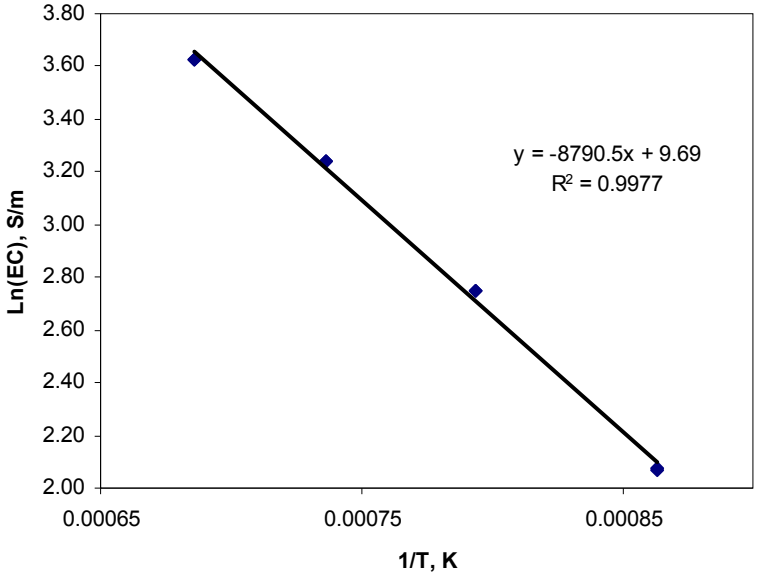

Figure C.12. Electrical Conductivity Trend for EM07-Ca-07 over Inverse Temperature

C.13 EM07-Cr-001 Electrical Conductivity Data

Table C.13. Electrical Conductivity Data for EM07-Cr-001

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1182	48.02	0.00069	3.87
1182	47.99	0.00069	3.87
1073	33.63	0.00074	3.52
1073	33.70	0.00074	3.52
974	22.07	0.00080	3.09
974	22.11	0.00080	3.10
871	12.78	0.00087	2.55
871	12.80	0.00087	2.55

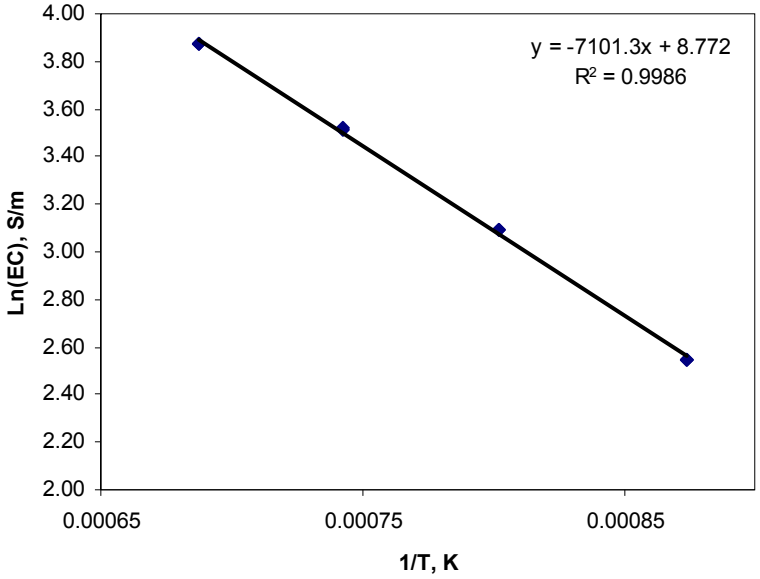

Figure C.13. Electrical Conductivity Trend for EM07-Cr-001 over Inverse Temperature

C.14 EM07-Cr-012 Electrical Conductivity Data

Table C.14. Electrical Conductivity Data for EM07-Cr-012

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	42.03	0.00069	3.74
1180	42.03	0.00069	3.74
1081	30.80	0.00074	3.43
1081	30.81	0.00074	3.43
983	20.74	0.00080	3.03
983	20.77	0.00080	3.03
882	12.24	0.00087	2.50
882	12.28	0.00087	2.51

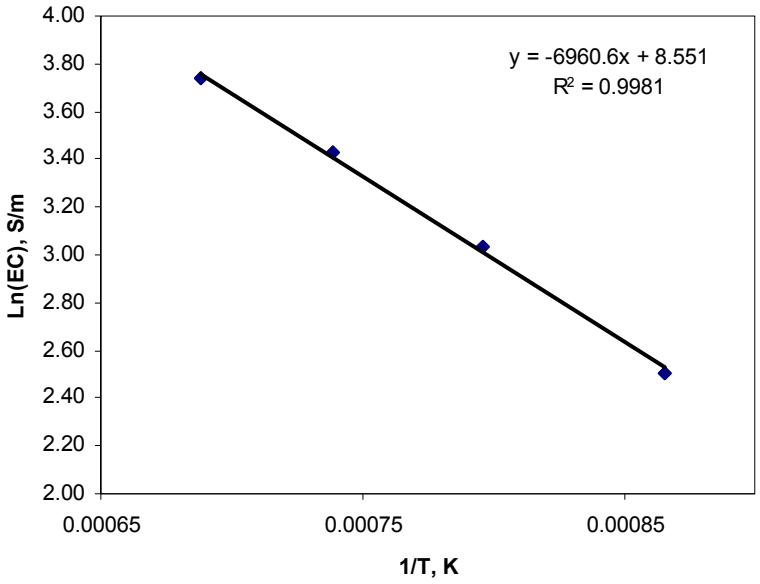

Figure C.14. Electrical Conductivity Trend for EM07-Cr-012 over Inverse Temperature

C.15 EM07-Cr-02 Electrical Conductivity Data

Table C.15. Electrical Conductivity Data for EM07-Cr-02

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1183	41.87	0.00069	3.73
1183	42.22	0.00069	3.74
1083	30.60	0.00074	3.42
1083	30.65	0.00074	3.42
983	20.36	0.00080	3.01
983	20.38	0.00080	3.01
885	11.92	0.00086	2.48
885	11.94	0.00086	2.48

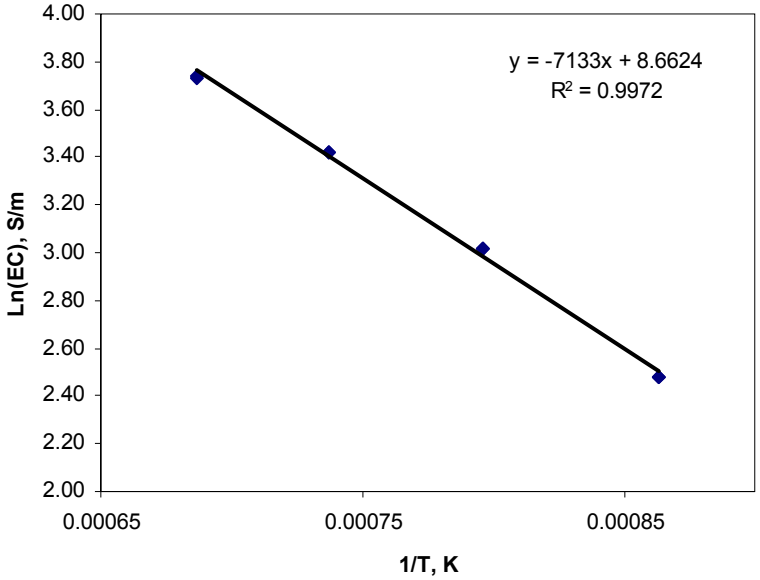

Figure C.15. Electrical Conductivity Trend for EM07-Cr-02 over Inverse Temperature

C.16 EM07-F-02 Electrical Conductivity Data

Table C.16. Electrical Conductivity Data for EM07-F-02

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	57.00	0.00069	4.04
1180	56.99	0.00069	4.04
1081	43.57	0.00074	3.77
1081	43.62	0.00074	3.78
983	30.71	0.00080	3.42
983	30.77	0.00080	3.43
882	19.18	0.00087	2.95
882	19.24	0.00087	2.96

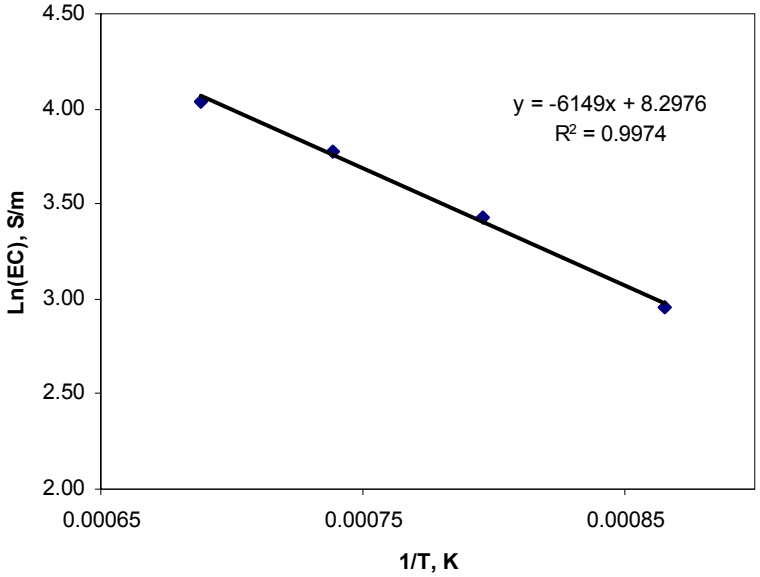

Figure C.16. Electrical Conductivity Trend for EM07-F-02 over Inverse Temperature

C.17 EM07-Fe-05 Electrical Conductivity Data

Table C.17. Electrical Conductivity Data for EM07-Fe-05

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	40.97	0.00069	3.71
1180	40.93	0.00069	3.71
1081	30.15	0.00074	3.41
1081	30.16	0.00074	3.41
983	20.40	0.00080	3.02
983	20.40	0.00080	3.02
882	11.73	0.00087	2.46
882	11.74	0.00087	2.46

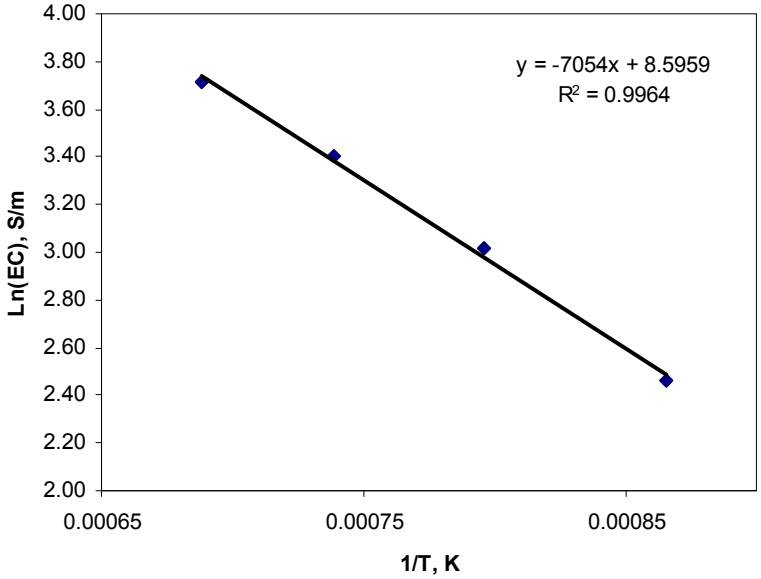

Figure C.17. Electrical Conductivity Trend for EM07-Fe-05 over Inverse Temperature

C.18 EM07-Fe-15 Electrical Conductivity Data

Table C.18. Electrical Conductivity Data for EM07-Fe-15

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	38.89	0.00069	3.66
1180	38.78	0.00069	3.66
1081	28.52	0.00074	3.35
1081	28.53	0.00074	3.35
983	19.36	0.00080	2.96
983	19.40	0.00080	2.97
882	11.51	0.00087	2.44
882	11.30	0.00087	2.43

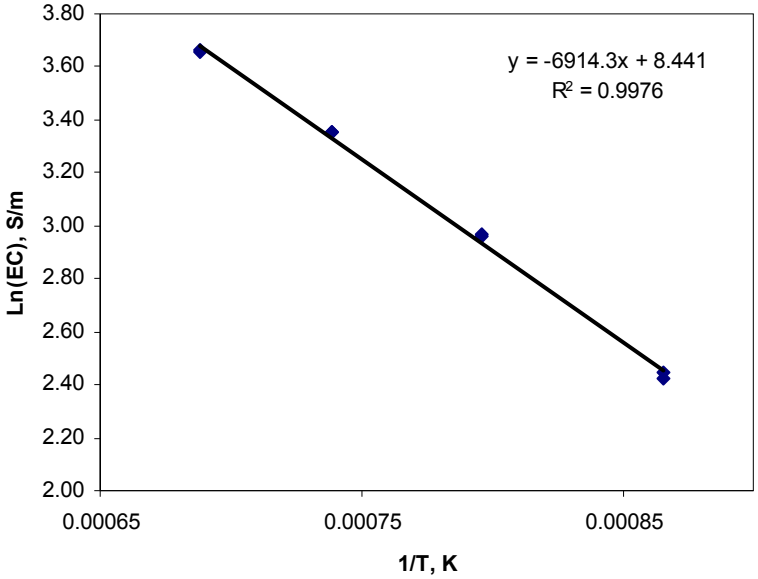

Figure C.18. Electrical Conductivity Trend for EM07-Fe-15 over Inverse Temperature

C.19 EM07-Fe-20 Electrical Conductivity Data

Table C.19. Electrical Conductivity Data for EM07-Fe-20

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	38.89	0.00069	3.66
1180	38.78	0.00069	3.66
1081	28.52	0.00074	3.35
1081	28.53	0.00074	3.35
983	19.36	0.00080	2.96
983	19.40	0.00080	2.97
882	11.51	0.00087	2.44
882	11.30	0.00087	2.43

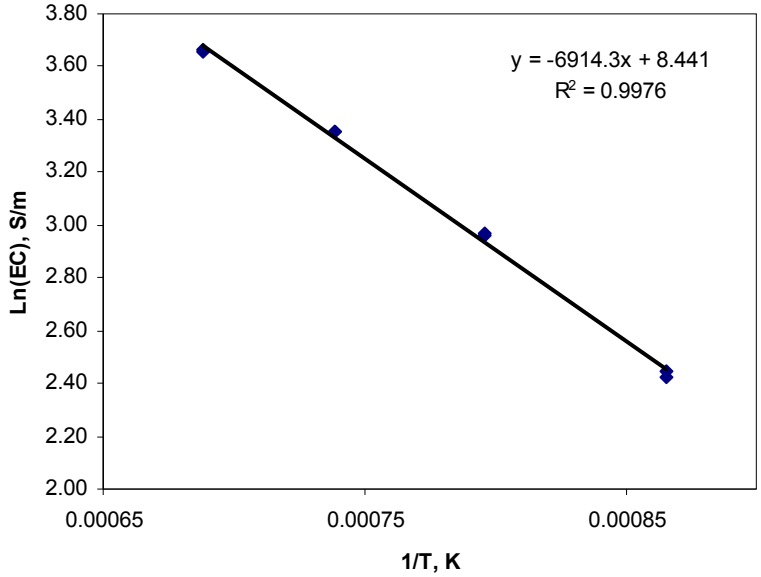

Figure C.19. Electrical Conductivity Trend for EM07-Fe-20 over Inverse Temperature

C.20 EM07-K-03 Electrical Conductivity Data

Table C.20. Electrical Conductivity Data for EM07-K-03

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	42.15	0.00069	3.74
1180	42.25	0.00069	3.74
1081	30.91	0.00074	3.43
1081	30.93	0.00074	3.43
983	20.46	0.00080	3.02
983	20.49	0.00080	3.02
882	11.75	0.00087	2.46
882	11.79	0.00087	2.47

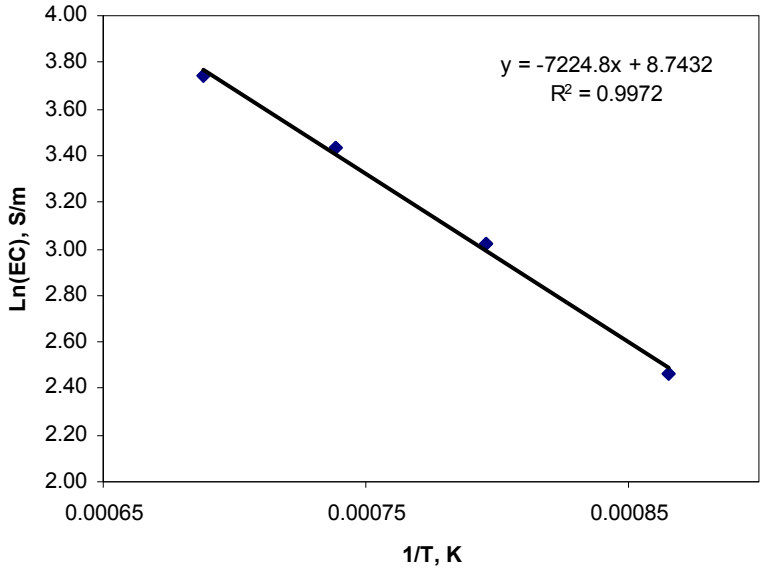

Figure C.20. Electrical Conductivity Trend for EM07-K-03 over Inverse Temperature

C.21 EM07-K-06 Electrical Conductivity Data

Table C.21. Electrical Conductivity Data for EM07-K-06

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1185	44.00	0.00069	3.78
1185	44.09	0.00069	3.79
1086	31.43	0.00074	3.45
1086	31.49	0.00074	3.45
987	20.43	0.00079	3.02
987	20.49	0.00079	3.02
888	11.62	0.00086	2.45
888	11.68	0.00086	2.46

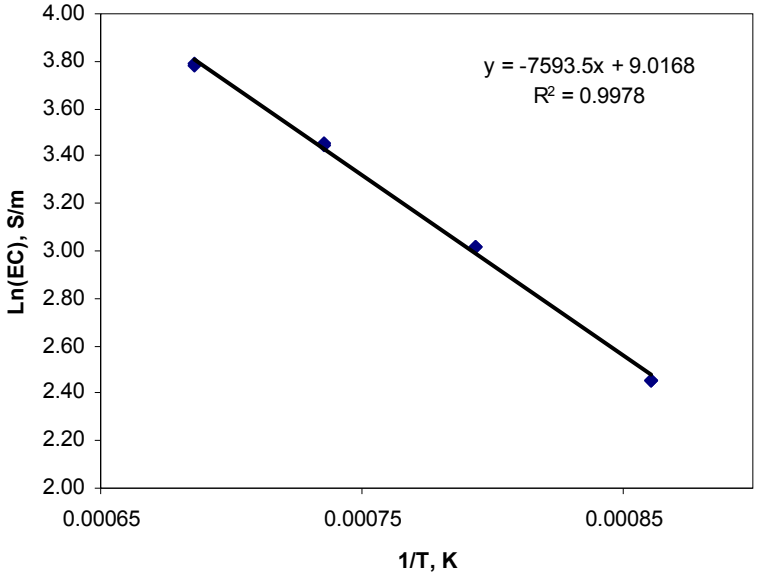

Figure C.21. Electrical Conductivity Trend for EM07-K-06 over Inverse Temperature

C.22 EM07-Li-015 Electrical Conductivity Data

Table C.22. Electrical Conductivity Data for EM07-Li-015

Temperature, °C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	36.19	0.00069	3.59
1180	36.18	0.00069	3.59
1081	26.59	0.00074	3.28
1081	26.59	0.00074	3.28
983	17.96	0.00080	2.89
983	17.99	0.00080	2.89
882	10.60	0.00087	2.36
882	10.64	0.00087	2.36

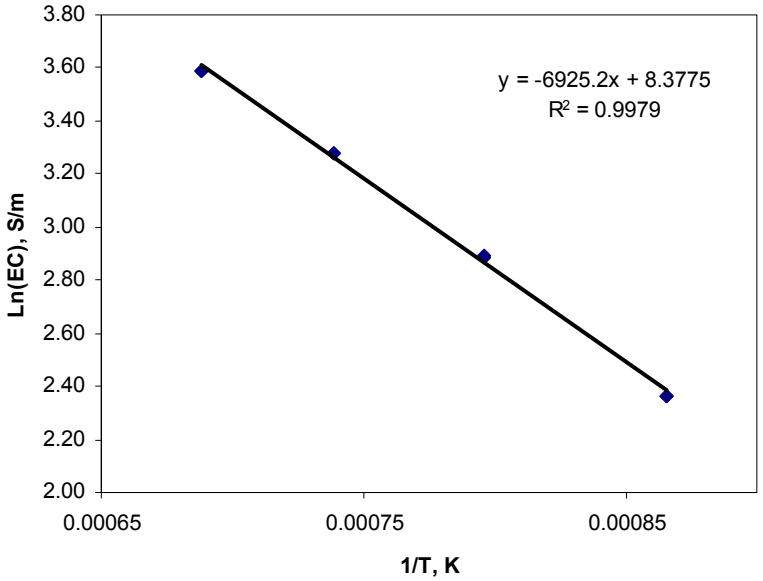

Figure C.22. Electrical Conductivity Trend for EM07-Li-015 over Inverse Temperature

C.23 EM07-Li-04 Electrical Conductivity Data

Table C.23. Electrical Conductivity Data for EM07-Li-04

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	45.95	0.00069	3.83
1180	46.80	0.00069	3.85
1081	34.36	0.00074	3.54
1081	34.37	0.00074	3.54
983	23.14	0.00080	3.14
983	23.14	0.00080	3.14
882	13.58	0.00087	2.61
882	13.59	0.00087	2.61

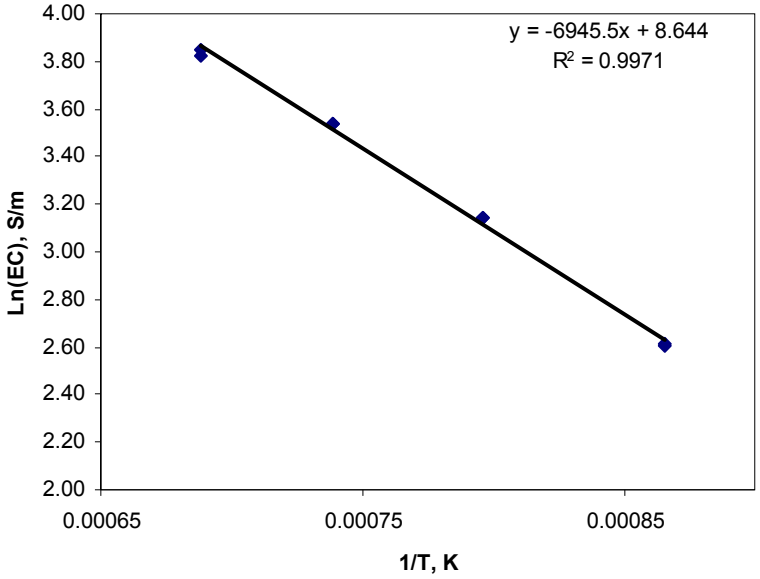

Figure C.24. Electrical Conductivity Trend for EM07-Li-04 over Inverse Temperature

C.25 EM07-Mn-01 Electrical Conductivity Data

Table C.25. Electrical Conductivity Data for EM07-Mn-01

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1184	52.78	0.00069	3.97
1184	52.82	0.00069	3.97
1085	38.17	0.00074	3.64
1085	38.18	0.00074	3.64
986	25.35	0.00079	3.23
986	25.41	0.00079	3.24
887	14.83	0.00086	2.70
887	14.91	0.00086	2.70

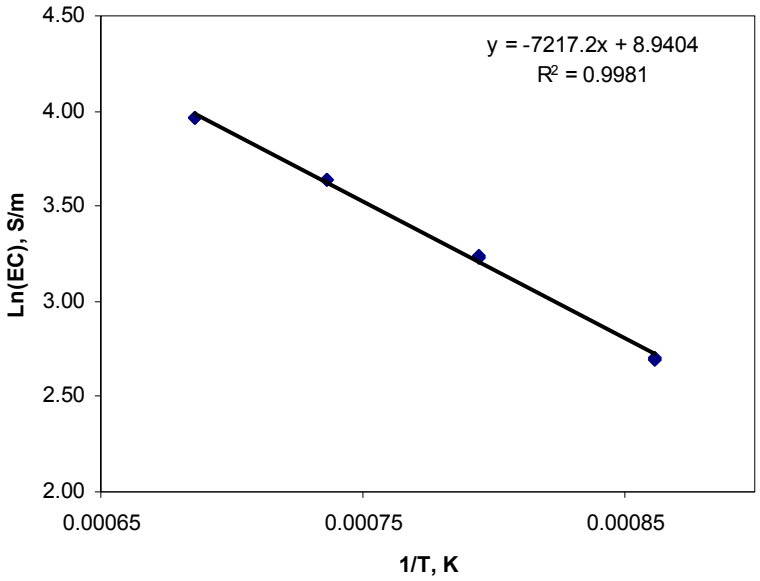

Figure C.25. Electrical Conductivity Trend for EM07-Mn-01 over Inverse Temperature

C.26 EM07-Mn-04 Electrical Conductivity Data

Table C.26. Electrical Conductivity Data for EM07-Mn-04

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	42.27	0.00069	3.74
1180	42.35	0.00069	3.75
1081	30.94	0.00074	3.43
1081	30.95	0.00074	3.43
983	20.57	0.00080	3.02
983	20.62	0.00080	3.03
882	12.00	0.00087	2.48
882	12.05	0.00087	2.49

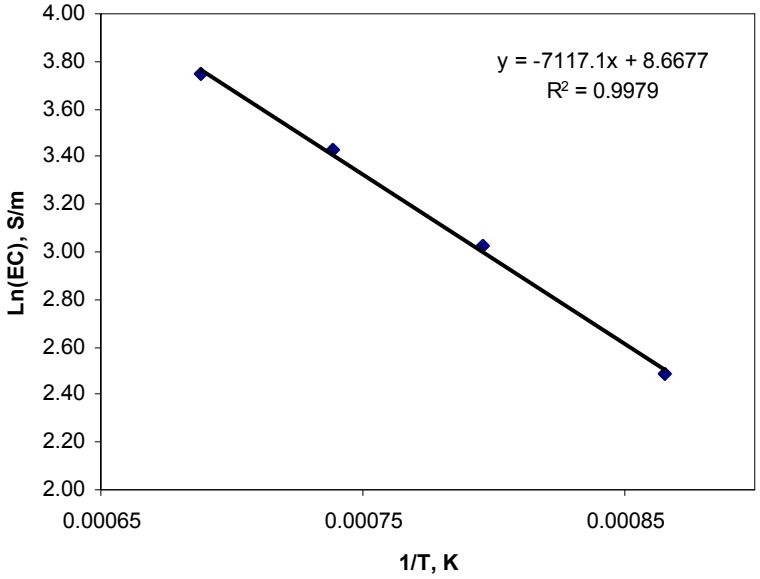

Figure C.26. Electrical Conductivity Trend for EM07-Mn-04 over Inverse Temperature

C.27 EM07-Na-05 Electrical Conductivity Data

Table C.27. Electrical Conductivity Data for EM07-Na-05

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	16.80	0.00069	2.82
1180	16.66	0.00069	2.81
1081	12.22	0.00074	2.50
1081	12.22	0.00074	2.50
983	8.04	0.00080	2.08
983	8.06	0.00080	2.09
882	4.71	0.00087	1.55
882	4.72	0.00087	1.55

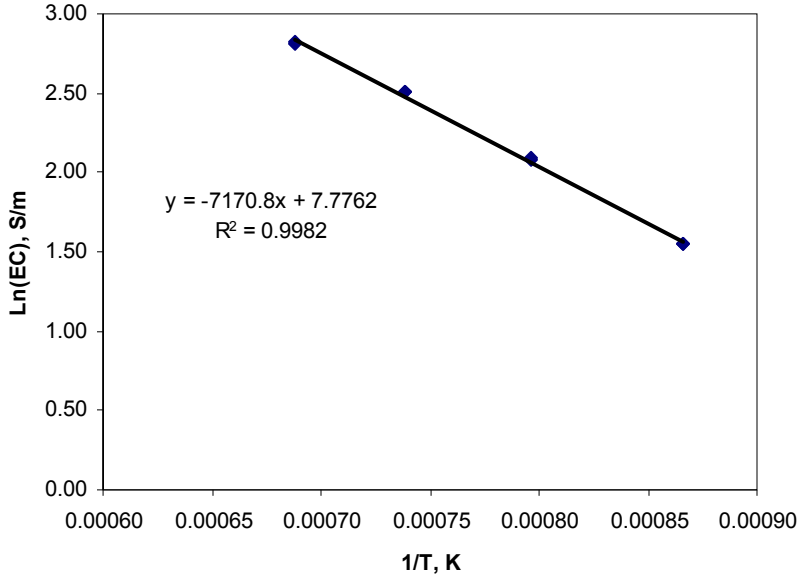

Figure C.27. Electrical Conductivity Trend for EM07-Na-05 over Inverse Temperature

C.28 EM07-Na-10 Electrical Conductivity Data

Table C.28. Electrical Conductivity Data for EM07-Na-10

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	23.20	0.00069	3.14
1180	23.29	0.00069	3.15
1081	16.39	0.00074	2.80
1081	16.55	0.00074	2.81
983	10.44	0.00080	2.35
983	10.44	0.00080	2.35
882	6.11	0.00087	1.81
882	6.12	0.00087	1.81

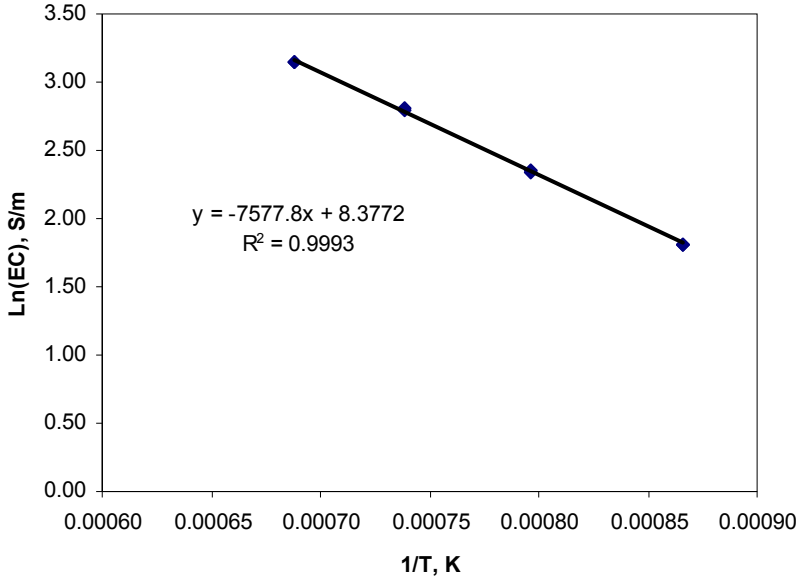

Figure C.28. Electrical Conductivity Trend for EM07-Na-10 over Inverse Temperature

C.28 EM07-Na-20 Electrical Conductivity Data

Table C.28. Electrical Conductivity Data for EM07-Na-20

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	66.40	0.00069	4.20
1180	66.52	0.00069	4.20
1081	51.29	0.00074	3.94
1081	51.31	0.00074	3.94
983	36.50	0.00080	3.60
983	36.54	0.00080	3.60
882	22.99	0.00087	3.13
882	23.05	0.00087	3.14

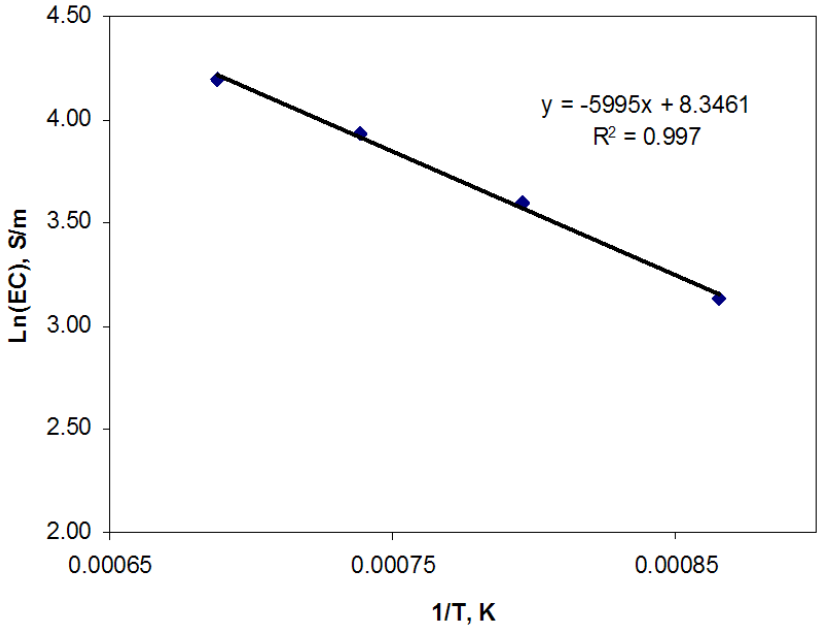

Figure C.28. Electrical Conductivity Trend for EM07-Na-20 over Inverse Temperature

C.29 EM07-Ni-001 Electrical Conductivity Data

Table C.29. Electrical Conductivity Data for EM07-Ni-001

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1184	51.05	0.00069	3.93
1184	51.06	0.00069	3.93
1135	43.43	0.00071	3.77
1135	43.44	0.00071	3.77
1036	29.57	0.00076	3.39
1036	29.68	0.00076	3.39
937	18.26	0.00083	2.90
937	18.27	0.00083	2.91

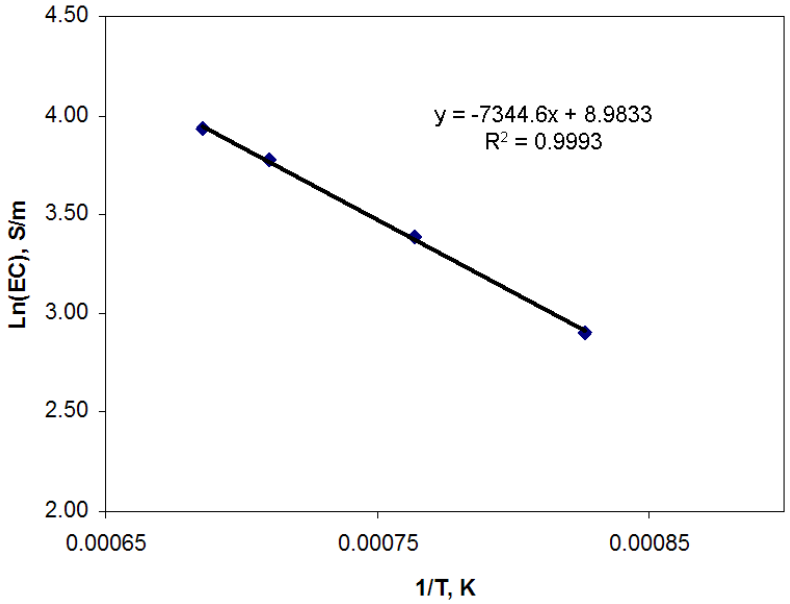

Figure C.29. Electrical conductivity trend for EM07-Ni-001 over inverse temperature

C.30 EM07-Ni-02 Electrical Conductivity Data

Table C.30. Electrical Conductivity Data for EM07-Ni-02

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	36.28	0.00069	3.59
1180	37.78	0.00069	3.63
1081	29.11	0.00074	3.37
1081	26.77	0.00074	3.29
1081	27.51	0.00074	3.31
1081	27.57	0.00074	3.32
882	10.81	0.00087	2.38
882	10.83	0.00087	2.38

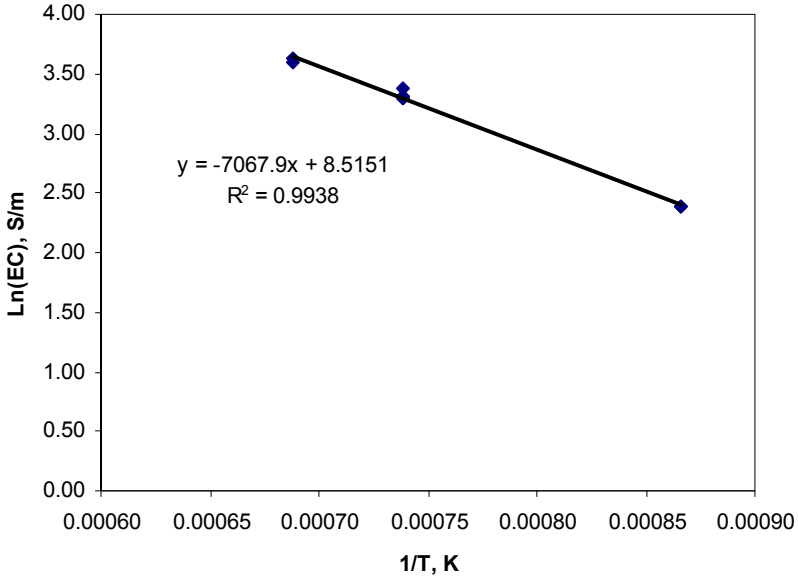

Figure C.30. Electrical Conductivity Trend for EM07-Ni-02 over Inverse Temperature

C.31 EM07-P-0 Electrical Conductivity Data

Table C.31. Electrical conductivity data for EM07-P-0

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	44.15	0.00069	3.79
1180	44.19	0.00069	3.79
1081	32.59	0.00074	3.48
1081	32.60	0.00074	3.48
983	21.99	0.00080	3.09
983	22.02	0.00080	3.09
882	12.96	0.00087	2.56
882	13.02	0.00087	2.57

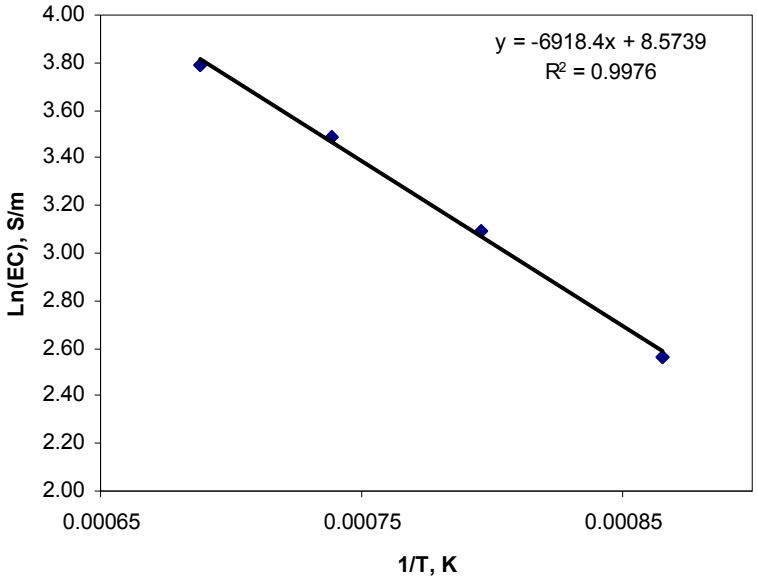

Figure C.32. Electrical Conductivity Trend for EM07-P-0 over Inverse Temperature

C.33 EM07-P-025 Electrical Conductivity Data

Table C.33. Electrical Conductivity Data for EM07-P-025

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1183	46.52	0.00069	3.84
1183	46.55	0.00069	3.84
1081	34.53	0.00074	3.54
1081	34.57	0.00074	3.54
988	34.55	0.00079	3.54
988	34.58	0.00079	3.54
882	23.60	0.00087	3.16
882	23.68	0.00087	3.16

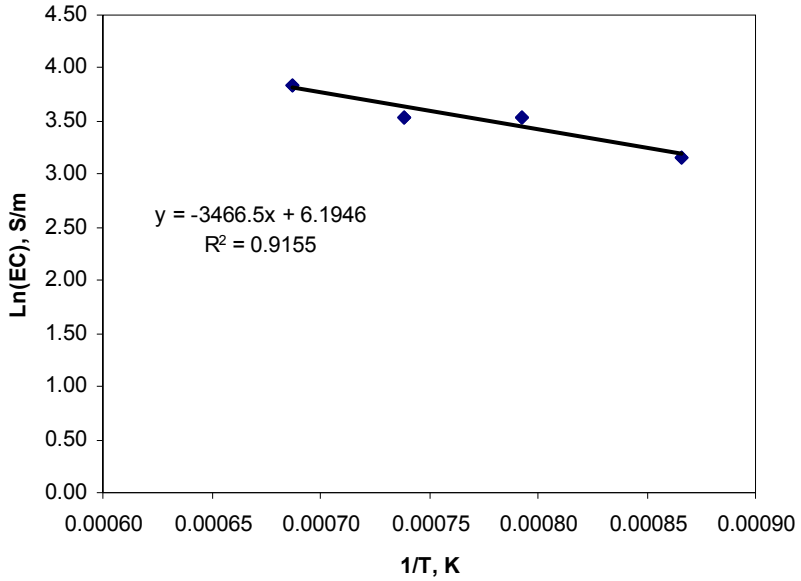

Figure C.33. Electrical Conductivity Trend for EM07-P-025 over Inverse Temperature

C.34 EM07-Si-30 Duplicate Electrical Conductivity Data

Table C.34. Electrical Conductivity Data for EM07-Si-30 Duplicate

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1186	56.63	0.00069	4.04
1186	56.38	0.00069	4.03
1085	42.76	0.00074	3.76
1085	42.79	0.00074	3.76
984	30.13	0.00080	3.41
984	30.17	0.00080	3.41
885	18.94	0.00086	2.94
885	19.02	0.00086	2.95

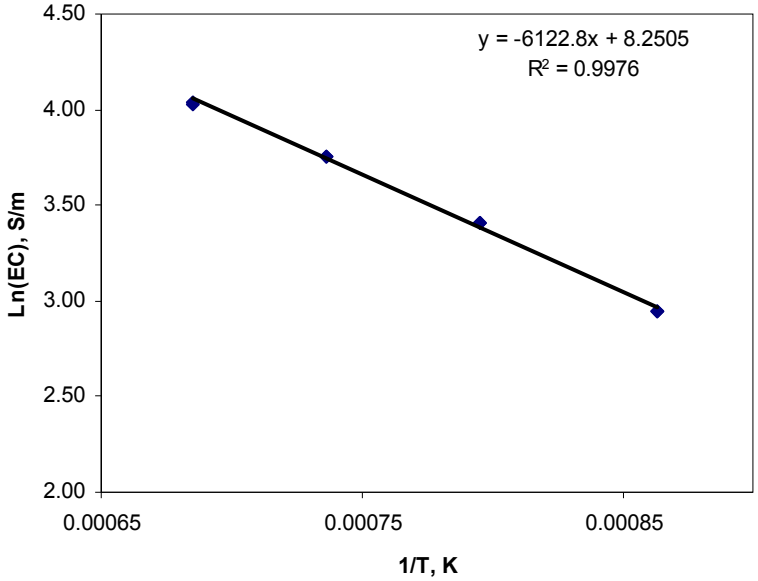

Figure C.35. Electrical Conductivity Trend for EM07-Si-30 Duplicate over Inverse Temperature

C.35 EM07-Si-37 Electrical Conductivity Data

Table C.35. Electrical Conductivity Data for EM07-Si-37

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1183	54.57	0.00069	4.00
1183	54.59	0.00069	4.00
1081	40.14	0.00074	3.69
1081	40.17	0.00074	3.69
988	27.58	0.00079	3.32
988	27.64	0.00079	3.32
882	16.92	0.00087	2.83
882	16.95	0.00087	2.83

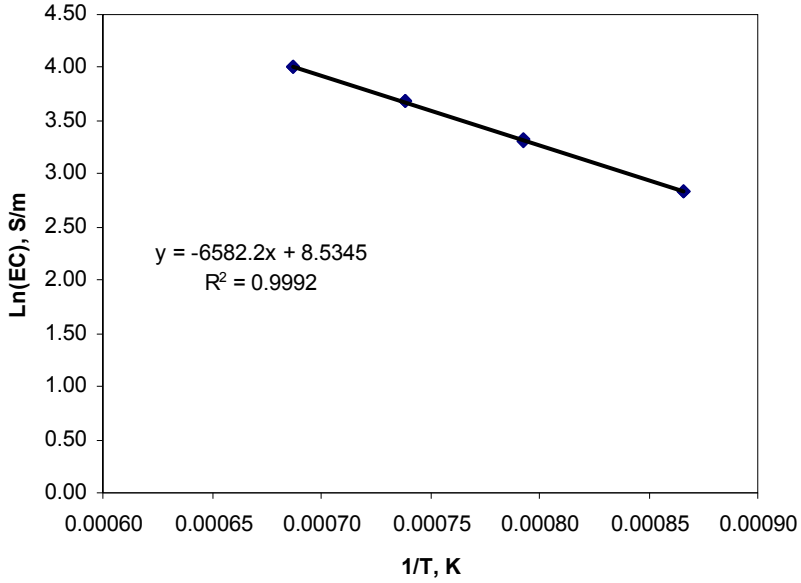

Figure C.35. Electrical Conductivity Trend for EM07-Si-37 over Inverse Temperature

C.36 EM07-Si-37 Duplicate Electrical Conductivity Data

Table C.36. Electrical Conductivity Data for EM07-Si-37 Duplicate

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1186	51.36	0.00069	3.94
1186	51.77	0.00069	3.95
1085	39.04	0.00074	3.66
1085	39.00	0.00074	3.66
984	26.68	0.00080	3.28
984	26.74	0.00080	3.29
885	16.24	0.00086	2.79
885	16.28	0.00086	2.79

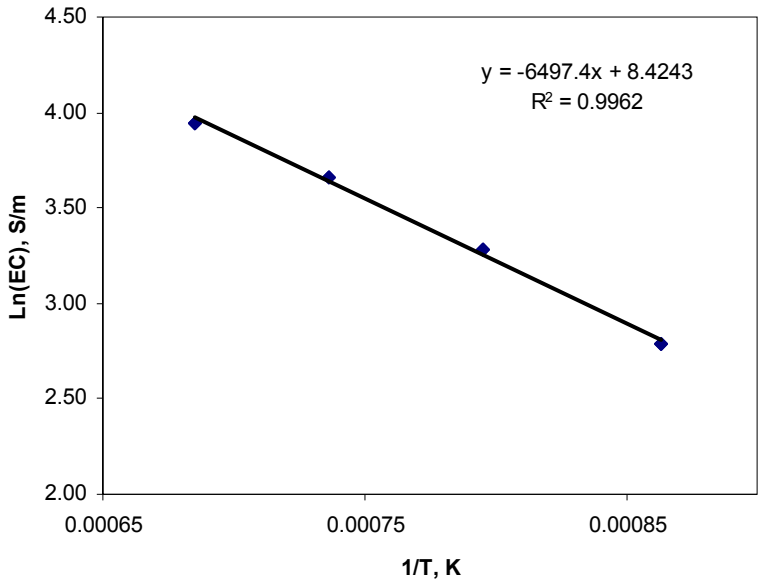

Figure C.36. Electrical Conductivity Trend for EM07-Si-37 Duplicate over Inverse Temperature

C.37 EM07-Si-50 Electrical Conductivity Data

Table C.37. Electrical Conductivity Data for EM07-Si-50

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	35.51	0.00069	3.57
1180	35.61	0.00069	3.57
1081	25.48	0.00074	3.24
1081	25.51	0.00074	3.24
980	16.64	0.00080	2.81
980	16.66	0.00080	2.81
882	8.83	0.00087	2.18
882	8.83	0.00087	2.18

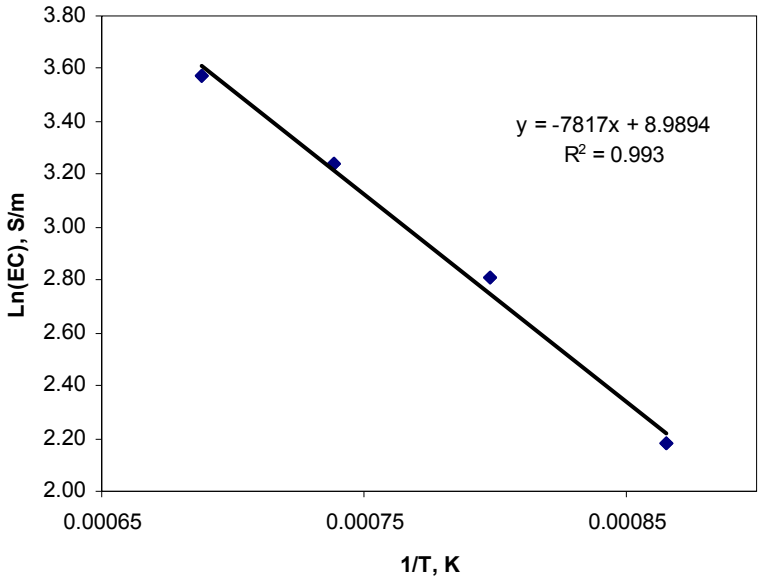

Figure C.37. Electrical Conductivity Trend for EM07-Si-50 over Inverse Temperature

C.38 EM07-Si-50 Duplicate Electrical Conductivity Data

Table C.38. Electrical Conductivity Data for EM07-Si-50 Duplicate

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1186	25.81	0.00069	3.25
1186	25.69	0.00069	3.25
1085	18.25	0.00074	2.90
1085	18.24	0.00074	2.90
984	11.92	0.00080	2.48
984	11.94	0.00080	2.48
885	6.81	0.00086	1.92
885	6.83	0.00086	1.92

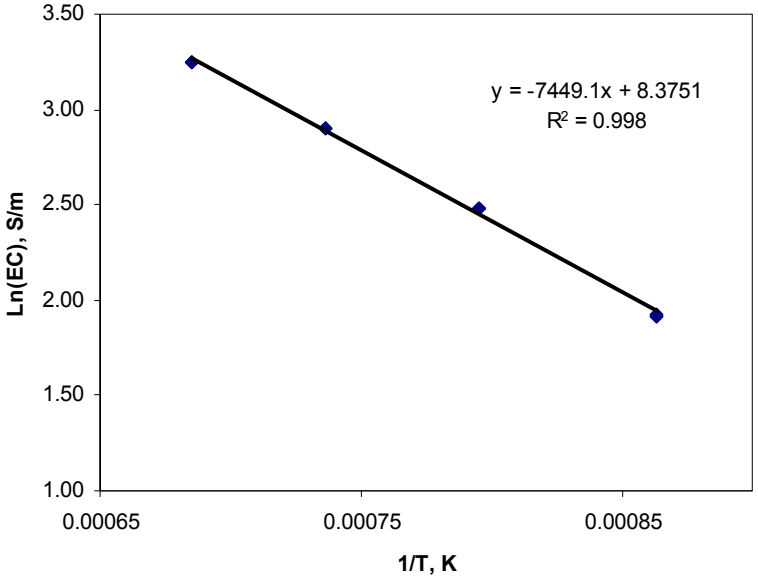

Figure C.38. Electrical Conductivity Trend for EM07-Si-50 Duplicate over Inverse Temperature

C.39 EM07-Zr-001 Electrical Conductivity Data

Table C.39. Electrical Conductivity Data for EM07-Zr-001

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1180	38.14	0.00069	3.64
1180	39.32	0.00069	3.67
1081	28.94	0.00074	3.37
1081	28.95	0.00074	3.37
983	19.26	0.00080	2.96
983	19.49	0.00080	2.97
882	11.66	0.00087	2.46
882	11.67	0.00087	2.46

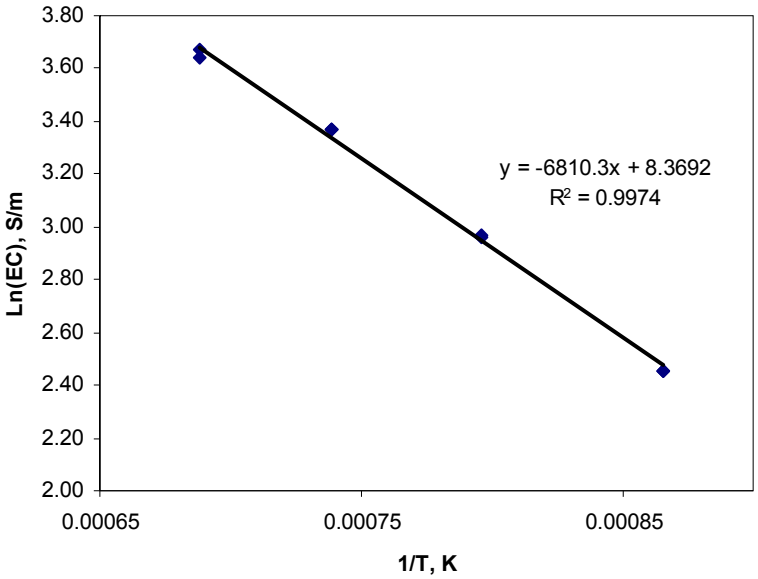

Figure C.39. Electrical Conductivity Trend for EM07-Zr-001 over Inverse Temperature

C.40 EM07-Zr-05 Electrical Conductivity Data

Table C.40. Electrical Conductivity Data for EM07-Zr-05

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1183	39.60	0.00069	3.68
1183	39.46	0.00069	3.68
1081	27.91	0.00074	3.33
1081	27.93	0.00074	3.33
988	18.45	0.00079	2.92
988	18.54	0.00079	2.92
882	10.82	0.00087	2.38
882	10.84	0.00087	2.38

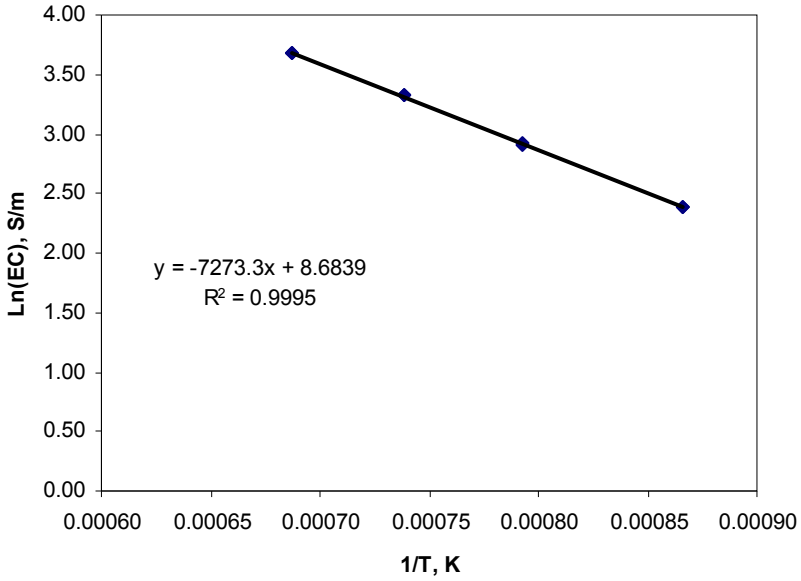

Figure C.40. Electrical Conductivity Trend for EM07-Zr-05 over Inverse Temperature

C.41 EM07-NM-0025 Electrical Conductivity Data

Table C.41. Electrical Conductivity Data for EM07-NM-0025

Temperature,°C	Conductivity, S/m	1/T, K	Ln(EC), S/m
1183	28.36	0.00069	3.34
1183	28.55	0.00069	3.35
1080	19.07	0.00074	2.95
1080	18.49	0.00074	2.92
980	11.62	0.00080	2.45
980	11.62	0.00080	2.45
888	8.76	0.00086	2.17
888	8.79	0.00086	2.17

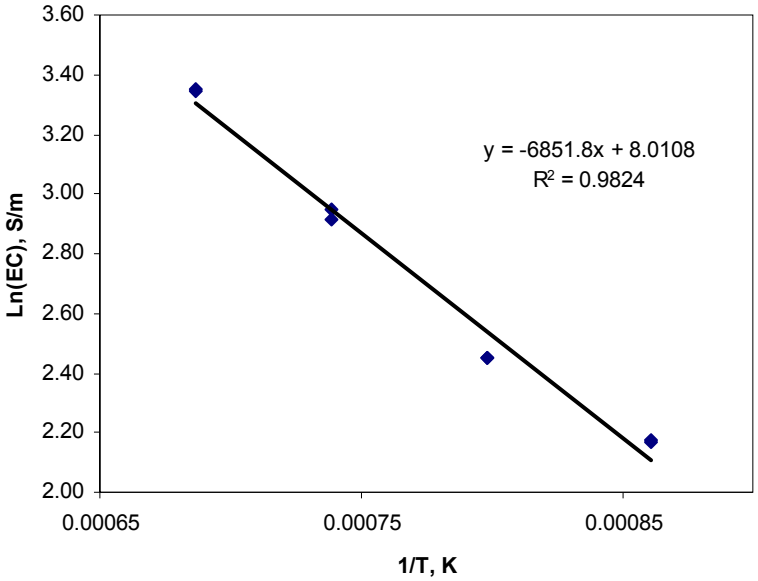

Figure C.41. Electrical Conductivity Trend for EM07-NM-0025 over Inverse Temperature

Appendix D: Optical T_L Experiments and Observations

This section summarizes the results of heat treatments and optical observations performed on the EM07 and HWL glasses They are sorted alphabetically by sample ID (Content column) and then by the date/time that the heat treatment was initiated.

Table D.1. Summary of Liquidus Temperature (T_L) Heat Treatments and Optical Observations for EM07 and HWL Glasses as well as the Reference Material. ("Fur" refers the furnace used for that a particular heat treatment, "TS" means that a thin section as made of this specimen, and the strikethrough entries represent specimens that were only made for XRD purposes – no optical data collected).

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
EM07-Al-06	10	10/25/2007 16:44	1201	10/26/2007 15:40	22.9	NO	NO	Sample clear
EM07-Al-06	8	10/25/2007 16:44	996	10/26/2007 15:40	22.9	YES	YES	Lots of spinel, some undissolved material
EM07-Al-06	5	10/25/2007 16:44	1099	10/26/2007 15:40	22.9	NO	NO	Sample clear
EM07-Al-06	10	10/29/2007 17:36	1173	10/30/2007 16:25	22.8	NO	NO	Sample clear
EM07-Al-06	5	10/30/2007 17:36	1051	10/31/2007 16:50	23.2	YES	YES	Lots of spinel, Ru present
~~EM07-Al-06~~	~~5~~	~~11/2/2007 16:30~~	~~1078~~	~~11/3/2007 15:29~~	23.0	~~-------~~	~~-------~~	~~Volatilized out of crucible~~
EM07-Al-06	10	11/4/2007 16:30	1074	11/5/2007 14:20	21.8	YES	YES	Very few spinel, some other undissolved material present
EM07-Al-06	10	11/12/2007 16:41	1085	11/13/2007 15:07	22.4	YES	NO	Sample clear of spinel, some Ru
EM07-Al-06	10	11/14/2007 15:26	1077	11/15/2007 15:37	24.2	YES	NO	No spinel, some other undissolved materials
~~EM07-Al-06~~	~~10~~	~~1/16/2008 11:05~~	~~947~~	~~1/17/2008 9:20~~	22.3	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-Al-06~~	~~5~~	~~1/28/2008 14:40~~	~~1026~~	~~1/29/2008 14:40~~	24.0	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-Al-15	10	10/30/2007 17:36	1190	10/31/2007 16:50	23.2	YES	YES	Lots of spinel and other undissolved material
EM07-Al-15	8	10/30/2007 17:36	1151	10/31/2007 16:50	23.2	YES	YES	Lots of spinel, some undissolved material
EM07-Al-15	5	10/30/2007 17:36	1051	10/31/2007 16:50	23.2	YES	YES	Highly crystallized, Ru present
EM07-Al-15	5	10/31/2007 18:33	1262	11/1/2007 16:35	22.0	YES	YES	Redox, several spinel, some other undissolved materials
EM07-Al-15	5	11/1/2007 17:45	1281	11/2/2007 15:55	22.2	?	YES	Brown in color, redox, very dark, some large spinel
EM07-Al-15	5	11/8/2007 17:12	1301	11/9/2007 15:40	22.5	?	YES	Very dark, redox, few spinel, other undissolved mat'ls at base
~~EM07-Al-15~~	~~5~~	~~12/20/2007 13:22~~	~~1322~~	~~12/20/2007 17:15~~	3.9	~~---------~~	~~---------~~	~~Volatilized out of crucible~~
EM07-Al-15	5	12/22/2007 11:30	1343	12/22/2007 15:50	4.3	NO	NO	Redox visible (appears to be a glass/ceramic) no spinel visible
EM07-Al-15	5	1/3/2008 14:00	1330	1/3/2008 18:14	4.2	?	?	Redox visible, sample clear of spinel as observed
EM07-Al-15	8	1/9/2008 14:35	1314	1/9/2008 18:20	3.8	?	?	Redox visible, sample appears clear of spinel or other undissolved materials
EM07-Al-15	5	1/17/2008 14:05	1308	1/17/2008 17:40	3.6	?	YES	Redox visible, few crystals throughout bulk (star-like but geometric)
EM07-Al-15	5	1/24/2008 14:24	1318	1/24/2008 18:21	3.9	Und. mat'l	Crys.	Redox, one crystal, one agglomerate (noble metals)
EM07-Al-15	5	2/1/2008 9:30	1327	2/1/2008 14:20	4.8	NO	NO	Sample clear of large spinels - lots of small particles (due to air quench)
~~EM07-Al-15~~	~~5~~	~~2/7/2008 10:00~~	~~1326~~	~~2/7/2008 14:00~~	4.0	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-Al-20	10	11/6/2007 15:55	1227	11/7/2007 15:30	23.6	YES	YES	Several spinel and other undissolved materials
EM07-Al-20	8	11/6/2007 15:55	1140	11/7/2007 15:30	23.6	YES	YES	Extremely crystallized with spinel, undissolved material
EM07-Al-20	5	11/6/2007 15:55	1065	11/7/2007 15:30	23.6	YES	YES	Extremely crystallized with spinel, undissolved material
EM07-Al-20	8	11/8/2007 17:12	1327	11/9/2007 15:40	22.5	?	YES	Redox, dark brown, volatilized components, spinel, some other undissolved materials
EM07-Al-20	5	11/8/2007 17:12	1301	11/9/2007 15:40	22.5	?	YES	Very dark, redox, spinel, other undissolved materials
EM07-Al-20	5	12/20/2007 13:22	1322	12/20/2007 17:15	3.9	YES	YES	Redox visible, very few spinel
~~EM07-Al-20~~	~~5~~	~~12/28/2007 11:14~~	~~1361~~	~~12/28/2007 15:30~~	4.3	~~--------~~	~~--------~~	~~Volatilized out of crucible~~
EM07-Al-20	5	1/2/2008 14:34	1364	1/2/2008 18:34	4.0	?	?	Redox visible, sample appears to be clear
EM07-Al-20	5	1/8/2008 12:01	1350	1/8/2008 16:30	4.5	?	YES	Redox visible, one spinel surrounded by light halo
EM07-Al-20	5	1/15/2008 12:02	1360	1/15/2008 17:05	5.1	?	YES	Redox visible, some spinel at base surrounded by like halo

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
EM07-Al-225	5	7/21/2009 15:00	1152	7/21/2009 15:00	0.0	————	YES	Bad glass
EM07-Al-225	8	7/23/2009 15:00	1275	7/24/2009 13:35	22.6	————	YES	Crystals throughout
EM07-Al-225	5	9/2/2009 11:30	1320	9/3/2009 9:30	22.0	————	YES	Crystals
EM07-Al-225	5	9/14/2009 10:45	1340	9/15/2009 9:00	22.3	————	YES	Crystals
EM07-Al-225	5	9/22/2009 11:40	1380	9/22/2009 15:40	4.0	————	YES	Crystals
EM07-Al-225	5	10/5/2009 9:20	1400	10/5/2009 13:20	4.0	————	YES	Spinel
EM07-Al-225	5	10/9/2009 9:30	1438	10/9/2009 13:40	4.2	————	YES	Sponel
EM07-Al-225	5	10/9/2009 15:15	1428	10/9/2009 19:35	4.3	————	YES	Spinel
EM07-Al-225	5	10/13/2009 10:30	1446	10/13/2009 14:30	4.0	————	YES	Spinel
EM07-Al-225	5	10/13/2009 14:45	1456	10/13/2009 18:50	4.1	————	YES	Spinel peppered
EM07-Al-225	5	10/14/2009 12:00	1465	10/14/2009 17:00	5.0	————	YES	Spinel peppered
EM07-Al-225	5	10/16/2009 9:00	1476	10/16/2009 13:40	4.7	————	YES	Spinel peppered
EM07-B-05	10	10/7/2007 14:37	942	10/8/2007 15:30	24.9	YES	YES	Surface crystallization, undissolved materials, spinel everywhere
EM07-B-05	8	10/7/2007 14:38	1042	10/8/2007 15:30	24.9	YES	YES	Surface crystallization, undissolved materials, spinel everywhere
EM07-B-05	10	10/10/2007 15:15	1157	10/11/2007 13:40	22.4	YES	YES	Several spinel, some undissolved material
EM07-B-05	10	10/11/2007 16:23	1247	10/12/2007 14:30	22.1	NO	NO	Sample clear
EM07-B-05	10	10/17/2007 17:28	1202	10/18/2007 15:31	22.0	YES	YES	Lots of spinel, some undissolved material
EM07-B-05	5	10/29/2007 17:36	1238	10/30/2007 16:25	22.8	NO	NO	Sample clear
EM07-B-05	10	11/3/2007 16:30	1220	11/4/2007 15:18	22.8	YES	YES	Few small spinel throughout bulk, some Ru
EM07-B-05	10	11/6/2007 15:55	1227	11/7/2007 15:30	23.6	?	?	Sample clear aside from a strange undissolved agglomerate at base
EM07-B-05	10	11/9/2007 16:42	1230	11/10/2007 14:56	22.2	YES	YES	Very few large spinels, some other undissolved materials
EM07-B-05	10	11/13/2007 15:55	1239	11/14/2007 14:18	22.4	NO	NO	Sample clear
~~EM07-B-05~~	~~10~~	~~1/17/2008 13:40~~	~~1051~~	~~1/18/2008 12:00~~	22.3	————	————	~~XRD sample only~~
~~EM07-B-05~~	~~10~~	~~1/23/2008 17:49~~	~~1103~~	~~1/24/2008 17:45~~	23.9	————	————	~~XRD sample only~~
EM07-B-125	5	7/21/2009 15:00	1152	7/21/2009 15:00	0.0	————	YES	Crystals throughout
EM07-B-125	5	7/30/2009 14:35	1234	7/31/2009 14:50	24.2	————	YES	Lightly peppered
EM07-B-125	5	10/1/2009 14:25	1243	10/1/2009 14:25	0.0	————	YES	Bottom layer and peppered throughout
EM07-B-125	8	10/13/2009 14:45	1252	10/14/2009 11:45	21.0	————	YES	Spinel bottom layer
EM07-B-125	8	10/14/2009 12:00	1261	10/15/2009 10:15	22.3	————	YES	1 spinel glob on bottom
EM07-B-125	8	10/15/2009 13:35	1271	10/16/2009 11:35	22.0	————	YES	1 spinel glob on bottom
EM07-B-125	8	10/16/2009 12:00	1281	10/17/2009 13:10	25.2	————	YES	Tiny spinel
EM07-B-125	8	10/17/2009 13:20	1291	10/18/2009 13:35	24.2	————	YES	Tiny spinel
EM07-B-15	10	10/7/2007 14:37	942	10/8/2007 15:30	24.9	YES	YES	Undissolved materials, spinel everywhere
EM07-B-15	8	10/7/2007 14:38	1042	10/8/2007 15:30	24.9	YES	YES	Undissolved materials, spinel everywhere
EM07-B-15	10	10/10/2007 15:15	1157	10/11/2007 13:40	22.4	YES	YES	Very small quantity of spinel, few undissolved Ru agglomerates
~~EM07-B-15~~	~~10~~	~~10/11/2007 16:23~~	~~1247~~	~~10/12/2007 14:30~~	22.1	————	————	————
EM07-B-15	10	10/15/2007 17:17	1254	10/16/2007 17:50	24.6	NO	NO	Sample clear
EM07-B-15	5	10/18/2007 17:13	1220	10/19/2007 15:15	22.0	NO	NO	Sample is clear
EM07-B-15	10	10/22/2007 16:20	1187	10/23/2007 16:53	24.6	NO	NO	Sample clear
EM07-B-15	10	10/26/2007 17:08	1184	10/27/2007 15:20	22.2	YES	NO	Sample clear of spinel, some Ru
EM07-B-15	10	10/29/2007 17:36	1173	10/30/2007 16:25	22.8	NO	NO	Sample clear
EM07-B-15	10	11/1/2007 17:45	1165	11/2/2007 15:55	22.2	YES	YES	Very few spinel, some undissolved agglomerates
~~EM07-B-15~~	~~10~~	~~1/17/2008 13:40~~	~~1051~~	~~1/18/2008 12:00~~	22.3	————	————	~~XRD sample only~~
~~EM07-B-15~~	~~10~~	~~1/23/2008 17:49~~	~~1103~~	~~1/24/2008 17:45~~	23.9	————	————	~~XRD sample only~~
~~EM07-B-15~~	~~8~~	~~1/28/2008 14:40~~	~~999~~	~~1/29/2008 14:40~~	24.0	————	————	~~XRD sample only~~
~~EM07-B-15~~	~~10~~	~~1/31/2008 17:15~~	~~974~~	~~2/1/2008 15:54~~	22.6	————	————	~~XRD sample only~~
EM07-B-175	5	7/21/2009 15:00	1152	7/21/2009 15:00	0.0	————	YES	Peppered throughout

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
EM07-B-175	5	7/30/2009 14:35	1234	7/31/2009 14:50	24.2	~~--------~~	YES	1 small blob on bottom
EM07-B-175	5	8/24/2009 15:55	1190	8/25/2009 14:00	22.1	~~--------~~	YES	Small crystal blobs on bottom
EM07-B-175	5	10/2/2009 16:00	1201	10/2/2009 16:00	0.0	~~--------~~	YES	Spinel glob
EM07-B-175	5	10/3/2009 16:30	1211	10/4/2009 14:30	22.0	~~--------~~	YES	Spinel glob
EM07-B-175	5	10/6/2009 15:30	1221	10/7/2009 14:40	23.2	~~--------~~	N/A	Boiled out
EM07-B-175	5	10/10/2009 15:10	1245	10/11/2009 14:00	22.8	~~--------~~	NO	Glass
EM07-B-175	5	10/17/2009 16:00	1221	10/8/2009 15:00	-217.0	~~--------~~	YES	1 spinel glob on bottom
EM07-B-20	10	10/7/2007 14:37	942	10/8/2007 15:30	24.9	YES	YES	Undissolved materials, spinel everywhere
EM07-B-20	8	10/7/2007 14:38	1042	10/8/2007 15:30	24.9	YES	YES	Lots of undissolved material, spinel everywhere
EM07-B-20	10	10/10/2007 15:15	1157	10/11/2007 13:40	22.4	YES	YES	Sample clear of spinel, one small undissolved Ru agglomerate
EM07-B-20	10	10/11/2007 16:23	1247	10/12/2007 14:30	22.1	NO	NO	Sample clear
EM07-B-20	5	10/16/2007 18:12	1102	10/17/2007 16:45	22.5	YES	YES	Several spinel, some undissolved material
EM07-B-20	8	10/18/2007 17:13	1123	10/19/2007 15:15	22.0	YES	YES	Lots of little spinel, some undissolved material
~~EM07-B-20~~	~~8~~	~~10/22/2007 16:20~~	~~1141~~	~~10/23/2007 16:53~~	24.6	~~--------~~	~~--------~~	~~--------~~
~~EM07-B-20~~	~~8~~	~~10/24/2007 16:20~~	~~1160~~	~~10/25/2007 15:52~~	23.5	~~YES~~	~~NO~~	~~Sample clear of spinel, some Ru~~
EM07-B-20	8	10/26/2007 17:08	1134	10/27/2007 15:20	22.2	YES	YES	Several spinel, some undissolved material
EM07-B-20	8	10/30/2007 17:36	1151	10/31/2007 16:50	23.2	YES	YES	Lots of spinel, some undissolved material
EM07-B-20	8	11/1/2007 17:45	1149	11/2/2007 15:55	22.2	YES	NO	Sample clear
EM07-B-20	8	11/6/2007 15:55	1140	11/7/2007 15:30	23.6	YES	NO	Sample clear of spinel, a few undissolved agglomerates
EM07-Bi-025	10	10/7/2007 14:37	942	10/8/2007 15:30	24.9	YES	YES	Undissolved materials, spinel everywhere
EM07-Bi-025	8	10/7/2007 14:38	1042	10/8/2007 15:30	24.9	YES	YES	Undissolved materials, spinel everywhere
EM07-Bi-025	10	10/10/2007 15:15	1157	10/11/2007 13:40	22.4	YES	YES	Few spinel, very small quantity of undissolved material
EM07-Bi-025	10	10/11/2007 16:23	1247	10/12/2007 14:30	22.1	NO	NO	Sample clear
EM07-Bi-025	10	10/17/2007 17:28	1202	10/18/2007 15:31	22.0	NO	NO	Sample clear
EM07-Bi-025	10	10/21/2007 14:45	1177	10/22/2007 15:10	24.4	YES	YES	Very few spinel, some RuO2 agglomerates
EM07-Bi-025	10	10/23/2007 17:37	1190	10/24/2007 15:57	22.3	YES	NO	Sample clear of spinel, a few small undissolved agglomerates
EM07-Bi-025	10	10/24/2007 16:20	1194	10/25/2007 15:52	23.5	YES	NO	Sample clear of spinel, one small undissolved Ru agglomerate
EM07-Bi-025	10	10/26/2007 17:08	1184	10/27/2007 15:20	22.2	NO	NO	Sample clear
~~EM07-Bi-025~~	~~10~~	~~1/23/2008 17:49~~	~~1103~~	~~1/24/2008 17:45~~	23.9	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-Bi-05	10	10/7/2007 14:37	942	10/8/2007 15:30	24.9	YES	YES	Surface crystallization, undissolved materials, spinel everywhere
EM07-Bi-05	8	10/7/2007 14:38	1042	10/8/2007 15:30	24.9	YES	YES	Undissolved materials, spinel everywhere
EM07-Bi-05	10	10/10/2007 15:15	1157	10/11/2007 13:40	22.4	YES	YES	Few spinel, very small quantity of undissolved material
EM07-Bi-05	10	10/11/2007 16:23	1247	10/12/2007 14:30	22.1	NO	NO	Sample clear
EM07-Bi-05	10	10/17/2007 17:28	1202	10/18/2007 15:31	22.0	NO	NO	Sample clear
EM07-Bi-05	10	10/21/2007 14:45	1177	10/22/2007 15:10	24.4	YES	NO	Sample clear of spinel, a few small undissolved Ru agglomerates
EM07-Bi-05	10	10/27/2007 16:24	1167	10/28/2007 14:27	22.0	YES	YES	Very few spinel
EM07-Bi-05	10	11/1/2007 17:45	1165	11/2/2007 15:55	22.2	YES	YES	Very few spinel, some undissolved agglomerates
EM07-Bi-05	10	11/8/2007 17:12	1170	11/9/2007 15:40	22.5	YES	YES	Very few spinel, some undissolved agglomerates
~~EM07-Bi-05~~	~~10~~	~~1/23/2008 17:49~~	~~1103~~	~~1/24/2008 17:45~~	23.9	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-BL-1~~	~~10~~	~~9/26/2007 15:30~~	~~--------~~	~~9/27/2007 15:52~~	24.4	~~NO~~	~~NO~~	~~Sample clear~~
~~EM07-BL-1~~	~~10~~	~~9/27/2007 16:07~~	~~--------~~	~~9/28/2007 14:15~~	22.1	~~YES~~	~~YES~~	~~Ruthenium throughout, several small spinel~~
EM07-BL-1	8	10/4/2007 16:06	1048	10/5/2007 15:00	22.9	YES	YES	Undissolved materials, spinel everywhere
EM07-BL-1	10	10/4/2007 16:06	944	10/5/2007 15:00	22.9	YES	YES	Surface pigmentation, extremely crystallized w/ spinel
EM07-BL-1	8	10/10/2007 15:15	1148	10/11/2007 13:40	22.4	YES	YES	Lots of spinel, some undissolved material
EM07-BL-1	8	10/11/2007 16:23	1251	10/12/2007 14:30	22.1	NO	NO	Sample clear
EM07-BL-1	10	10/17/2007 17:28	1202	10/18/2007 15:31	22.0	NO	NO	Sample clear
EM07-BL-1	10	10/21/2007 14:45	1177	10/22/2007 15:10	24.4	YES	YES	Several spinel, some undissolved material

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
EM07-BL-1	10	10/23/2007 17:37	1190	10/24/2007 15:57	22.3	YES	NO	Sample clear of spinel, a few small undissolved agglomerates
EM07-BL-1	10	10/24/2007 16:20	1194	10/25/2007 15:52	23.5	NO	YES	One small cluster of spinel
EM07-BL-1	10	10/26/2007 17:08	1184	10/27/2007 15:20	22.2	YES	NO	No spinel observed, some Ru
EM07-BL-1	10	10/28/2007 14:45	1200	10/29/2007 15:35	24.8	YES	YES	Very few spinel near bubble on side
EM07-BL-1	10	10/31/2007 18:33	1208	11/1/2007 16:35	22.0	NO	NO	Sample clear
~~EM07-BL-1~~	~~10~~	~~1/17/2008 13:40~~	~~1051~~	~~1/18/2008 12:00~~	22.3	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-BL-1~~	~~10~~	~~1/23/2008 17:49~~	~~1103~~	~~1/24/2008 17:45~~	23.9	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-BL-2	10	10/25/2007 16:44	1201	10/26/2007 15:40	22.9	NO	YES	Very small clusters of spinel (TL ~+5-10)
EM07-BL-2	8	10/25/2007 16:44	996	10/26/2007 15:40	22.9	YES	YES	Highly crysallized, Ru present
EM07-BL-2	5	10/25/2007 16:44	1099	10/26/2007 15:40	22.9	YES	YES	Lots of spinel and other undissolved material
EM07-BL-2	10	10/29/2007 17:36	1173	10/30/2007 16:25	22.8	~~--------~~	~~--------~~	~~--------~~
EM07-BL-2	10	10/30/2007 17:36	1190	10/31/2007 16:50	23.2	NO	NO	Sample clear
EM07-BL-2	10	10/31/2007 18:33	1208	11/1/2007 16:35	22.0	NO	NO	Sample clear
~~EM07-BL-2~~	~~10~~	~~1/17/2008 13:40~~	~~1051~~	~~1/18/2008 12:00~~	22.3	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-BL-2~~	~~10~~	~~1/23/2008 17:49~~	~~1103~~	~~1/24/2008 17:45~~	23.9	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-Ca-035~~	~~10~~	~~10/14/2007 12:20~~	~~1251~~	~~10/15/2007 11:50~~	23.5	~~--------~~	~~--------~~	~~--------~~
EM07-Ca-035	8	10/14/2007 12:20	1150	10/15/2007 11:50	23.5	NO	NO	Sample clear
EM07-Ca-035	5	10/14/2007 12:20	1053	10/15/2007 11:50	23.5	YES	YES	Lots of spinel, some undissolved material
~~EM07-Ca-035~~	~~10~~	~~10/15/2007 17:17~~	~~1254~~	~~10/16/2007 17:50~~	24.6	~~--------~~	~~--------~~	~~--------~~
EM07-Ca-035	8	10/18/2007 17:13	1123	10/19/2007 15:15	22.0	YES	YES	A few spinel, some undissolved material
EM07-Ca-035	8	10/22/2007 16:20	1141	10/23/2007 16:53	24.6	NO	NO	Sample clear
EM07-Ca-035	8	10/26/2007 17:08	1134	10/27/2007 15:20	22.2	YES	YES	Very small quantity of spinel, some Ru
~~EM07-Ca-035~~	~~10~~	~~1/8/2008 18:14~~	~~915~~	~~1/10/2008 16:08~~	45.9	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-Ca-035~~	~~10~~	~~1/16/2008 11:05~~	~~947~~	~~1/17/2008 9:20~~	22.3	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-Ca-035~~	~~10~~	~~1/23/2008 17:49~~	~~1103~~	~~1/24/2008 17:45~~	23.9	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-Ca-035~~	~~8~~	~~1/28/2008 14:40~~	~~999~~	~~1/29/2008 14:40~~	24.0	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-Ca-07	10	10/7/2007 14:37	942	10/8/2007 15:30	24.9	YES	YES	Surface crystallization, undissolved materials, spinel everywhere
EM07-Ca-07	8	10/7/2007 14:38	1042	10/8/2007 15:30	24.9	YES	YES	Few spinel, very small quantity of undissolved material
EM07-Ca-07	10	10/10/2007 15:15	1157	10/11/2007 13:40	22.4	YES	YES	Sample clear
~~EM07-Ca-07~~	~~10~~	~~10/11/2007 16:23~~	~~1247~~	~~10/12/2007 14:30~~	22.1	~~--------~~	~~--------~~	~~--------~~
~~EM07-Ca-07~~	~~10~~	~~10/15/2007 17:17~~	~~1254~~	~~10/16/2007 17:50~~	24.6	~~--------~~	~~--------~~	~~--------~~
EM07-Ca-07	5	10/16/2007 18:12	1102	10/17/2007 16:45	22.5	NO	NO	Sample clear
EM07-Ca-07	5	10/21/2007 14:45	1073	10/22/2007 15:10	24.4	YES	YES	Lots of little spinel, some undissolved material
EM07-Ca-07	5	10/23/2007 17:37	1089	10/24/2007 15:57	22.3	YES	YES	Few spinel agglomerates at base, some Ru agglomerates at base
EM07-Ca-07	5	10/25/2007 16:44	1099	10/26/2007 15:40	22.9	YES	YES	Many spinel clusters at base of sample along with Ru
~~EM07-Ca-07~~	~~8~~	~~12/27/2007 17:20~~	~~1003~~	~~12/28/2007 15:45~~	22.4	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-Cr-001	10	10/25/2007 16:44	1201	10/26/2007 15:40	22.9	~~--------~~	~~--------~~	Sample volatilized out of conical crucible
EM07-Cr-001	8	10/25/2007 16:44	996	10/26/2007 15:40	22.9	YES	YES	Highly crystallized, Ru present
EM07-Cr-001	5	10/25/2007 16:44	1099	10/26/2007 15:40	22.9	YES	YES	Small clusters at the base of the sample
EM07-Cr-001	5	10/30/2007 17:36	1051	10/31/2007 16:50	23.2	YES	YES	Lots of small spinel, Ru present
EM07-Cr-001	10	11/1/2007 17:45	1165	11/2/2007 15:55	22.2	NO	NO	Sample clear
EM07-Cr-001	8	11/1/2007 17:45	1149	11/2/2007 15:55	22.2	NO	NO	Sample clear
EM07-Cr-001	8	11/5/2007 15:00	1224	11/6/2007 15:54	24.9	YES	NO	No spinel, a few Ru
EM07-Cr-001	8	11/7/2007 16:42	1112	11/8/2007 15:40	23.0	YES	NO	No spinel, some undissolved materials present
EM07-Cr-001	8	11/9/2007 16:42	1105	11/10/2007 14:56	22.2	NO	NO	Sample clear
EM07-Cr-001	8	11/28/2007 16:04	1098	11/29/2007 14:21	22.3	NO	NO	Sample clear
EM07-Cr-001	8	12/2/2007 14:57	1091	12/3/2007 14:30	23.5	YES	NO	Sample clear of spinel, several undissolved agglomerates

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
EM07-Cr-001	8	12/4/2007 17:22	1082	12/5/2007 16:27	23.1	YES	NO	Sample clear of spinel, lots of other undissolved mat'ls
EM07-Cr-001	8	12/9/2007 14:17	1074	12/10/2007 15:00	24.7	YES	NO	Several undissolved agglomerates, no spinel
EM07-Cr-001	8	12/14/2007 16:11	1065	12/15/2007 14:20	22.1	YES	?	Lots of small cubic crystals (appear to be spinel) some other undissolved mat'ls
~~EM07-Cr-001~~	~~10~~	~~1/8/2008 18:14~~	~~915~~	~~1/10/2008 16:08~~	45.9	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-Cr-001~~	~~5~~	~~1/28/2008 14:40~~	~~1026~~	~~1/29/2008 14:40~~	24.0	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-Cr-001~~	~~10~~	~~1/31/2008 17:15~~	~~974~~	~~2/1/2008 15:54~~	22.6	~~---------~~	~~---------~~	~~XRD sample only~~
EM07-Cr-012	10	10/25/2007 16:44	1201	10/26/2007 15:40	22.9	YES	YES	Surface crystallization, spinel everywhere, undissolved Ru
EM07-Cr-012	8	10/25/2007 16:44	996	10/26/2007 15:40	22.9	YES	YES	Highly crystallized, Ru present
EM07-Cr-012	5	10/25/2007 16:44	1099	10/26/2007 15:40	22.9	~~---------~~	~~---------~~	~~---------~~
EM07-Cr-012	5	10/29/2007 17:36	1238	10/30/2007 16:25	22.8	YES	YES	Surface crystallization, severely crystallized, some Ru
EM07-Cr-012	5	11/1/2007 17:45	1281	11/2/2007 15:55	22.2	YES	YES	Brown in color, redox, lots of spinel and other undissolved material
EM07-Cr-012	8	11/8/2007 17:12	1327	11/9/2007 15:40	22.5	?	YES	Redox, dark brown, volatilized components, spinel, some other undissolved materials
EM07-Cr-012	5	12/20/2007 13:22	1322	12/20/2007 17:15	3.9	YES	YES	Redox visible, few spinel throughout bulk, some other undissolved mat'ls (Cr?)
EM07-Cr-012	5	12/22/2007 11:30	1343	12/22/2007 15:50	4.3	YES	YES	Redox visible (appears to be a glass/ceramic), very few spinel visible
~~EM07-Cr-012~~	~~5~~	~~12/28/2007 11:14~~	~~1361~~	~~12/28/2007 15:30~~	4.3	~~---------~~	~~---------~~	~~Volatilized out of crucible~~
EM07-Cr-012	5	1/2/2008 14:34	1364	1/2/2008 18:34	4.0	?	?	Redox visible, sample appears to be clear
EM07-Cr-012	5	1/8/2008 12:01	1350	1/8/2008 16:30	4.5	?	YES	Redox visible, few spinel throughout bulk surrounded by light halo
EM07-Cr-012	5	1/15/2008 12:02	1360	1/15/2008 17:05	5.1	?	YES	Redox visible, very few crystal (multi-faceted geometric shapes) w/ light halo surrounding
EM07-Cr-0145	5	6/17/2009 10:30	1110	6/18/2009 8:45	22.3	~~---------~~	YES	Full of crystals
EM07-Cr-0145	8	6/17/2009 10:30	970	6/18/2009 8:45	22.3	~~---------~~	YES	
EM07-Cr-0145	8	7/8/2009 15:25	1140	7/9/2009 13:35	22.2	~~---------~~	YES	Crystals throughout
EM07-Cr-0145	8	7/14/2009 11:45	1180	7/15/2009 10:10	22.4	~~---------~~	YES	Crystals throughout
EM07-Cr-0145	8	7/16/2009 12:15	1215	7/17/2009 13:20	25.1	~~---------~~	YES	Crystals throughout
EM07-Cr-0145	8	7/23/2009 15:00	1275	7/24/2009 13:35	22.6	~~---------~~	YES	Crystals throughout
EM07-Cr-0145	5	9/2/2009 11:30	1320	9/3/2009 9:30	22.0	~~---------~~	YES	Crystals scattered throughout
EM07-Cr-0145	5	9/14/2009 10:45	1340	9/15/2009 9:00	22.3	~~---------~~	YES	Crystals
EM07-Cr-0145	5	9/22/2009 11:40	1380	9/22/2009 15:40	4.0	~~---------~~	YES	Crystals
EM07-Cr-0145	5	10/5/2009 9:20	1400	10/5/2009 13:20	4.0	~~---------~~	YES	Spinel
EM07-Cr-0145	5	10/9/2009 9:30	1438	10/9/2009 13:40	4.2	~~---------~~	YES	Spinel
EM07-Cr-0145	5	10/9/2009 15:15	1428	10/9/2009 19:35	4.3	~~---------~~	YES	Spinel
EM07-Cr-0145	5	10/13/2009 10:30	1446	10/13/2009 14:30	4.0	~~---------~~	YES	Spinel
EM07-Cr-0145	5	10/13/2009 14:45	1456	10/13/2009 18:50	4.1	~~---------~~	YES	Spinel peppered
EM07-Cr-0145	5	10/14/2009 12:00	1465	10/14/2009 17:00	5.0	~~---------~~	YES	Spinel peppered
EM07-Cr-0145	5	10/16/2009 9:00	1476	10/16/2009 13:40	4.7	~~---------~~	YES	Spinel peppered
EM07-Cr-02	10	10/25/2007 16:44	1201	10/26/2007 15:40	22.9	YES	YES	Surface crystallization, spinel everywhere, undissolved Ru
EM07-Cr-02	8	10/25/2007 16:44	996	10/26/2007 15:40	22.9	YES	YES	Surface crystallized, highly crystallized, Ru present
EM07-Cr-02	5	10/25/2007 16:44	1099	10/26/2007 15:40	22.9	~~---------~~	~~---------~~	Surface crystallization
EM07-Cr-02	5	10/29/2007 17:36	1238	10/30/2007 16:25	22.8	YES	YES	Surface crystallization, severely crystallized, some Ru
EM07-Cr-02	5	11/1/2007 17:45	1281	11/2/2007 15:55	22.2	YES	YES	Surface crystallization, large quantity of spinel and other undissolved materials
EM07-Cr-02	8	11/8/2007 17:12	1327	11/9/2007 15:40	22.5	?	YES	Redox, dark brown, volatilized components, spinel, some other undissolved materials
EM07-Cr-02	5	12/20/2007 13:22	1322	12/20/2007 17:15	3.9	YES	YES	Redox visible, spinel throughout bulk, some other undissolved mat'ls (Cr?)
EM07-Cr-02	5	12/22/2007 11:30	1343	12/22/2007 15:50	4.3	YES	YES	Redox visible, sample packed with spinel, some other undissolved mat'ls (Cr?)
EM07-Cr-02	5	12/28/2007 11:14	1361	12/28/2007 15:30	4.3	YES	YES	Redox visible, lots of spinel, other undissolved mat'ls (Cr)
EM07-Cr-02	5	1/10/2008 11:06	1418	1/10/2008 14:15	3.1	YES	YES	Redox visible, several large spinel everywhere, other undissolved mat'ls
EM07-Cr-02	5	2/12/2008 10:03	1457	2/12/2008 14:42	4.7	Und. mat'l	Crys.	Long brown crystals, geometric opaque cryst's (spinel?), light brown round crystals
EM07-Cr-02	5	2/13/2008 11:40	1495	2/13/2008 16:05	4.4	Und. mat'l	Crys.	Long brown crystals (light transparent brown)
EM07-F-02	8	10/4/2007 16:06	1048	10/5/2007 15:00	22.9	YES	YES	Undissolved materials, spinel everywhere

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
EM07-F-02	10	10/4/2007 16:06	944	10/5/2007 15:00	22.9	YES	YES	Undissolved materials, spinel everywhere
EM07-F-02	8	10/10/2007 15:15	1148	10/11/2007 13:40	22.4	YES	YES	Several spinel, some undissolved material
EM07-F-02	8	10/11/2007 16:23	1251	10/12/2007 14:30	22.1	NO	NO	Sample clear
EM07-F-02	10	10/17/2007 17:28	1202	10/18/2007 15:31	22.0	NO	NO	Sample clear
EM07-F-02	8	10/21/2007 14:45	1176	10/22/2007 15:10	24.4	YES	YES	Few spinel, very small quantity of undissolved material
EM07-F-02	8	10/23/2007 17:37	1191	10/24/2007 15:57	22.3	YES	YES	Very few spinel in cluster at base, some undissolved Ru
EM07-F-02	8	11/4/2007 16:30	1198	11/5/2007 14:20	21.8	YES	NO	No spinel, some undissolved materials present
~~EM07-F-02~~	~~10~~	~~1/28/2008 14:40~~	~~1101~~	~~1/29/2008 14:40~~	24.0	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-Fe-05	10	10/25/2007 16:44	1201	10/26/2007 15:40	22.9	NO	NO	Sample clear
EM07-Fe-05	8	10/25/2007 16:44	996	10/26/2007 15:40	22.9	YES	YES	Lots of spinel in sample, some Ru
EM07-Fe-05	5	10/25/2007 16:44	1099	10/26/2007 15:40	22.9	NO	NO	Sample clear
EM07-Fe-05	10	10/29/2007 17:36	1173	10/30/2007 16:25	22.8	~~--------~~	~~--------~~	~~--------~~
EM07-Fe-05	5	10/30/2007 17:36	1051	10/31/2007 16:50	23.2	YES	YES	Highly crystallized, Ru present
EM07-Fe-05	5	11/2/2007 16:30	1078	11/3/2007 15:29	23.0	YES	NO	No spinel, some Ru present
EM07-Fe-05	5	11/6/2007 15:55	1065	11/7/2007 15:30	23.6	YES	YES	Many little spinel throughout in convective patterns, some other undissolved mat'l
EM07-Fe-05	5	11/9/2007 16:42	1079	11/10/2007 14:56	22.2	YES	YES	Several little spinel, some other undissolved materials
EM07-Fe-05	5	11/13/2007 15:55	1090	11/14/2007 14:18	22.4	YES	YES	Very few spinel and some other undissolved materials
EM07-Fe-05	5	11/15/2007 16:48	1099	11/16/2007 16:42	23.9	YES	NO	No spinel, some other undissolved materials
~~EM07-Fe-05~~	~~8~~	~~12/28/2007 17:08~~	~~844~~	~~12/30/2007 17:29~~	48.4	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-Fe-05~~	~~10~~	~~1/8/2008 18:14~~	~~915~~	~~1/10/2008 16:08~~	45.9	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-Fe-05~~	~~10~~	~~1/16/2008 11:05~~	~~947~~	~~1/17/2008 9:20~~	22.3	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-Fe-15	10	10/30/2007 17:36	1190	10/31/2007 16:50	23.2	YES	YES	Lots of spinel, some undissolved material
EM07-Fe-15	8	10/30/2007 17:36	1151	10/31/2007 16:50	23.2	YES	YES	Lots of spinel, some undissolved material
EM07-Fe-15	5	10/30/2007 17:36	1051	10/31/2007 16:50	23.2	YES	YES	Highly crystallized, Ru present
EM07-Fe-15	5	11/1/2007 17:45	1281	11/2/2007 15:55	22.2	?	YES	Some spinel, redox, very dark, lost some glass formers
EM07-Fe-15	5	11/8/2007 17:12	1301	11/9/2007 15:40	22.5	~~--------~~	~~--------~~	Sample ambiguous with Fe-20 at same run
EM07-Fe-15	5	12/20/2007 13:22	1322	12/20/2007 17:15	3.9	?	?	Redox visible, seems to be a glass/ceramic, no spinel seen
~~EM07-Fe-15~~	~~10~~	~~12/27/2007 17:20~~	~~1214~~	~~12/28/2007 15:45~~	22.4	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-Fe-15	5	12/31/2007 11:47	1301	12/31/2007 15:51	4.1	NO	NO	Redox visible, sample clear
~~EM07-Fe-15~~	~~5~~	~~1/7/2008 13:30~~	~~1214~~	~~1/7/2008 17:48~~	4.3	~~--------~~	~~--------~~	~~Volatilized out of crucible~~
EM07-Fe-15	5	1/9/2008 14:35	1292	1/9/2008 18:20	3.8	?	?	Redox visible, sample appears clear of spinel or other undissolved materials
EM07-Fe-20	10	10/30/2007 17:36	1190	10/31/2007 16:50	23.2	YES	YES	Surface crystallization, lots of spinel and other undissolved material
EM07-Fe-20	8	10/30/2007 17:36	1151	10/31/2007 16:50	23.2	YES	YES	Lots of spinel, some undissolved material
EM07-Fe-20	5	10/30/2007 17:36	1051	10/31/2007 16:50	23.2	YES	YES	Surface crystallization, highly crystallized, Ru present
EM07-Fe-20	5	10/31/2007 18:33	1262	11/1/2007 16:35	22.0	YES	YES	Volatilized out of crucible, redox, several spinel, other undissolved materials
EM07-Fe-20	5	11/1/2007 17:45	1281	11/2/2007 15:55	22.2	?	YES	Sample volatilized out mostly - lost some glass formers, lots of spinel, redox
EM07-Fe-20	5	11/8/2007 17:12	1301	11/9/2007 15:40	22.5	~~--------~~	~~--------~~	Sample ambiguous with Fe-15 at same run
EM07-Fe-20	5	12/20/2007 13:22	1322	12/20/2007 17:15	3.9	YES	YES	Redox visible, several spinel in bulk
EM07-Fe-20	5	12/22/2007 11:30	1343	12/22/2007 15:50	4.3	YES	YES	Redox visible (appears to be a glass/ceramic), very few spinel visible
EM07-Fe-20	5	12/28/2007 11:14	1361	12/28/2007 15:30	4.3	NO	NO	Redox visible, no spinel visible, glass-ceramic
EM07-Fe-20	5	1/8/2008 12:01	1350	1/8/2008 16:30	4.5	?	?	Redox visible, sample appears to be clear of spinel, lots of reflective specks in sample (Fe?)
~~EM07-K-03~~	~~10~~	~~10/14/2007 12:20~~	~~1251~~	~~10/15/2007 11:50~~	23.5	~~--------~~	~~--------~~	~~--------~~
EM07-K-03	8	10/14/2007 12:20	1150	10/15/2007 11:50	23.5	YES	YES	Sample clear
EM07-K-03	5	10/14/2007 12:20	1053	10/15/2007 11:50	23.5	YES	YES	Lots of undissolved material, spinel everywhere
EM07-K-03	5	10/16/2007 18:12	1102	10/17/2007 16:45	22.5	YES	NO	Sample clear of spinel
EM07-K-03	5	10/21/2007 14:45	1073	10/22/2007 15:10	24.4	YES	YES	Lots of little spinel, some undissolved material
EM07-K-03	5	10/23/2007 17:37	1089	10/24/2007 15:57	22.3	YES	YES	Lots of spinel throughout, some Ru agglomerates

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
EM07-K-03	5	10/25/2007 16:44	1099	10/26/2007 15:40	22.9	NO	NO	Sample clear
EM07-K-03	5	11/3/2007 16:30	1093	11/4/2007 15:18	22.8	YES	YES	Small spinels throughout, some undissolved agglomerates
~~EM07-K-03~~	~~5~~	~~1/28/2008 14:40~~	~~1026~~	~~1/29/2008 14:40~~	24.0	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-K-03~~	~~8~~	~~1/28/2008 14:40~~	~~999~~	~~1/29/2008 14:40~~	24.0	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-K-03~~	~~10~~	~~1/31/2008 17:15~~	~~974~~	~~2/1/2008 15:54~~	22.6	~~---------~~	~~---------~~	~~XRD sample only~~
EM07-K-06	10	10/14/2007 12:20	1251	10/15/2007 11:50	23.5	NO	NO	Sample clear of spinel
EM07-K-06	8	10/14/2007 12:20	1150	10/15/2007 11:50	23.5	NO	NO	Sample clear
EM07-K-06	5	10/14/2007 12:20	1053	10/15/2007 11:50	23.5	YES	NO	No spinel, one Ru agglomerate
EM07-K-06	8	10/27/2007 16:24	1024	10/28/2007 14:27	22.0	YES	NO	Sample clear
EM07-K-06	8	10/31/2007 18:33	1009	11/1/2007 16:35	22.0	YES	YES	Several spinel, some other undissolved material present
EM07-K-06	8	11/3/2007 16:30	1018	11/4/2007 15:18	22.8	YES	YES	Very few spinel, some RuO2 agglomerates
~~EM07-K-06~~	~~10~~	~~1/31/2008 17:15~~	~~974~~	~~2/1/2008 15:54~~	22.6	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-K-06~~	~~10~~	~~2/1/2008 17:00~~	~~849~~	~~2/5/2008 14:20~~	93.3	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-K-06~~	~~10~~	~~2/7/2008 10:00~~	~~903~~	~~2/8/2008 11:40~~	25.7	~~---------~~	~~---------~~	~~XRD sample only~~
EM07-Li-00	5	6/16/2009 11:20	1092	6/17/2009 9:30	22.2	~~---------~~	YES	Small crystals throughout
EM07-Li-00	8	6/16/2009 11:20	992	6/17/2009 9:30	22.2	~~---------~~	YES	
EM07-Li-00	5	7/13/2009 11:30	1121	7/14/2009 9:35	22.1	~~---------~~	YES	Crystals throughout
EM07-Li-00	5	7/14/2009 11:45	1165	7/15/2009 10:10	22.4	~~---------~~	YES	Crystals throughout
EM07-Li-00	5	7/22/2009 16:00	1185	7/22/2009 16:00	0.0	~~---------~~	YES	Crystals throughout
EM07-Li-00	5	7/30/2009 14:35	1234	7/31/2009 14:50	24.2	~~---------~~	YES	Full of crystals
EM07-Li-00	5	9/2/2009 11:30	1320	9/3/2009 9:30	22.0	~~---------~~	YES	Cystals peppered
EM07-Li-00	5	9/14/2009 10:45	1340	9/15/2009 9:00	22.3	~~---------~~	YES	Crystals
EM07-Li-00	5	9/22/2009 11:40	1380	9/22/2009 15:40	4.0	~~---------~~	YES	Crystals
EM07-Li-00	5	10/5/2009 9:20	1400	10/5/2009 13:20	4.0	~~---------~~	N/A	Boiled out
EM07-Li-00	5	10/12/2009 10:10	1382	10/12/2009 14:10	4.0	~~---------~~	YES	Tiny spinel
EM07-Li-00	5	10/12/2009 15:25	1390	10/12/2009 20:15	4.8	~~---------~~	YES	Tiny spinel
EM07-Li-00	5	10/21/2009 14:00	1360	10/21/2009 18:05	4.1	~~---------~~	YES	Tiny spinel
EM07-Li-00	5	10/22/2009 8:05	1370	10/22/2009 12:05	4.0	~~---------~~	YES	Tiny spinel
EM07-Li-00	5	10/22/2009 12:10	1349	10/22/2009 16:10	4.0	~~---------~~	YES	Tiny spinel
EM07-Li-015	10	10/14/2007 12:20	1251	10/15/2007 11:50	23.5	NO	YES	Very small amount of spinel
EM07-Li-015	8	10/14/2007 12:20	1150	10/15/2007 11:50	23.5	YES	YES	Lots of spinel, some undissolved material
EM07-Li-015	5	10/14/2007 12:20	1053	10/15/2007 11:50	23.5	YES	YES	Lots of spinel, some undissolved material
EM07-Li-015	5	10/17/2007 17:28	1300	10/18/2007 15:31	22.0	NO	NO	Sample is brown in color, no crystals or other undissolved material
EM07-Li-015	5	10/27/2007 16:24	1275	10/28/2007 14:27	22.0	NO	NO	Sample clear
EM07-Li-015	5	10/31/2007 18:33	1262	11/1/2007 16:35	22.0	YES	YES	Volatilized out of crucible, Redox, some spinel, possibly other undissolved materials
EM07-Li-015	5	11/4/2007 16:30	1268	11/5/2007 14:20	21.8	NO	NO	Sample clear
~~EM07-Li-015~~	~~8~~	~~1/18/2008 9:40~~	~~1219~~	~~1/19/2008 10:22~~	24.7	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-Li-015~~	~~8~~	~~1/21/2008 13:19~~	~~1313~~	~~1/21/2008 17:30~~	4.2	~~---------~~	~~---------~~	~~XRD sample only~~
EM07-Li-04	10	10/14/2007 12:20	1251	10/15/2007 11:50	23.5	NO	NO	Sample clear of spinel
EM07-Li-04	8	10/14/2007 12:20	1150	10/15/2007 11:50	23.5	NO	NO	Sample Clear
EM07-Li-04	5	10/14/2007 12:20	1053	10/15/2007 11:50	23.5	YES	YES	Lots of spinel, some undissolved material
EM07-Li-04	8	10/18/2007 17:13	1123	10/19/2007 15:15	22.0	YES	YES	Lots of little spinel, some undissolved material
EM07-Li-04	8	10/22/2007 16:20	1141	10/23/2007 16:53	24.6	NO	NO	Sample clear
EM07-Li-04	8	10/26/2007 17:08	1134	10/27/2007 15:20	22.2	NO	NO	Sample clear of spinel
EM07-Li-04	8	11/2/2007 16:30	1129	11/3/2007 15:29	23.0	YES	YES	Very few spinel, some undissolved agglomerates
~~EM07-Li-04~~	~~8~~	~~12/27/2007 17:20~~	~~1003~~	~~12/28/2007 15:45~~	22.4	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-Li-04~~	~~10~~	~~1/8/2008 18:14~~	~~915~~	~~1/10/2008 16:08~~	45.9	~~---------~~	~~---------~~	~~XRD sample only~~

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
~~EM07-Li-04~~	~~10~~	~~1/28/2008 14:40~~	~~1101~~	~~1/29/2008 14:40~~	24.0	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-Li-04~~	~~10~~	~~1/31/2008 17:15~~	~~974~~	~~2/1/2008 15:54~~	22.6	~~---------~~	~~---------~~	~~XRD sample only~~
EM07-Li-05	5	6/16/2009 11:20	1092	6/17/2009 9:30	22.2	~~---------~~	YES	Crystal lightly peppered
EM07-Li-05	8	6/16/2009 11:20	992	6/17/2009 9:30	22.2	~~---------~~	YES	
EM07-Li-05	5	7/13/2009 11:30	1121	7/14/2009 9:35	22.1	~~---------~~	YES	Clusters on bottom
EM07-Li-05	5	7/14/2009 11:45	1165	7/15/2009 10:10	22.4	~~---------~~	NO	Glass
EM07-Li-05	5	7/21/2009 15:00	1152	7/21/2009 15:00	0.0	~~---------~~	NO	Glass
EM07-Li-05	5	9/26/2009 12:40	1140	9/27/2009 14:00	25.3	-	NO	Glass
EM07-Li-05	5	9/30/2009 13:00	1131	10/1/2009 13:00	24.0	-	NO	Glass
~~EM07-Mn-01~~	~~10~~	~~9/27/2007 16:07~~	~~-~~	~~9/28/2007 14:15~~	22.1	~~YES~~	~~?~~	~~Few RuO2, possibly some spinel~~
EM07-Mn-01	8	10/4/2007 16:06	1048	10/5/2007 15:00	22.9	YES	YES	Undissolved materials, spinel everywhere
EM07-Mn-01	10	10/4/2007 16:06	944	10/5/2007 15:00	22.9	YES	YES	Surface pigmentation, undissolved materials, spinel everywhere
EM07-Mn-01	8	10/10/2007 15:15	1148	10/11/2007 13:40	22.4	NO	YES	Very small quantity of spinel
EM07-Mn-01	8	10/11/2007 16:23	1251	10/12/2007 14:30	22.1	NO	NO	Sample clear
EM07-Mn-01	8	10/17/2007 17:28	1202	10/18/2007 15:31	22.0	NO	NO	Sample clear
EM07-Mn-01	8	10/21/2007 14:45	1176	10/22/2007 15:10	24.4	NO	NO	Sample clear
EM07-Mn-01	8	10/24/2007 16:20	1160	10/25/2007 15:52	23.5	YES	NO	Sample clear of spinel, one small undissolved Ru agglomerate
EM07-Mn-01	8	10/30/2007 17:36	1151	10/31/2007 16:50	23.2	YES	NO	No spinel, some Ru present
~~EM07-Mn-01~~	~~8~~	~~12/27/2007 17:20~~	~~1003~~	~~12/28/2007 15:45~~	22.4	~~---------~~	~~---------~~	~~XRD sample only~~
~~Em07-Mn-01~~	~~10~~	~~1/28/2008 14:40~~	~~1101~~	~~1/29/2008 14:40~~	24.0	~~---------~~	~~---------~~	~~XRD sample only~~
EM07-Mn-04	10	10/7/2007 14:37	942	10/8/2007 15:30	24.9	~~---------~~	~~---------~~	Surface crystallization
EM07-Mn-04	8	10/7/2007 14:38	1042	10/8/2007 15:30	24.9	YES	YES	Undissolved materials, spinel everywhere
EM07-Mn-04	8	10/10/2007 15:15	1148	10/11/2007 13:40	22.4	YES	YES	Several spinel, some undissolved material
EM07-Mn-04	8	10/11/2007 16:23	1251	10/12/2007 14:30	22.1	YES	YES	Sample clear
EM07-Mn-04	10	10/16/2007 18:12	1201	10/17/2007 16:45	22.5	YES	YES	Very few spinel, some RuO2 agglomerates
EM07-Mn-04	5	10/18/2007 17:13	1220	10/19/2007 15:15	22.0	YES	NO	Sample is clear of spinel, one ruthenium agglomerate at base of sample
EM07-Mn-04	5	10/22/2007 16:20	1210	10/23/2007 16:53	24.6	Maybe	YES	Three or four small spinel clusters in bulk and at base
EM07-Mn-04	5	10/26/2007 17:08	1213	10/27/2007 15:20	22.2	NO	YES	Very few spinel
~~EM07-Mn-04~~	~~5~~	~~1/16/2008 11:05~~	~~1175~~	~~1/17/2008 9:20~~	22.3	~~---------~~	~~---------~~	~~Volatilized out of crucible~~
~~EM07-Mn-04~~	~~10~~	~~1/28/2008 14:40~~	~~1101~~	~~1/29/2008 14:40~~	24.0	~~---------~~	~~---------~~	~~XRD sample only~~
EM07-Na-05	8	10/4/2007 16:06	1048	10/5/2007 15:00	22.9	YES	YES	Surface crystallization, spinel everywhere, other crystals present
EM07-Na-05	10	10/4/2007 16:06	944	10/5/2007 15:00	22.9	YES	YES	Surface crystallization, extremely crystallized w/ spinel
EM07-Na-05	8	10/10/2007 15:15	1148	10/11/2007 13:40	22.4	YES	YES	Extremely crystallized with spinel, undissolved material
EM07-Na-05	8	10/11/2007 16:23	1251	10/12/2007 14:30	22.1	YES	YES	Lots of spinel, some undissolved material
EM07-Na-05	5	10/17/2007 17:28	1300	10/18/2007 15:31	22.0	YES	YES	Lots of spinel, some undissolved material
EM07-Na-05	5	10/24/2007 16:20	1349	10/25/2007 15:52	23.5	YES	YES	Sample volatilized out of conical crucible, very dark, several spinel
EM07-Na-05	5	12/20/2007 13:22	1322	12/20/2007 17:15	3.9	YES	YES	Redox visible, several spinel in bulk, some other undissolved mat'ls
EM07-Na-05	5	12/22/2007 11:30	1343	12/22/2007 15:50	4.3	YES	YES	Redox visible, some spinel appear to have spines on corners
EM07-Na-05	5	12/28/2007 11:14	1361	12/28/2007 15:30	4.3	YES	YES	Redox visible, several spinel, other undissolved mat'ls
~~EM07-Na-05~~	~~5~~	~~1/4/2008 14:05~~	~~1378~~	~~1/4/2008 18:05~~	4.0	~~---------~~	~~---------~~	~~Volatilized out of crucible~~
EM07-Na-10	8	10/4/2007 16:06	1048	10/5/2007 15:00	22.9	YES	YES	Surface crystallization, undissolved materials, spinel everywhere
EM07-Na-10	10	10/4/2007 16:06	944	10/5/2007 15:00	22.9	YES	YES	Surface crystallization, extremely crystallized w/ spinel
EM07-Na-10	5	10/10/2007 15:15	1150	10/11/2007 13:40	22.4	YES	YES	Several spinel, some undissolved material
EM07-Na-10	5	10/11/2007 16:23	1250	10/12/2007 14:30	22.1	YES	YES	Lots of spinel, some undissolved material
EM07-Na-10	5	10/17/2007 17:28	1300	10/18/2007 15:31	22.0	YES	YES	Sample is brown in color, lots of spinel in bulk
EM07-Na-10	5	10/24/2007 16:20	1349	10/25/2007 15:52	23.5	NO	NO	Sample volatilized out of conical crucible, very dark, seems to be amorphous
EM07-Na-10	8	11/8/2007 17:12	1327	11/9/2007 15:40	22.5	?	YES	Redox, dark brown, few spinel, some other undissolved materials

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
~~EM07-Na-10~~	~~5~~	~~12/20/2007 13:22~~	~~1322~~	~~12/20/2007 17:15~~	3.9	~~---------~~	~~---------~~	~~Volatilized out of crucible~~
EM07-Na-10	5	12/22/2007 11:30	1343	12/22/2007 15:50	4.3	YES	YES	Redox visible, section of sample viewable is packed with spinel, some other undissolved mat'ls present
EM07-Na-10	5	12/28/2007 11:14	1361	12/28/2007 15:30	4.3	YES	YES	Redox visible, some spinel present, glass-ceramic
~~EM07-Na-10~~	~~5~~	~~1/4/2008 14:05~~	~~1378~~	~~1/4/2008 18:05~~	4.0	~~---------~~	~~---------~~	~~Volatilized out of crucible~~
~~EM07-Na-10~~	~~8~~	~~1/8/2008 15:25~~	~~1403~~	~~1/8/2008 17:30~~	2.1	~~---------~~	~~---------~~	~~Volatilized out of crucible~~
EM07-Na-10	5	1/10/2008 11:06	1418	1/10/2008 14:15	3.1	?	?	Redox visible, appears to be clear
EM07-Na-10	5	1/21/2008 13:19	1400	1/21/2008 17:30	4.2	?	Crys.	Few crystals throughout bulk (star-like)
EM07-Na-10	5	2/8/2008 12:23	1410	2/8/2008 16:36	4.2	Und. mat'l	Crys.	5-10 star-like crystals throughout bulk
EM07-Na-20	8	10/9/2007 14:30	1047	10/10/2007 14:12	23.7	NO	NO	Sample clear
EM07-Na-20	10	10/9/2007 14:30	949	10/10/2007 14:12	23.7	YES	YES	Several spinel, some undissolved material
EM07-Na-20	5	10/10/2007 15:15	1150	10/11/2007 13:40	22.4	NO	NO	Sample clear
EM07-Na-20	5	10/11/2007 16:23	1250	10/12/2007 14:30	22.1	YES	YES	Sample clear of spinel
EM07-Na-20	8	10/16/2007 18:12	999	10/17/2007 16:45	22.5	YES	YES	Few pools of spinel, some undissolved RuO2
EM07-Na-20	8	10/27/2007 16:24	1024	10/28/2007 14:27	22.0	YES	NO	Sample clear of spinel, few Ru agglomerates
EM07-Na-20	8	10/31/2007 18:33	1009	11/1/2007 16:35	22.0	YES	YES	Very few spinel, some other undissolved material present
EM07-Na-20	8	11/3/2007 16:30	1018	11/4/2007 15:18	22.8	YES	YES	Very few spinel, some RuO2 agglomerates
~~EM07-Na-20~~	~~8~~	~~12/28/2007 17:08~~	~~844~~	~~12/30/2007 17:29~~	48.4	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-Na-20~~	~~8~~	~~1/28/2008 14:40~~	~~999~~	~~1/29/2008 14:40~~	24.0	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-Na-20~~	~~10~~	~~2/7/2008 10:00~~	~~903~~	~~2/8/2008 11:40~~	25.7	~~---------~~	~~---------~~	~~XRD sample only~~
EM07-Na-225	5	6/16/2009 11:20	1092	6/17/2009 9:30	22.2	-	NO	Glass
EM07-Na-225	8	6/16/2009 11:20	992	6/17/2009 9:30	22.2	~~---------~~	NO	Glass
EM07-Na-225	8	7/13/2009 11:30	891	7/14/2009 9:35	22.1	-	YES	Crystals throughout
EM07-Na-225	8	7/30/2009 14:35	942	7/31/2009 14:50	24.2	-	YES	Crystal swirls
EM07-Na-225	8	9/8/2009 15:50	916	9/9/2009 13:45	21.9	-	YES	Crystal swirls
EM07-Na-225	8	10/3/2009 16:30	927	10/4/2009 14:30	22.0	~~---------~~	YES	Spinel swirls
EM07-Na-225	8	10/6/2009 13:50	935	10/7/2009 13:00	23.2	~~---------~~	N/A	In furnace too long
EM07-Na-225	8	10/7/2009 14:30	935	10/8/2009 13:30	23.0	~~---------~~	YES	Spinel swirls
EM07-Na-225	8	10/20/2009 10:45	952	10/21/2009 9:00	22.3	~~---------~~	YES	Spinel swirls
EM07-Na-225	8	10/21/2009 11:15	962	10/22/2009 9:20	22.1	~~---------~~	YES	Broken spinel clumps
EM07-Na-225	8	10/22/2009 11:30	972	10/23/2009 11:15	23.8	~~---------~~	YES	Broken spinel
EM07-Ni-001	10	10/28/2007 14:45	1200	10/29/2007 15:35	24.8	YES	NO	No spinel, several small Ru agglomerates throughout bulk
EM07-Ni-001	5	10/28/2007 14:45	1151	10/29/2007 15:35	24.8	YES	NO	Sample clear of spinel, some Ru
EM07-Ni-001	5	10/30/2007 17:36	1051	10/31/2007 16:50	23.2	YES	YES	Lots of small spinel, Ru present
EM07-Ni-001	8	10/31/2007 18:33	1009	11/1/2007 16:35	22.0	YES	YES	Lots of spinel, some other undissolved material present
EM07-Ni-001	8	11/2/2007 16:30	1129	11/3/2007 15:29	23.0	YES	NO	No spinel, some Ru present
EM07-Ni-001	5	11/2/2007 16:30	1078	11/3/2007 15:29	23.0	YES	YES	Several small spinel, some undissolved Ru materials
EM07-Ni-001	5	11/3/2007 16:30	1093	11/4/2007 15:18	22.8	YES	YES	Very few small spinel in bulk, some undissolved agglomerates
EM07-Ni-001	5	11/5/2007 15:00	1111	11/6/2007 15:54	24.9	YES	NO	No spinel, a few Ru
EM07-Ni-001	5	11/7/2007 16:42	1105	11/8/2007 15:40	23.0	NO	NO	Sample clear
EM07-Ni-001	5	11/12/2007 16:41	1099	11/13/2007 15:07	22.4	YES	YES	Lots of small undissolved particles, some appear cubic
~~EM07-Ni-001~~	~~10~~	~~1/16/2008 11:05~~	~~947~~	~~1/17/2008 9:20~~	22.3	~~---------~~	~~---------~~	~~XRD sample only~~
~~EM07-Ni-001~~	~~10~~	~~2/7/2008 10:00~~	~~903~~	~~2/8/2008 11:40~~	25.7	~~---------~~	~~---------~~	~~XRD sample only~~
EM07-Ni-02	10	10/28/2007 14:45	1200	10/29/2007 15:35	24.8	YES	YES	Several spinel, some undissolved material
EM07-Ni-02	5	10/28/2007 14:45	1151	10/29/2007 15:35	24.8	YES	YES	Spinel everywhere, undissolved Ru
~~EM07-Ni-02~~	~~5~~	~~10/31/2007 18:33~~	~~1262~~	~~11/1/2007 16:35~~	22.0	~~-------~~	~~-------~~	~~Volatilized out of crucible~~
EM07-Ni-02	5	11/1/2007 17:45	1281	11/2/2007 15:55	22.2	NO	NO	Sample clear
EM07-Ni-02	10	11/5/2007 15:00	1240	11/6/2007 15:54	24.9	YES	YES	Several spinel at the base of the sample

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
EM07-Ni-02	10	11/7/2007 16:42	1249	11/8/2007 15:40	23.0	NO	YES	Very few large spinel, no Ru
EM07-Ni-02	8	11/12/2007 16:41	1270	11/13/2007 15:07	22.4	YES	NO	Sample clear of spinel, some Ru
EM07-Ni-02	8	11/14/2007 15:26	1257	11/15/2007 15:37	24.2	YES	YES	One spinel, some small undissolved agglomerates
EM07-Ni-02	8	11/15/2007 16:48	1250	11/16/2007 16:42	23.9	YES	YES	Few large spinel throughout bulk, some small clusters of Ru
EM07-Ni-02	8	11/19/2007 13:30	1264	11/20/2007 11:30	22.0	NO	NO	Sample clear
~~EM07-Ni-02~~	~~10~~	~~1/22/2008 12:05~~	~~1060~~	~~1/23/2008 10:47~~	22.7	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-Ni-02~~	~~10~~	~~1/28/2008 14:40~~	~~1101~~	~~1/29/2008 14:40~~	24.0	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-NM-0025	10	11/6/2007 15:55	1227	11/7/2007 15:30	23.6	YES	?	Several very small undissolved particles (maybe spinel)
EM07-NM-0025	8	11/6/2007 15:55	1140	11/7/2007 15:30	23.6	YES	YES	Large quantities of spinel and other undissolved materials
EM07-NM-0025	5	11/6/2007 15:55	1065	11/7/2007 15:30	23.6	YES	YES	Large quantities of spinel and other undissolved materials
EM07-NM-0025	10	11/8/2007 17:12	1170	11/9/2007 15:40	22.5	YES	YES	Several spinel, some undissolved material
EM07-NM-0025	10	11/9/2007 16:42	1230	11/10/2007 14:56	22.2	?	?	Several very small undissolved particles (maybe spinel)
EM07-NM-0025	8	11/12/2007 16:41	1270	11/13/2007 15:07	22.4	?	?	Lots of very small undissolved particles
~~EM07-NM-0025~~	~~10~~	~~12/11/2007 16:25~~	~~1229~~	~~12/12/2007 14:35~~	22.2	~~--------~~	~~--------~~	~~--------~~
EM07-NM-0025	10	12/14/2007 16:11	1221	12/15/2007 14:20	22.1	YES	?	Lots of small undissolved particles, some larger
EM07-NM-0025	10	12/20/2007 17:18	1193	12/21/2007 16:30	23.2	YES	YES	Several spinel throughout bulk, lots of small undissolved particles
EM07-NM-0025	10	12/27/2007 17:20	1214	12/28/2007 15:45	22.4	YES	NO	No spinel observed, some small undissolved particles (Ru?)
EM07-NM-0025	10	1/2/2008 14:12	1203	1/3/2008 13:45	23.5	YES	YES	One spinel (very near TL), lots of small undissolved particles, few agglom. at base
EM07-P-0	8	10/9/2007 14:30	1047	10/10/2007 14:12	23.7	YES	YES	Undissolved materials, spinel everywhere
EM07-P-0	10	10/9/2007 14:30	949	10/10/2007 14:12	23.7	YES	YES	Undissolved materials, spinel everywhere
EM07-P-0	5	10/10/2007 15:15	1150	10/11/2007 13:40	22.4	YES	YES	Several spinel, some undissolved material
EM07-P-0	5	10/11/2007 16:23	1250	10/12/2007 14:30	22.1	YES	YES	Sample clear of spinel
EM07-P-0	8	10/17/2007 17:28	1202	10/18/2007 15:31	22.0	NO	NO	Sample clear
EM07-P-0	8	10/21/2007 14:45	1176	10/22/2007 15:10	24.4	YES	YES	Very few spinel, some Ru agglomerates
EM07-P-0	8	10/23/2007 17:37	1191	10/24/2007 15:57	22.3	YES	NO	Sample clear of spinel, a few Ru agglomerates
EM07-P-0	8	10/28/2007 14:45	1184	10/29/2007 15:35	24.8	YES	YES	Very few spinel
~~EM07-P-0~~	~~10~~	~~1/28/2008 14:40~~	~~1101~~	~~1/29/2008 14:40~~	24.0	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-P-0~~	~~8~~	~~1/29/2008 14:40~~	~~999~~	~~1/30/2008 14:30~~	23.8	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-P-02	8	6/16/2009 11:20	992	6/17/2009 9:30	22.2	-	YES	
EM07-P-02	5	6/17/2009 10:30	1110	6/18/2009 8:45	22.3	~~--------~~	YES	Small crystals throughout
EM07-P-02	5	7/14/2009 11:45	1165	7/15/2009 10:10	22.4	~~--------~~	YES	Crystals throughout
EM07-P-02	8	7/16/2009 12:15	1215	7/17/2009 13:20	25.1	~~--------~~	YES	Clusters on bottom
EM07-P-02	8	7/22/2009 16:00	1224	7/22/2009 16:00	0.0	~~--------~~	NO	Glass
EM07-P-025	8	10/4/2007 16:06	1048	10/5/2007 15:00	22.9	YES	YES	Undissolved materials, spinel everywhere
EM07-P-025	10	10/4/2007 16:06	944	10/5/2007 15:00	22.9	YES	YES	Surface pigmentation, undissolved materials, spinel everywhere
EM07-P-025	8	10/10/2007 15:15	1148	10/11/2007 13:40	22.4	YES	YES	Few spinel, very small quantity of undissolved material
~~EM07-P-025~~	~~8~~	~~10/11/2007 16:23~~	~~1251~~	~~10/12/2007 14:30~~	22.1	~~-------~~	~~-------~~	~~-------~~
EM07-P-025	10	10/15/2007 17:17	1254	10/16/2007 17:50	24.6	NO	NO	Sample clear
EM07-P-025	10	10/16/2007 18:12	1201	10/17/2007 16:45	22.5	NO	NO	Sample clear
EM07-P-025	10	10/18/2007 17:13	1161	10/19/2007 15:15	22.0	YES	YES	Lots of spinel, some undissolved material
EM07-P-025	10	10/21/2007 14:45	1177	10/22/2007 15:10	24.4	YES	YES	Very few spinel, some Ru agglomerates
EM07-P-025	10	10/22/2007 16:20	1187	10/23/2007 16:53	24.6	YES	YES	One cluster of spinel, some ruthenium oxide
EM07-P-025	10	10/24/2007 16:20	1194	10/25/2007 15:52	23.5	YES	NO	Sample clear of spinel, one small undissolved Ru agglomerate
EM07-P-03	5	6/17/2009 10:30	1110	6/18/2009 8:45	22.3	~~--------~~	YES	Crystals throughout
EM07-P-03	8	6/17/2009 10:30	970	6/18/2009 8:45	22.3	~~--------~~	YES	~~--------~~
EM07-P-03	5	7/14/2009 11:45	1165	7/15/2009 10:10	22.4	~~--------~~	YES	Crystals throughout
EM07-P-03	8	7/16/2009 12:15	1215	7/17/2009 13:20	25.1	~~--------~~	YES	Clusters on bottom

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
EM07-P-03	8	7/22/2009 16:00	1224	7/22/2009 16:00	0.0	---------	YES	Globs at bottom
EM07-P-03	5	7/30/2009 14:35	1234	7/31/2009 14:50	24.2	---------	NO	Glass
~~EM07-Si-30~~	~~10~~	~~10/28/2007 14:45~~	~~1200~~	~~10/29/2007 15:35~~	24.8	---------	---------	~~Volatilized out of crucible~~
EM07-Si-30	5	10/28/2007 14:45	1151	10/29/2007 15:35	24.8	YES	YES	Several spinel, some undissolved material
EM07-Si-30	5	10/29/2007 17:36	1238	10/30/2007 16:25	22.8	?	?	Sample looks very strange, temperature was too high for this glass, altered chemistry
EM07-Si-30	10	10/30/2007 17:36	1190	10/31/2007 16:50	23.2	YES	YES	Lost glass formers - some spinel in reduced glass at bottom
EM07-Si-30	10	1/4/2008 14:05	1194	1/4/2008 18:05	4.0	?	YES	Redox visible, several multi-pronged star-like crystals present throughout bulk
~~EM07-Si-30~~	~~10~~	~~1/7/2008 13:30~~	~~1214~~	~~1/7/2008 17:48~~	4.3	---------	---------	~~Volatilized out of crucible~~
EM07-Si-30	8	1/10/2008 11:06	1205	1/10/2008 14:15	3.1	?	YES	Several multi-pronged star-like crystals throughout bulk, maybe other undissolved mat'ls
EM07-Si-30	8	1/18/2008 10:15	1218	1/18/2008 15:11	4.9	Und. mat'l	Crys.	A few crystals - look like cubes with spines on the corners
EM07-Si-30	8	1/21/2008 13:19	1313	1/21/2008 17:30	4.2	---------	---------	---------
EM07-Si-30	10	1/21/2008 18:21	1213	1/22/2008 17:45	23.4	---------	---------	---------
~~EM07-Si-30~~	~~10~~	~~1/22/2008 12:05~~	~~1060~~	~~1/23/2008 10:47~~	22.7	---------	---------	~~XRD sample only~~
EM07-Si-30	8	1/24/2008 14:24	1229	1/24/2008 18:21	3.9	Und. mat'l	Crys.	Lots of star-like crystals throughout sample
EM07-Si-30	5	1/25/2008 9:20	1335	1/25/2008 15:20	6.0	Und. mat'l	Crys.	Lots of tiny specs (small spinel?)
EM07-Si-30	8	2/7/2008 10:00	1250	2/7/2008 14:00	4.0	Und. mat'l	Crys.	Redox present, several star-like crystals throughout bulk
EM07-Si-30	8	2/12/2008 10:03	1267	2/12/2008 14:42	4.7	Und. mat'l	Crys.	Crystals apparent (just a few)
EM07-Si-30	8	2/13/2008 11:40	1288	2/13/2008 16:05	4.4	?	?	Sample appears clear
EM07-Si-30	8	2/14/2008 12:14	1280	2/14/2008 16:18	4.1	Und. mat'l	Crys.	Some star-like crystals throughout sample
EM07-Si-335	5	6/17/2009 10:30	1110	6/18/2009 8:45	22.3	-	YES	Crystals throughout
EM07-Si-335	8	6/17/2009 10:30	970	6/18/2009 8:45	22.3	---------	YES	---------
EM07-Si-335	8	7/8/2009 15:25	1140	7/9/2009 13:35	22.2	---------	YES	Bottom layer of crystals
EM07-Si-335	8	7/14/2009 11:45	1180	7/15/2009 10:10	22.4	---------	YES	Bottom layer of crystals
EM07-Si-335	8	7/16/2009 12:15	1215	7/17/2009 13:20	25.1	---------	YES	Glass with boil off
EM07-Si-335	5	8/24/2009 15:55	1190	8/25/2009 14:00	22.1	-	YES	Spinel clusters on bottom
EM07-Si-335	5	9/28/2009 11:15	1208	9/29/2009 9:25	22.2	-	YES	Giant spinel peppered
EM07-Si-37	10	10/16/2007 18:12	1201	10/17/2007 16:45	22.5	NO	NO	Sample clear
EM07-Si-37	8	10/16/2007 18:12	999	10/17/2007 16:45	22.5	YES	YES	Lots of spinel, some undissolved material
EM07-Si-37	5	10/16/2007 18:12	1102	10/17/2007 16:45	22.5	YES	YES	Lots of spinel, some undissolved material
EM07-Si-37	10	10/18/2007 17:13	1161	10/19/2007 15:15	22.0	YES	YES	Lots of spinel, some undissolved material
EM07-Si-37	10	10/21/2007 14:45	1177	10/22/2007 15:10	24.4	YES	YES	Lots of spinel, some undissolved material
EM07-Si-37	10	10/22/2007 16:20	1187	10/23/2007 16:53	24.6	YES	YES	Few large spinel throughout bulk, some small clusters of Ru at base
EM07-Si-37	10	10/24/2007 16:20	1194	10/25/2007 15:52	23.5	YES	YES	Few small spinel agglomerates at base, some Ru
~~EM07-Si-37~~	~~5~~	~~1/16/2008 11:05~~	~~1175~~	~~1/17/2008 9:20~~	22.3	---------	---------	~~Volatilized out of crucible~~
~~EM07-Si-37~~	~~10~~	~~1/22/2008 12:05~~	~~1060~~	~~1/23/2008 10:47~~	22.7	---------	---------	~~XRD sample only~~
EM07-Si-50	10	10/16/2007 18:12	1201	10/17/2007 16:45	22.5	YES	NO	Sample clear of spinel, a few small undissolved Ru agglomerates
EM07-Si-50	8	10/16/2007 18:12	999	10/17/2007 16:45	22.5	YES	YES	Extremely crystallized with spinel, undissolved material
EM07-Si-50	5	10/16/2007 18:12	1102	10/17/2007 16:45	22.5	YES	YES	Lots of spinel, some undissolved material
EM07-Si-50	10	10/18/2007 17:13	1161	10/19/2007 15:15	22.0	YES	YES	Lots of tiny spinel, some undissolved material at base
EM07-Si-50	10	10/21/2007 14:45	1177	10/22/2007 15:10	24.4	YES	YES	Lots of little spinel, some undissolved material
EM07-Si-50	10	10/22/2007 16:20	1187	10/23/2007 16:53	24.6	YES	NO	Sample clear of spinel, few Ru agglomerates
EM07-Si-50	10	10/26/2007 17:08	1184	10/27/2007 15:20	22.2	YES	YES	Lots of little spinel throughout, some Ru agglomerates
EM07-Si-50	10	10/30/2007 17:36	1190	10/31/2007 16:50	23.2	YES	YES	Very few spinel (TL probably +10)
EM07-Si-50	10	11/2/2007 16:30	1197	11/3/2007 15:29	23.0	YES	NO	Sample clear of spinel, some Ru
EM07-Si-50	10	11/29/2007 15:47	1202	11/30/2007 15:40	23.9	YES	NO	Sample clear of spinel, some other undissolved mat'ls
~~EM07-Si-50~~	~~10~~	~~1/22/2008 12:05~~	~~1060~~	~~1/23/2008 10:47~~	22.7	---------	---------	~~XRD sample only~~
EM07-Zr-001	10	10/14/2007 12:20	1251	10/15/2007 11:50	23.5	NO	NO	Sample clear of spinel

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
EM07-Zr-001	8	10/14/2007 12:20	1150	10/15/2007 11:50	23.5	YES	YES	Lots of spinel, some undissolved material
EM07-Zr-001	5	10/14/2007 12:20	1053	10/15/2007 11:50	23.5	YES	YES	Lots of undissolved material, spinel everywhere
EM07-Zr-001	8	10/17/2007 17:28	1202	10/18/2007 15:31	22.0	YES	NO	Sample clear of spinel, one small undissolved Ru agglomerate
EM07-Zr-001	8	10/21/2007 14:45	1176	10/22/2007 15:10	24.4	NO	NO	Sample clear
EM07-Zr-001	8	10/24/2007 16:20	1160	10/25/2007 15:52	23.5	YES	YES	Several spinel, some undissolved material
EM07-Zr-001	8	10/29/2007 17:36	1166	10/30/2007 16:25	22.8	YES	YES	Very few spinel
~~EM07-Zr-001~~	~~10~~	~~1/29/2008 14:40~~	~~1101~~	~~1/30/2008 14:30~~	23.8	~~--------~~	~~--------~~	~~XRD sample only~~
~~EM07-Zr-001~~	~~8~~	~~1/29/2008 14:40~~	~~999~~	~~1/30/2008 14:30~~	23.8	~~--------~~	~~--------~~	~~XRD sample only~~
EM07-Zr-05	8	10/4/2007 16:06	1048	10/5/2007 15:00	22.9	YES	YES	Undissolved materials, spinel everywhere
EM07-Zr-05	10	10/4/2007 16:06	944	10/5/2007 15:00	22.9	YES	YES	Surface crystallization, undissolved materials, spinel everywhere
EM07-Zr-05	5	10/10/2007 15:15	1150	10/11/2007 13:40	22.4	YES	YES	Several spinel, some undissolved material
EM07-Zr-05	5	10/11/2007 16:23	1250	10/12/2007 14:30	22.1	NO	NO	Sample clear
EM07-Zr-05	8	10/17/2007 17:28	1202	10/18/2007 15:31	22.0	YES	NO	Sample clear of spinel, a few small undissolved Ru agglomerates
EM07-Zr-05	8	10/21/2007 14:45	1176	10/22/2007 15:10	24.4	YES	YES	Very few spinel, some RuO2 agglomerates
EM07-Zr-05	8	10/23/2007 17:37	1191	10/24/2007 15:57	22.3	NO	NO	Sample clear of spinel
EM07-Zr-05	8	10/28/2007 14:45	1184	10/29/2007 15:35	24.8	YES	YES	Very few spinel
~~EM07-Zr-05~~	~~10~~	~~1/22/2008 12:05~~	~~1060~~	~~1/23/2008 10:47~~	22.7	~~--------~~	~~--------~~	~~XRD sample only~~
HAL-17	10	11/12/2007 16:41	1085	11/13/2007 15:07	22.4	?	YES	Extremely crystallized with spinel, undissolved material
HAL-17	8	11/12/2007 16:41	1270	11/13/2007 15:07	22.4	?	YES	Redox, brown, lots of spinel visible on bottom/side edges
HAL-17	5	11/12/2007 16:41	1099	11/13/2007 15:07	22.4	?	YES	Extremely crystallized with spinel, undissolved material
HAL-17	5	12/31/2007 11:47	1301	12/31/2007 15:51	4.1	YES	YES	Redox visible, spinel in corner visible, glass-ceramic
HAL-17	5	1/3/2008 14:00	1330	1/3/2008 18:14	4.2	?	?	Redox visible, sample clear of spinel
HAL-17	8	1/9/2008 14:35	1314	1/9/2008 18:20	3.8	YES	YES	Redox visible, a few spinel in polished corner
HAL-17	8	2/22/2008 11:42	1325	2/22/2008 15:20	3.6	Und. mat'l	YES	Few spinel in bulk and base with halos around them
HAL-17	5	2/22/2008 11:42	1322	2/22/2008 15:20	3.6	Und. mat'l	YES	Few spinel in bulk and base with halos around them
~~HWL-01Q~~	~~10~~	~~11/13/2007 15:55~~	~~1239~~	~~11/14/2007 14:18~~	22.4	~~------~~	~~------~~	~~Sample volatilized out of crucible~~
HWL-01Q	8	11/13/2007 15:55	994	11/14/2007 14:18	22.4	YES	YES	Lots of spinels and some other undissolved materials
HWL-01Q	5	11/13/2007 15:55	1090	11/14/2007 14:18	22.4	YES	YES	Lots of spinels and some other undissolved materials
HWL-01Q	10	11/15/2007 16:48	1152	11/16/2007 16:42	23.9	YES	NO	No spinel, some other undissolved materials
HWL-01Q	5	11/19/2007 13:30	1121	11/20/2007 11:30	22.0	?	YES	Several spinel throughout sample, some undissolved materials
HWL-01Q	5	11/28/2007 16:04	1138	11/29/2007 14:21	22.3	YES	YES	Several spinel, some other undissolved material present
HWL-01Q	5	12/2/2007 14:57	1148	12/3/2007 14:30	23.5	YES	YES	Very few spinel, some other small undissolved mat'ls
HWL-01Q	5	12/6/2007 16:28	1162	12/7/2007 15:10	22.7	NO	NO	Sample clear of spinel
HWL-01Q	8	12/10/2007 15:50	1157	12/11/2007 15:57	24.1	YES	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-02Q	10	12/2/2007 14:57	1168	12/3/2007 14:30	23.5	YES	YES	Lots of spinel throughout bulk, other undissolved mat'ls (some star-like spinel)
HWL-02Q	8	12/2/2007 14:57	1091	12/3/2007 14:30	23.5	YES	YES	Several large spinel everywhere, other undissolved mat'ls
HWL-02Q	10	12/4/2007 17:22	1191	12/5/2007 16:27	23.1	YES	YES	Spinel present, some star-like crystals (baddeleyite?), and other undissolved mat'ls
HWL-02Q	10	12/9/2007 14:17	1198	12/10/2007 15:00	24.7	YES	YES	Lots of large spinel at base, some throughout bulk, strange pentagonal crystals
HWL-02Q	10	12/12/2007 16:13	1208	12/13/2007 16:13	24.0	YES	NO	Sample clear of spinel, some undissolved materials
HWL-03Q	10	11/13/2007 15:55	1239	11/14/2007 14:18	22.4	NO	NO	Sample clear
HWL-03Q	8	11/13/2007 15:55	994	11/14/2007 14:18	22.4	YES	YES	Lots of spinels and some other undissolved materials
HWL-03Q	5	11/13/2007 15:55	1090	11/14/2007 14:18	22.4	YES	YES	Lots of spinels and some other undissolved materials
HWL-03Q	10	11/15/2007 16:48	1152	11/16/2007 16:42	23.9	NO	NO	Sample clear
HWL-03Q	5	11/19/2007 13:30	1121	11/20/2007 11:30	22.0	?	YES	Several spinel throughout sample, some undissolved materials
HWL-03Q	5	11/28/2007 16:04	1138	11/29/2007 14:21	22.3	YES	YES	Several spinel, some other undissolved material present
HWL-03Q	5	12/2/2007 14:57	1148	12/3/2007 14:30	23.5	YES	NO	Clear of spinel, one small undissolved agglomerate
HWL-04Q	10	12/2/2007 14:57	1168	12/3/2007 14:30	23.5	YES	YES	Lots of spinel throughout bulk, other undissolved mat'ls (some star-like spinel)

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
HWL-04Q	8	12/2/2007 14:57	1091	12/3/2007 14:30	23.5	YES	YES	Several large spinel everywhere, other undissolved mat'ls
~~HWL-04Q~~	10	12/4/2007 17:22	~~1191~~	~~12/5/2007 16:27~~	23.1	~~--------~~	~~--------~~	~~Sample volatilized out of crucible~~
HWL-04Q	10	12/9/2007 14:17	1198	12/10/2007 15:00	24.7	YES	NO	One small cluster of undissolved material, no spinel
HWL-04Q	8	12/10/2007 15:50	1157	12/11/2007 15:57	24.1	YES	YES	Several spinel and other undissolved materials
~~HWL-04Q~~	~~8~~	~~12/11/2007 16:25~~	~~1098~~	~~12/12/2007 14:35~~	22.2	~~--------~~	~~--------~~	~~--------~~
HWL-04Q	10	12/13/2007 15:35	1187	12/14/2007 15:50	24.2	YES	YES	Various shapes/sizes of crystals (cubes, stars, pentagons, etc.)
~~HWL-04Q~~	~~10~~	~~12/20/2007 17:18~~	~~1193~~	~~12/21/2007 16:30~~	23.2	~~--------~~	~~--------~~	~~Volatilized out of crucible~~
~~HWL-05Q~~	~~10~~	~~11/13/2007 15:55~~	~~1239~~	~~11/14/2007 14:18~~	22.4	~~------~~	~~------~~	~~Sample volatilized out of crucible~~
HWL-05Q	8	11/13/2007 15:55	994	11/14/2007 14:18	22.4	YES	YES	Lots of spinels and some other undissolved materials
HWL-05Q	5	11/13/2007 15:55	1090	11/14/2007 14:18	22.4	YES	YES	Several little spinels and some other undissolved materials
HWL-05Q	10	11/15/2007 16:48	1152	11/16/2007 16:42	23.9	NO	NO	Sample clear
HWL-05Q	5	11/19/2007 13:30	1121	11/20/2007 11:30	22.0	?	YES	Very few spinel, some rather large undissolved agglomerates
HWL-05Q	5	11/28/2007 16:04	1138	11/29/2007 14:21	22.3	YES	YES	Several spinel, some other undissolved material present
HWL-05Q	5	12/2/2007 14:57	1148	12/3/2007 14:30	23.5	YES	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-06Q	10	11/13/2007 15:55	1239	11/14/2007 14:18	22.4	NO	NO	Sample clear
HWL-06Q	8	11/13/2007 15:55	994	11/14/2007 14:18	22.4	YES	YES	Lots of spinels and some other undissolved materials
HWL-06Q	5	11/13/2007 15:55	1090	11/14/2007 14:18	22.4	YES	YES	Lots of spinels and some other undissolved materials
HWL-06Q	10	11/15/2007 16:48	1152	11/16/2007 16:42	23.9	YES	YES	Moderate amount of spinel, some other undissolved materials
HWL-06Q	10	11/19/2007 13:30	1161	11/20/2007 11:30	22.0	?	YES	Few cubic structures amongst base of sample, other undissolved materials?
HWL-06Q	10	11/28/2007 16:04	1172	11/29/2007 14:21	22.3	NO	NO	Sample clear
HWL-06Q	10	12/2/2007 14:57	1168	12/3/2007 14:30	23.5	YES	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-07Q	10	11/20/2007 16:05	1050	11/21/2007 14:22	22.3	YES	YES	Lots of spinel equally distributed throughout bulk, some undissolved mat'ls at base
HWL-07Q	8	11/20/2007 16:05	1148	11/21/2007 14:22	22.3	NO	NO	Sample clear
HWL-07Q	5	11/20/2007 16:05	1250	11/21/2007 14:22	22.3	NO	NO	Sample clear, sample volatilized out of crucible
HWL-07Q	8	11/28/2007 16:04	1098	11/29/2007 14:21	22.3	YES	YES	Several spinel and some other undissolved mat'ls (mainly at base)
HWL-07Q	8	12/6/2007 16:28	1126	12/7/2007 15:10	22.7	NO	NO	Sample clear of spinel
HWL-07Q	8	12/13/2007 15:35	1108	12/14/2007 15:50	24.2	YES	YES	Several spinel and other undissolved materials at base on one side
HWL-07Q	8	12/20/2007 17:18	1118	12/21/2007 16:30	23.2	NO	NO	Sample clear
HWL-08Q	10	11/20/2007 16:05	1050	11/21/2007 14:22	22.3	YES	YES	Lots of spinel equally distributed throughout bulk, some undissolved mat'ls at base
HWL-08Q	8	11/20/2007 16:05	1148	11/21/2007 14:22	22.3	?	YES	Few somewhat cubic structures throughout bottom half of sample
HWL-08Q	5	11/20/2007 16:05	1250	11/21/2007 14:22	22.3	NO	NO	Sample clear
HWL-08Q	10	11/28/2007 16:04	1172	11/29/2007 14:21	22.3	NO	NO	Sample clear
HWL-08Q	10	12/2/2007 14:57	1168	12/3/2007 14:30	23.5	NO	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-08Q	8	12/10/2007 15:50	1157	12/11/2007 15:57	24.1	NO	NO	Sample clear
HWL-09Q	10	11/20/2007 16:05	1050	11/21/2007 14:22	22.3	YES	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-09Q	8	11/20/2007 16:05	1148	11/21/2007 14:22	22.3	NO	NO	Sample clear
HWL-09Q	5	11/20/2007 16:05	1250	11/21/2007 14:22	22.3	NO	NO	Sample clear, sample volatilized out of crucible
HWL-09Q	10	11/27/2007 16:00	994	11/28/2007 16:00	24.0	NO	NO	Sample clear
HWL-09Q	5	11/29/2007 15:47	954	11/30/2007 15:40	23.9	YES	YES	Sample full of spinel throughout bulk, some other undissolved mat'ls
HWL-09Q	5	12/4/2007 17:22	974	12/5/2007 16:27	23.1	YES	YES	Some cubic crystals at base and side, other undissolved mat'ls (some appear pentagonal)
HWL-09Q	5	12/12/2007 16:13	983	12/13/2007 16:13	24.0	YES	YES	Few spinel in trails from base, some other undissolved materials
HWL-09Q	5	12/26/2007 16:47	991	12/27/2007 16:20	23.5	YES	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-10Q	10	11/20/2007 16:05	1050	11/21/2007 14:22	22.3	YES	NO	Sample clear of spinel, one large undissolved agglomerate at top of sample
HWL-10Q	8	11/20/2007 16:05	1148	11/21/2007 14:22	22.3	YES	NO	Sample clear of spinel, one small undissolved Ru agglomerate
HWL-10Q	5	11/20/2007 16:05	1250	11/21/2007 14:22	22.3	NO	NO	Sample clear, sample volatilized out of crucible
HWL-10Q	10	11/27/2007 16:00	994	11/28/2007 16:00	24.0	YES	YES	Lots of spinel, some other undissolved material present
HWL-10Q	8	11/29/2007 15:47	1019	11/30/2007 15:40	23.9	YES	YES	Several spinel (mostly at base and sides), some other undissolved mat'ls

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
HWL-10Q	8	12/3/2007 17:37	1033	12/4/2007 16:58	23.3	YES	NO	No spinel, some other undissolved mat'ls
HWL-10Q	8	12/5/2007 17:06	1026	12/6/2007 16:30	23.4	YES	YES	Very few spinels, some other undissolved agglomerates and particles
HWL-11Q	10	11/20/2007 16:05	1050	11/21/2007 14:22	22.3	YES	YES	Lots of spinel (mainly at base/sides) one large undissolved agglomerate
HWL-11Q	8	11/20/2007 16:05	1148	11/21/2007 14:22	22.3	NO	NO	Sample clear
HWL-11Q	5	11/20/2007 16:05	1250	11/21/2007 14:22	22.3	NO	NO	Sample clear, sample volatilized out of crucible
HWL-11Q	8	11/28/2007 16:04	1098	11/29/2007 14:21	22.3	NO	NO	Sample clear
HWL-11Q	10	12/3/2007 17:37	1072	12/4/2007 16:58	23.3	YES	YES	Modest amount of spinel, other undissolved mat'ls
~~HWL-11Q~~	~~10~~	~~12/5/2007 17:06~~	~~1187~~	~~12/6/2007 16:30~~	23.4	~~---------~~	~~---------~~	~~Sample volatilized out of crucible~~
HWL-11Q	10	12/6/2007 16:28	1082	12/7/2007 15:10	22.7	YES	YES	Few spinel, other materials
HWL-11Q	10	12/10/2007 15:50	1090	12/11/2007 15:57	24.1	NO	NO	Sample clear
HWL-12Q	10	11/23/2007 12:25	1045	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-12Q	8	11/23/2007 12:25	1149	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-12Q	5	11/23/2007 12:25	1249	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-12Q	10	11/27/2007 16:00	994	11/28/2007 16:00	24.0	YES	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-12Q	5	11/29/2007 15:47	954	11/30/2007 15:40	23.9	YES	YES	Few patches of spinel at base, some other undissolved mat'ls
HWL-12Q	5	12/4/2007 17:22	974	12/5/2007 16:27	23.1	NO	NO	Sample clear
HWL-12Q	5	12/10/2007 15:50	965	12/11/2007 15:57	24.1	NO	NO	Sample clear
HWL-12Q	5	12/14/2007 16:11	960	12/15/2007 14:20	22.1	NO	NO	Sample clear
HWL-13Q	10	11/23/2007 12:25	1045	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-13Q	8	11/23/2007 12:25	1149	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-13Q	5	11/23/2007 12:25	1249	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-13Q	10	11/27/2007 16:00	994	11/28/2007 16:00	24.0	YES	YES	A few sets of spinel (mainly at base and sides)
HWL-13Q	8	11/29/2007 15:47	1019	11/30/2007 15:40	23.9	YES	YES	Very few spinel (mostly at base and sides), some other undissolved mat'ls
HWL-13Q	8	12/3/2007 17:37	1033	12/4/2007 16:58	23.3	YES	NO	No spinel, some other undissolved mat'ls
HWL-13Q	8	12/5/2007 17:06	1026	12/6/2007 16:30	23.4	NO	NO	Sample clear
HWL-14Q	10	11/23/2007 12:25	1045	11/24/2007 12:13	23.8	YES	YES	Lots of spinel, mostly at base and sides, some large agglomerates of undissolved mat'ls
HWL-14Q	8	11/23/2007 12:25	1149	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-14Q	5	11/23/2007 12:25	1249	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-14Q	8	11/28/2007 16:04	1098	11/29/2007 14:21	22.3	NO	NO	Sample clear
HWL-14Q	10	12/3/2007 17:37	1072	12/4/2007 16:58	23.3	YES	YES	Modest amount of spinel, other undissolved mat'ls
~~HWL-14Q~~	~~10~~	~~12/5/2007 17:06~~	~~1187~~	~~12/6/2007 16:30~~	23.4	~~---------~~	~~---------~~	~~Sample volatilized out of crucible~~
HWL-14Q	10	12/6/2007 16:28	1082	12/7/2007 15:10	22.7	YES	YES	Few spinel, other materials
HWL-14Q	10	12/10/2007 15:50	1090	12/11/2007 15:57	24.1	NO	NO	Sample clear
HWL-15Q	10	11/23/2007 12:25	1045	11/24/2007 12:13	23.8	YES	NO	Sample clear of spinel, one undissolved agglomerate at base
~~HWL-15Q~~	~~8~~	~~11/23/2007 12:25~~	~~1149~~	~~11/24/2007 12:13~~	23.8	~~------~~	~~------~~	~~Volatilized out of crucible~~
HWL-15Q	5	11/23/2007 12:25	1249	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-15Q	10	11/27/2007 16:00	994	11/28/2007 16:00	24.0	YES	YES	Two agglomerates at base, appear to contain some cubic structures (spinel?)
HWL-15Q	8	11/29/2007 15:47	1019	11/30/2007 15:40	23.9	NO	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-15Q	5	11/29/2007 15:47	954	11/30/2007 15:40	23.9	YES	YES	Very few spinel (verify w/ lower temperature run), some other undissolved mat'ls
HWL-15Q	5	12/3/2007 17:37	903	12/4/2007 16:58	23.3	YES	YES	Several streaks of spinel, other undissolved mat'ls
HWL-15Q	5	12/5/2007 17:06	924	12/6/2007 16:30	23.4	YES	YES	Lots of spinel throughout bulk, other undissolved mat'ls
HWL-15Q	5	12/9/2007 14:17	941	12/10/2007 15:00	24.7	YES	YES	Some possibly crystalline materials
HWL-15Q	5	12/11/2007 16:25	948	12/12/2007 14:35	22.2	YES	YES	Few spinel on sides, lots of other undissolved materials
HWL-16Q	10	11/23/2007 12:25	1045	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-16Q	8	11/23/2007 12:25	1149	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-16Q	5	11/23/2007 12:25	1249	11/24/2007 12:13	23.8	NO	NO	Sample clear
HWL-16Q	10	11/27/2007 16:00	994	11/28/2007 16:00	24.0	YES	YES	Few agglomerates, some spinel in trails from sides and at base

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
HWL-16Q	8	11/29/2007 15:47	1019	11/30/2007 15:40	23.9	NO	NO	Sample clear
HWL-16Q	5	11/29/2007 15:47	954	11/30/2007 15:40	23.9	NO	NO	Sample clear
HWL-16Q	5	12/3/2007 17:37	903	12/4/2007 16:58	23.3	YES	YES	Several streaks of spinel, other undissolved mat'ls
HWL-16Q	5	12/5/2007 17:06	924	12/6/2007 16:30	23.4	YES	YES	Lots of crystals- cubic, rectangular, pentagonal, hematite?, others irregularly shaped
HWL-16Q	5	12/9/2007 14:17	941	12/10/2007 15:00	24.7	YES	YES	Spinel and other undissolved materials throughout bulk of sample
HWL-16Q	5	12/11/2007 16:25	948	12/12/2007 14:35	22.2	YES	YES	Lots of spinel and other undissolved material
HWL-16Q	5	12/13/2007 15:35	1003	12/14/2007 15:50	24.2	YES	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-16Q	10	12/21/2007 16:57	1000	12/22/2007 15:50	22.9	YES	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-17Q	10	11/26/2007 16:30	995	11/27/2007 15:08	22.6	?	Yes	Several spinel throughout sample, some undissolved materials
HWL-17Q	8	11/26/2007 16:30	1063	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-17Q	5	11/26/2007 16:30	1152	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-17Q	8	11/29/2007 15:47	1019	11/30/2007 15:40	23.9	YES	YES	Very few spinel (mostly at sides), some other undissolved mat'ls
HWL-17Q	8	12/3/2007 17:37	1033	12/4/2007 16:58	23.3	YES	NO	No spinel, some other undissolved mat'ls
HWL-17Q	8	12/5/2007 17:06	1026	12/6/2007 16:30	23.4	YES	YES	Few spinel (base and sides), some other undissolved materials
HWL-18Q	10	11/26/2007 16:30	995	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-18Q	8	11/26/2007 16:30	1063	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-18Q	5	11/26/2007 16:30	1152	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-18Q	5	11/29/2007 15:47	954	11/30/2007 15:40	23.9	NO	NO	Sample clear
HWL-18Q	5	12/3/2007 17:37	903	12/4/2007 16:58	23.3	YES	NO	Sample clear
HWL-18Q	10	12/17/2007 11:53	861	12/18/2007 13:38	25.8	YES	NO	Sample clear of spinel, a few undissolved agglomerates
HWL-18Q	10	12/19/2007 17:52	869	12/20/2007 16:30	22.6	NO	NO	Sample clear
HWL-18Q	8	12/21/2007 16:57	802	12/23/2007 14:45	45.8	YES	YES	Very few spinel
HWL-18Q	8	12/26/2007 16:47	816	12/27/2007 16:20	23.5	YES	YES	Several spinel through bulk
HWL-18Q	8	12/28/2007 17:08	844	12/30/2007 17:29	48.4	YES	NO	No spinel present, some other undissolved mat'ls
HWL-18Q	8	12/31/2007 16:30	820	1/2/2008 13:51	45.3	YES	YES	Lots of spinel trails visible throughout bulk, other undissolved mat'ls
HWL-18Q	8	1/2/2008 14:12	833	1/4/2008 13:20	47.1	YES	YES	One small trail of spinel in bulk, other undissolved materials present
HWL-18Q	8	1/4/2008 13:55	825	1/6/2008 14:50	48.9	YES	YES	Several spinel and other undissolved materials in streams through bulk
HWL-19Q	10	11/26/2007 16:30	995	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-19Q	8	11/26/2007 16:30	1063	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-19Q	5	11/26/2007 16:30	1152	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-19Q	5	11/29/2007 15:47	954	11/30/2007 15:40	23.9	NO	NO	Sample clear
HWL-19Q	8	12/17/2007 11:53	895	12/18/2007 13:38	25.8	-	_____	_____
HWL-19Q	10	12/19/2007 17:52	869	12/20/2007 16:30	22.6	YES	YES	Sample full of spinel throughout bulk, some other undissolved mat'ls
HWL-19Q	10	12/26/2007 16:47	899	12/27/2007 16:20	23.5	YES	YES	Lots of undissolved materials (some appear cubic, others round)
HWL-19Q	10	1/3/2008 14:46	924	1/4/2008 13:20	22.6	YES	NO	Sample clear of spinel, possibly some undissolved materials
HWL-19Q	10	1/7/2008 17:50	909	1/8/2008 15:55	22.1	YES	YES	Some spinel and other materials in streams
HWL-19Q	10	1/8/2008 17:20	915	1/10/2008 16:08	46.8	?	NO	Sample clear of spinel, possibly some undissolved materials
HWL-20Q	10	11/26/2007 16:30	995	11/27/2007 15:08	22.6	YES	YES	Several little spinel (at base and sides), some other undissolved mat'ls
HWL-20Q	8	11/26/2007 16:30	1063	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-20Q	5	11/26/2007 16:30	1152	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-20Q	8	11/29/2007 15:47	1019	11/30/2007 15:40	23.9	YES	YES	Very few spinel (mostly at sides and base), some other undissolved mat'ls
HWL-20Q	8	12/3/2007 17:37	1033	12/4/2007 16:58	23.3	YES	NO	No spinel, some other undissolved mat'ls
HWL-20Q	8	12/5/2007 17:06	1026	12/6/2007 16:30	23.4	YES	YES	Very few spinel at base, some other undissolved materials
HWL-21Q	10	11/26/2007 16:30	995	11/27/2007 15:08	22.6	YES	YES	Lots of spinel throughout, some other undissolved materials
HWL-21Q	8	11/26/2007 16:30	1063	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-21Q	5	11/26/2007 16:30	1152	11/27/2007 15:08	22.6	NO	NO	Sample clear
HWL-21Q	8	11/29/2007 15:47	1019	11/30/2007 15:40	23.9	YES	YES	Very few spinel (mostly at sides and base), some other undissolved mat'ls

Content	*Fur*	*IN / H.T. START*	*TEMP*	*OUT / H.T. FINISH*	*Dur. (hrs)*	*Undis. NM*	*Spinel*	*Total Observations*
HWL-21Q	8	12/3/2007 17:37	1033	12/4/2007 16:58	23.3	YES	YES	Very few spinel
HWL-21Q	8	12/12/2007 16:13	1043	12/13/2007 16:13	24.0	NO	NO	Sample clear
HWL-22Q	10	12/2/2007 14:57	1168	12/3/2007 14:30	23.5	NO	NO	Sample clear of spinel, some other undissolved mat'ls
HWL-22Q	8	12/2/2007 14:57	1091	12/3/2007 14:30	23.5	YES	YES	Few spinel at base, what appears to be hematite, some other undissolved mat'ls
~~HWL-22Q~~	~~5~~	~~12/6/2007 16:28~~	~~1162~~	~~12/7/2007 15:10~~	22.7	~~--------~~	~~--------~~	~~Sample volatilized out of crucible~~
HWL-22Q	8	12/9/2007 14:17	1074	12/10/2007 15:00	24.7	YES	YES	Several streak of spinel, some other undissolved materials
HWL-22Q	8	12/11/2007 16:25	1098	12/12/2007 14:35	22.2	NO	NO	Sample clear
SRM-773	10	10/1/2007 13:22	~~--------~~	10/2/2007 14:08	24.8	N/A	N/A	Crystals
SRM-773	8	10/1/2007 13:22	~~--------~~	10/2/2007 14:08	24.8	N/A	N/A	Crystals
SRM-773	5	10/1/2007 13:22	~~--------~~	10/2/2007 14:08	24.8	N/A	N/A	Crystals
SRM-773	10	10/2/2007 16:08	~~--------~~	10/3/2007 15:12	23.1	N/A	N/A	Crystals
SRM-773	8	10/2/2007 16:08	~~--------~~	10/3/2007 15:12	23.1	N/A	N/A	No crystals
SRM-773	5	10/2/2007 16:08	~~--------~~	10/3/2007 15:12	23.1	N/A	N/A	Crystals
SRM-773	10	10/3/2007 15:49	~~--------~~	10/4/2007 15:00	23.2	N/A	N/A	No crystals
SRM-773	8	10/3/2007 15:49	~~--------~~	10/4/2007 15:00	23.2	N/A	N/A	Crystals
SRM-773	5	10/3/2007 15:49	~~--------~~	10/4/2007 15:00	23.2	N/A	N/A	Crystals
SRM-773	5	10/4/2007 16:06	~~--------~~	10/5/2007 15:00	22.9	N/A	N/A	No crystals
SRM-773	5	10/7/2007 14:36	~~--------~~	10/8/2007 15:30	24.9	N/A	N/A	Crystals

Appendix E: Crystal Fraction Data

This section presents the data obtained by performing XRD on heat treated specimens from each glass sample run at different temperatures. The temperature (T) versus crystal mass fraction (C_F) data was plotted and the resulting trend line was presented in Table E.1 as $T = Slope \times C_F + Y\text{-Int}$ and thus Y-Int is equal to the T_L value obtained using the crystal fraction method.

Table E.1. Summary of Crystal Mass Fraction Data for EM07 Glasses. The slope, Y-Int, and correlation coefficient (R^2) are statistical parameters fit to the temperature as a function of the concentration of trevorite (spinel). The Y-Int listed in the table corresponds to the calculated data for T_L using the crystal fraction method.

Glass ID	Trevorite	Zircon	Total Crys.	Glass	Temp. (°C)	Slope	*Y*-Int.	R^2
EM07-BL-1	2.0		2.0	98.0	944	-116.18	1181	0.985
EM07-BL-1	0.2		0.2	99.8	1148			
EM07-BL-1	0.8		0.8	99.2	1103			
EM07-BL-1	1.1		1.1	98.9	1051			
EM07-Al-06	1.6		1.6	98.4	947	-84.62	1086	0.991
EM07-Al-06	0.8		0.8	99.2	1026			
EM07-Al-06	0.4		0.4	99.6	1051			
EM07-Al-06	0.1		0.1	99.9	1074			
EM07-Al-15	1.0		1.0	99.0	1190	-135.14	1297	0.864
EM07-Al-15	1.8		1.8	98.2	1051			
EM07-Al-15	0.9		0.9	99.1	1151			
EM07-Al-20	2.4		2.4	97.6	1140	-101.04	1380	0.999
EM07-Al-20	3.1		3.1	96.9	1065			
EM07-Al-20	1.5		1.5	98.5	1227			
EM07-B-05	0.5		0.5	99.5	1157	-107.71	1228	0.923
EM07-B-05	1.5		1.5	98.5	1103			
EM07-B-05	1.6		1.6	98.4	1051			
EM07-B-05	2.5		2.5	97.5	942			
EM07-B-15	1.0		1.0	99.0	1051	-66.13	1107	0.879
EM07-B-15	1.4		1.4	98.6	999			
EM07-B-15	2.1		2.1	97.9	974			
EM07-B-20	1.1		1.1	98.9	942	-172.08	1143	0.971
EM07-B-20	0.7		0.7	99.3	1042			
EM07-B-20	0.2		0.2	99.8	1102			
EM07-B-20	0.1		0.1	99.9	1123			
EM07-Bi-025	1.9		1.9	98.1	942	-121.40	1173	0.952
EM07-Bi-025	0.9		0.9	99.1	1042			
EM07-Bi-025	0.8		0.8	99.2	1103			
EM07-Bi-025	0.1		0.1	99.9	1157			
EM07-Bi-05	1.6		1.6	98.4	942	-146.30	1174	0.980
EM07-Bi-05	0.8		0.8	99.2	1042			
EM07-Bi-05	0.6		0.6	99.4	1103			

EM07-Bi-05	0.1		0.1	99.9	1157			
EM07-Ca-035	2.3		2.3	97.7	915	-92.52	1126	0.976
EM07-Ca-035	2.0		2.0	98.0	947			
EM07-Ca-035	1.2		1.2	98.8	999			
EM07-Ca-035	0.7		0.7	99.3	1053			
EM07-Ca-035	0.4		0.4	99.6	1103			
EM07-Ca-07	1.6		1.6	98.4	942	-104.44	1112	0.989
EM07-Ca-07	0.4		0.4	99.6	1073			
EM07-Ca-07	0.6		0.6	99.4	1042			
EM07-Ca-07	1.1		1.1	98.9	1003			
EM07-Cr-001	1.6		1.6	98.4	915	-86.68	1067	0.904
EM07-Cr-001	1.3		1.3	98.7	974			
EM07-Cr-001	0.6		0.6	99.4	996			
EM07-Cr-001	0.6		0.6	99.4	1026			
EM07-Cr-001	0.2		0.2	99.8	1051			
EM07-Cr-012	1.9		1.9	98.1	1099	-125.46	1320	0.979
EM07-Cr-012	2.5		2.5	97.5	996			
EM07-Cr-012	0.9		0.9	99.1	1201			
EM07-F-02	0.2		0.2	99.8	1148	-158.34	1182	0.994
EM07-F-02	0.9		0.9	99.1	1048			
EM07-F-02	1.1		1.1	98.9	1001			
EM07-F-02	1.5		1.5	98.5	944			
EM07-Fe-05	1.4		1.4	98.6	844	-154.57	1065	0.995
EM07-Fe-05	1.0		1.0	99.0	915			
EM07-Fe-05	0.8		0.8	99.2	947			
EM07-Fe-05	0.4		0.4	99.6	996			
EM07-Fe-05	0.1		0.1	99.9	1051			
EM07-Fe-15	2.0		2.0	98.0	1051	-110.02	1270	0.991
EM07-Fe-15	1.0		1.0	99.0	1151			
EM07-Fe-15	0.8		0.8	99.2	1190			
EM07-Fe-15	0.5		0.5	99.5	1214			
EM07-Fe-20	3.9		3.9	96.1	1051	-88.21	1398	0.989
EM07-Fe-20	2.9		2.9	97.1	1151			
EM07-Fe-20	2.3		2.3	97.7	1190			
EM07-K-03	0.2		0.2	99.8	1089	-101.06	1105	0.985
EM07-K-03	0.7		0.7	99.3	1026			
EM07-K-03	1.1		1.1	98.9	999			
EM07-K-03	1.3		1.3	98.7	974			
EM07-K-06	1.8		1.8	98.2	849	-112.86	1048	0.983
EM07-K-06	0.7		0.7	99.3	974			
EM07-K-06	1.2		1.2	98.8	903			
EM07-Li-015	1.4		1.4	98.6	1053	-165.00	1283	1.000
EM07-Li-015	0.8		0.8	99.2	1150			
EM07-Li-015	0.2		0.2	99.8	1251			
EM07-Li-04	0.6		0.6	99.4	1053	-60.13	1075	0.902
EM07-Li-04	2.0		2.0	98.0	974			
EM07-Li-04	2.5		2.5	97.5	915			

EM07-Li-04	1.0		1.0	99.0	1003			
EM07-Li-04	1.0		1.0	99.0	1001			
EM07-Mn-01	1.7		1.7	98.3	944	-113.10	1134	0.987
EM07-Mn-01	0.8		0.8	99.2	1048			
EM07-Mn-01	1.1		1.1	98.9	1003			
EM07-Mn-04	1.0		1.0	99.0	1042	-91.87	1143	0.859
EM07-Mn-04	0.3		0.3	99.7	1148			
EM07-Mn-04	1.1		1.1	98.9	1001			
EM07-Mn-04	2.4		2.4	97.6	942			
EM07-Na-20	0.1		0.1	99.9	999	-90.95	1006	0.998
EM07-Na-20	0.6		0.6	99.4	949			
EM07-Na-20	1.1		1.1	98.9	903			
EM07-Na-20	1.8		1.8	98.2	844			
EM07-Ni-001	1.1		1.1	98.9	903	-156.46	1076	0.990
EM07-Ni-001	1.0		1.0	99.0	915			
EM07-Ni-001	0.5		0.5	99.5	1009			
EM07-Ni-001	0.1		0.1	99.9	1051			
EM07-Ni-001	0.0		0.0	100.0	1078			
EM07-Ni-02	0.9		0.9	99.1	1151	-115.00	1264	0.982
EM07-Ni-02	0.6		0.6	99.4	1200			
EM07-Ni-02	1.9		1.9	98.1	1060			
EM07-Ni-02	2.2		2.2	97.8	1001			
EM07-P-0	2.2		2.2	97.8	949	-104.87	1174	0.987
EM07-P-0	1.6		1.6	98.4	999			
EM07-P-0	1.7		1.7	98.3	1001			
EM07-P-0	1.1		1.1	98.9	1047			
EM07-P-0	0.3		0.3	99.7	1150			
EM07-P-025	2.2		2.2	97.8	944	-121.00	1202	0.980
EM07-P-025	1.1		1.1	98.9	1048			
EM07-P-025	0.4		0.4	99.6	1161			
EM07-P-025	0.5		0.5	99.5	1148			
EM07-Si-37	2.8		2.8	97.2	999	-73.17	1198	0.879
EM07-Si-37	1.5		1.5	98.5	1102			
EM07-Si-37	0.7		0.7	99.3	1161			
EM07-Si-37	1.4		1.4	98.6	1060			
EM07-Si-50	1.3		1.3	98.7	999	-147.26	1184	0.960
EM07-Si-50	0.6		0.6	99.4	1102			
EM07-Si-50	0.2		0.2	99.8	1161			
EM07-Si-50	0.7		0.7	99.3	1060			
EM07-Zr-001	0.2		0.2	99.8	1150	-93.50	1160	0.975
EM07-Zr-001	0.6		0.6	99.4	1101			
EM07-Zr-001	1.0		1.0	99.0	1053			
EM07-Zr-001	1.8		1.8	98.2	999			
EM07-Zr-05	2.1		2.1	97.9	944	-108.24	1170	1.000
EM07-Zr-05	0.2		0.2	99.8	1150			
EM07-Zr-05	1.0		1.0	99.0	1060			
EM07-NM-	0.4		0.4	99.6	1170	-129.81	1220	0.999

0025								
EM07-NM-0025	0.6		0.6	99.4	1140			
EM07-NM-0025	1.2		1.2	98.8	1065			
EM07-BL-2	1.9		1.9	98.1	996.0	-96.92	1182	0.995
EM07-BL-2	1.4		1.4	98.6	1051.0			
EM07-BL-2	0.8		0.8	99.2	1103.0			
EM07-Cr-02	2.7		2.7	97.3	1099	-189.35	1603	0.958
EM07-Cr-02	3.1		3.1	96.9	996			
EM07-Cr-02	2.3		2.3	97.7	1201			
EM07-Cr-02	1.6		1.6	98.4	1281			
EM07-Na-05	5.5	2.0	7.5	92.5	1048			
EM07-Na-05	4.5	1.6	6.1	93.9	1148			
EM07-Na-10	2.5		2.5	97.5	1048	-150.00	1424	0.999
EM07-Na-10	1.2		1.2	98.8	1250			
EM07-Na-10	0.8		0.8	99.2	1300			
EM07-Si-30	2.1		2.1	97.9	1060	-101.93	1284	0.940
EM07-Si-30	1.5		1.5	98.5	1151			
EM07-Si-30	0.8		0.8	99.2	1194			

Appendix F: Toxicity Characteristic Leach Procedure (TCLP) Results

F.1 TCLP Metals Results for Quenched Glasses

Table F.1. TCLP Metals Results for Quenched EM07-BL-1

Client ID: 07310-001 (TCLP) Sample ID : L07120521-02
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1508
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1508
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1508
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1508
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1508
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1508
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1508
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1631

Table F.2. TCLP Metals Results for Quenched EM07-Al-06

Client ID: 07310-003 (TCLP) Sample ID : L07121715-02
Date Collected: 12/12/2007 1445
Matrix : Leachate Date Received : 12/14/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1710
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/02/2008	1710
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/02/2008	1710
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1710
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1710
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/02/2008	1710
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1710
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/31/2007	1808

Table F.3. TCLP Metals Results for Quenched EM07-Al-15

Client ID: 07310-005 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-02 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1605
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1605
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1605
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1605
LEAD, TOTAL		0.20		0.10	5.0	mg/l	BDL	01/28/2008	1605
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1605
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1605
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1006

Table F.4. TCLP Metals Results for Quenched EM07-Al-20

Client ID: 07310-007 (TCLP) Sample ID : L07120521-08
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010D									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1519
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1519
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1519
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1519
LEAD, TOTAL		0.15		0.10	5.0	mg/l	BDL	12/11/2007	1519
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1519
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1519
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/13/2007	1638

Table F.5. TCLP Metals Results for Quenched EM07-B-05

Client ID: 07310-009 (TCLP) Sample ID : L07120521-12
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1526
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1526
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1526
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1526
LEAD, TOTAL		0.18		0.10	5.0	mg/l	BDL	12/11/2007	1526
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1526
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1526
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1641

Table F.6. TCLP Metals Results for Quenched EM07-B-15

Client ID: 07310-011 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-04 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1608
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1608
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1608
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1608
LEAD, TOTAL		0.13		0.10	5.0	mg/l	BDL	01/28/2008	1608
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1608
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1608
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1008

Table F.7. TCLP Metals Results for Quenched EM07-B-20

Client ID: 07310-013 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-06 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1612
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1612
CADMIUM, TOTAL		0.072		0.050	1.0	mg/l	BDL	01/28/2008	1612
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1612
LEAD, TOTAL		0.13		0.10	5.0	mg/l	BDL	01/28/2008	1612
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1612
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1612
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1009

Table F.8. TCLP Metals Results for Quenched EM07-Bi-025

Client ID: 07310-015 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-08 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1616
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1616
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1616
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1616
LEAD, TOTAL		0.12		0.10	5.0	mg/l	BDL	01/28/2008	1616
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1616
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1616
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1010

Table F.9. TCLP Metals Results for Quenched EM07-Bi-05

Client ID: 07310-017 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-10 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1619
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1619
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1619
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1619
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1619
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1619
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1619
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1012

Table F.10. TCLP Metals Results for Quenched EM07-Ca-035

Client ID: 07310-019 (TCLP) Sample ID : L07121715-04
Date Collected: 12/12/2007 1445
Matrix : Leachate Date Received : 12/14/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1714
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/02/2008	1714
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/02/2008	1714
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1714
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1714
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/02/2008	1714
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1714
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/31/2007	1809

Table F.11. TCLP Metals Results for Quenched EM07-Ca-07

Client ID: 07310-021 (TCLP) Sample ID : L07120521-14
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1530
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1530
CADMIUM, TOTAL		0.079		0.050	1.0	mg/l	BDL	12/11/2007	1530
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1530
LEAD, TOTAL		0.13		0.10	5.0	mg/l	BDL	12/11/2007	1530
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1530
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1530
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1642

Table F.12. TCLP Metals Results for Quenched EM07-Cr-001

Client ID: 07310-023 (TCLP) Sample ID : L07120521-16
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1534
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1534
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1534
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1534
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1534
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1534
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1534
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1643

Table F.13. TCLP Metals Results for Quenched EM07-Cr-012

Client ID: 07310-025 (TCLP) Sample ID : L07121715-06
Date Collected: 12/12/2007 1445
Matrix : Leachate Date Received : 12/14/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1717
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/02/2008	1717
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/02/2008	1717
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1717
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1717
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/02/2008	1717
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1717
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/31/2007	181[illegible]

Table F.14. TCLP Metals Results for Quenched EM07-Cr-02

Client ID: 07310-027 (TCLP) Sample ID : L07120521-22
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1603
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1603
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1603
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1603
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1603
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1603
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1603
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1649

Table F.15. TCLP Metals Results for Quenched EM07-F-02

Client ID: 07310-029 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-12 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1629
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1629
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1629
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1629
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1629
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1629
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1629
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1016

Table F.16. TCLP Metals Results for Quenched EM07-Fe-05

Client ID: 07310-031 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-14 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1632
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1632
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1632
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1632
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1632
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1632
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1632
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1017

Table F.17. TCLP Metals Results for Quenched EM07-Fe-15

Client ID: 07310-033 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-16 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1636
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1636
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1636
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1636
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1636
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1636
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1636
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1019

Table F.18. TCLP Metals Results for Quenched EM07-Fe-20

Client ID: 07310-035 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-18 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1647
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1647
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1647
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1647
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1647
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1647
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1647
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1020

Table F.19. TCLP Metals Results for Quenched EM07-K-03

Client ID: 07310-037 (TCLP) Sample ID : L07121715-08
Date Collected: 12/12/2007 1145
Matrix : Leachate Date Received : 12/14/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1721
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/02/2008	1721
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/02/2008	1721
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1721
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1721
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/02/2008	1721
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1721
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/31/2007	1815

Table F.20. TCLP Metals Results for Quenched EM07-K-06

Client ID: 07310-039 (TCLP) Sample ID : L07120521-32
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1621
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1621
CADMIUM, TOTAL		0.065		0.050	1.0	mg/l	BDL	12/11/2007	1621
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1621
LEAD, TOTAL		0.12		0.10	5.0	mg/l	BDL	12/11/2007	1621
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1621
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1621
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1658

Table F.21. TCLP Metals Results for Quenched EM07-Li-015

Client ID: 07310-041 (TCLP) Sample ID : L07121715-10
Date Collected: 12/12/2007 1445
Matrix : Leachate Date Received : 12/14/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1725
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/02/2008	1725
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/02/2008	1725
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1725
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1725
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/02/2008	1725
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1725
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/31/2007	1816

Table F.22. TCLP Metals Results for Quenched EM07-Li-04

Client ID: 07310-043 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-20 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1651
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1651
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1651
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1651
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1651
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1651
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1651
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1021

Table F.23. TCLP Metals Results for Quenched EM07-Mn-01

Client ID: 07310-045 (TCLP) Sample ID : L07120521-34
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1632
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1632
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1632
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1632
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1632
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1632
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1632
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1659

Table F.24. TCLP Metals Results for Quenched EM07-Mn-04

Client ID: 07310-047 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-22 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1701
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1701
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1701
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1701
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1701
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1701
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1701
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1025

Table F.25. TCLP Metals Results for Quenched EM07-Na-05

Client ID: 07310-049 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-24 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1705
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1705
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1705
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1705
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1705
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1705
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1705
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1026

Table F.26. TCLP Metals Results for Quenched EM07-Na-10

Client ID: 07310-051 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-26 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1709
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1709
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1709
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1709
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1709
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1709
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1709
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1028

Table F.27. TCLP Metals Results for Quenched EM07-Na-20

Client ID: 07310-053 (TCLP) Sample ID : L07121715-12
Date Collected: 12/12/2007 1445
Matrix : Leachate Date Received : 12/14/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1728
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/02/2008	1728
CADMIUM, TOTAL		0.057		0.050	1.0	mg/l	BDL	01/02/2008	1728
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1728
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1728
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/02/2008	1728
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1728
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/31/2007	1818

Table F.28. TCLP Metals Results for Quenched EM07-Ni-001

Client ID: 07310-055 (TCLP) Sample ID : L07120521-36
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1636
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1636
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1636
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1636
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1636
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1636
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1636
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1701

Table F.29. TCLP Metals Results for Quenched EM07-Ni-02

Client ID: 07310-057 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-23 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1712
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1712
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1712
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1712
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1712
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1712
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1712
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1032

Table F.30. TCLP Metals Results for Quenched EM07-P-0

Client ID: 07310-059 (TCLP) Sample ID : L07121715-14
Date Collected: 12/12/2007 1445
Matrix : Leachate Date Received : 12/14/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1745
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/02/2008	1745
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/02/2008	1745
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1745
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1745
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/02/2008	1745
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/02/2008	1745
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/31/2007	1819

Table F.31. TCLP Metals Results for Quenched EM07-P-025

Client ID: 07310-061 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-30 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1716
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1716
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1716
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1716
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1716
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1716
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1716
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1033

Table F.32. TCLP Metals Results for Quenched EM07-Si-30

Client ID: 07310-063 (TCLP) Sample ID : L07120521-38
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1639
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1639
CADMIUM, TOTAL		0.20		0.050	1.0	mg/l	BDL	12/11/2007	1639
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1639
LEAD, TOTAL		0.41		0.10	5.0	mg/l	BDL	12/11/2007	1639
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1639
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1639
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1702

Table F.33. TCLP Metals Results for Quenched EM07-Si-37

Client ID: 07310-065 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-32 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1720
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1720
CADMIUM, TOTAL		0.070		0.050	1.0	mg/l	BDL	01/28/2008	1720
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1720
LEAD, TOTAL		0.15		0.10	5.0	mg/l	BDL	01/28/2008	1720
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1720
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1720
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1035

Table F.34. TCLP Metals Results for Quenched EM07-Si-50

Client ID: 07310-067 (TCLP) Sample ID : L07120521-40
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1643
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1643
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1643
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1643
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1643
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1643
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1643
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1703

Table F.35. TCLP Metals Results for Quenched EM07-Zr-001

Client ID: 07310-069 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-34 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1731
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1731
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1731
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1731
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1731
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1731
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1731
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1036

Table F.36. TCLP Metals Results for Quenched EM07-Zr-05

Client ID: 07310-071 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-36 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1734
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1734
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1734
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1734
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1734
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1734
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1734
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1037

Table F.37. TCLP Metals Results for Quenched EM07-NM-0025

Client ID: 07310-073 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-38 Date Received : 01/15/2008

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1738
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1738
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1738
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1738
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1738
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1738
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1738
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1039

Table F.38. TCLP Metals Results for Quenched EM07-BL-2

Client ID: 07310-075 (TCLP) Date Collected: 01/10/2008 0830
Sample ID: L08011602-40 Date Received : 01/15/2008

Parameter		Result	Qual	MDL	Limit	Units	Analyst	Date	Time
Matrix : Leachate									
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1742
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	01/28/2008	1742
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	01/28/2008	1742
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1742
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1742
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	01/28/2008	1742
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	01/28/2008	1742
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	01/31/2008	1046

F.2 TCLP Metals Results for CCC-Treated Glasses

Table F.39. TCLP Metals Results for CCC-Treated EM07-BL-1

Client ID: 07310-002 (TCLP) Sample ID : L07120311-02
Date Collected: 11/28/2007 1530
Matrix : Leachate Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1319
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1319
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1319
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1319
LEAD, TOTAL		0.12		0.10	5.0	mg/l	BDL	12/11/2007	1319
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1319
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1319
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1808

Table F.40. TCLP Metals Results for CCC-Treated EM07-Al-06

Client ID: 07310-004 (TCLP) Sample ID : L07120521-04
Date Collected: 12/03/2007 1400
Matrix : Leachate Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1512
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1512
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1512
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1512
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1512
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1512
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1512
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1633

Table F.41. TCLP Metals Results for CCC-Treated EM07-Al-15

Client ID: 07310-006 (TCLP) | Sample ID : L07120521-06
Matrix : Leachate | Date Collected: 12/03/2007 1400
Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1516
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1516
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1516
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1516
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1516
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1516
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1516
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1637

Table F.42. TCLP Metals Results for CCC-Treated EM07-Al-20

Client ID: 07310-000 (TCLP) | Sample ID : L07120521-10
Matrix : Leachate | Date Collected: 12/03/2007 1400
Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1523
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1523
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1523
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1523
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1523
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1523
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1523
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1639

Table F.43. TCLP Metals Results for CCC-Treated EM07-B-05

Client ID: 07310-010 (TCLP) | Sample ID : L07112106-02
Matrix : Leachate | Date Collected: 11/19/2007 0930
Date Received : 11/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1641
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1641
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/04/2007	1641
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1641
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1641
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1641
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1641
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1800

Table F.44. TCLP Metals Results for CCC-Treated EM07-B-15

Client ID: 07310-012 (TCLP) Sample ID : L07120311-04
Date Collected: 11/28/2007 1530
Matrix : Leachate Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1323
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1323
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1323
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1323
LEAD, TOTAL		0.12		0.10	5.0	mg/l	BDL	12/11/2007	1323
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1323
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1323
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1809

Table F.45. TCLP Metals Results for CCC-Treated EM07-B-20

Client ID: 07310-014 (TCLP) Sample ID : L07120311-06
Date Collected: 11/28/2007 1530
Matrix : Leachate Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1326
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1326
CADMIUM, TOTAL		0.10		0.050	1.0	mg/l	BDL	12/11/2007	1326
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1326
LEAD, TOTAL		0.20		0.10	5.0	mg/l	BDL	12/11/2007	1326
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1326
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1326
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1813

Table F.46. TCLP Metals Results for CCC-Treated EM07-Bi-025

Client ID: 07310-016 (TCLP) Sample ID : L07112106-04
Date Collected: 11/19/2007 0930
Matrix : Leachate Date Received : 11/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1645
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1645
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/04/2007	1645
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1645
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1645
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1645
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1645
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1801

Table F.47. TCLP Metals Results for CCC-Treated EM07-Bi-05

Client ID: 07310-018 (TCLP) Sample ID : L07120311-08
Date Collected: 11/28/2007 1530
Matrix : Leachate Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1337
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1337
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1337
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1337
LEAD, TOTAL		0.10		0.10	5.0	mg/l	BDL	12/11/2007	1337
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1337
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1337
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1815

Table F.48. TCLP Metals Results for CCC-Treated EM07-Ca-035

Client ID: 07310-020 (TCLP) Sample ID : L07120311-10
Date Collected: 11/28/2007 1530
Matrix : Leachate Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	J	0.10	5.0	mg/l	BDL	12/11/2007	1341
BARIUM, TOTAL	<	0.20	J	0.20	100	mg/l	BDL	12/11/2007	1341
CADMIUM, TOTAL	<	0.050	J	0.050	1.0	mg/l	BDL	12/11/2007	1341
CHROMIUM, TOTAL	<	0.10	J	0.10	5.0	mg/l	BDL	12/11/2007	1341
LEAD, TOTAL		0.10		0.10	5.0	mg/l	BDL	12/11/2007	1341
SELENIUM, TOTAL	<	0.10	J	0.10	1.0	mg/l	BDL	12/11/2007	1341
SILVER, TOTAL	<	0.10	J	0.10	5.0	mg/l	BDL	12/11/2007	1341
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	J	0.0020	0.20	mg/l	DHR	12/06/2007	1816

Table F.49. TCLP Metals Results for CCC-Treated EM07-Ca-07

Client ID: 07310-022 (TCLP) | Sample ID : L07120311-12
Matrix : Leachate | Date Collected: 11/28/2007 1530
Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1344
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1344
CADMIUM, TOTAL		0.053		0.050	1.0	mg/l	BDL	12/11/2007	1344
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1344
LEAD, TOTAL		0.12		0.10	5.0	mg/l	BDL	12/11/2007	1344
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1344
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1344
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1817

Table F.50. TCLP Metals Results for CCC-Treated EM07-Cr-001

Client ID: 07310-024 (TCLP) | Sample ID : L07120521-18
Matrix : Leachate | Date Collected: 12/03/2007 1400
Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1537
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1537
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1537
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1537
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1537
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1537
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1537
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1645

Table F.51. TCLP Metals Results for CCC-Treated EM07-Cr-012

Client ID: 07310-026 (TCLP) | Sample ID : L07120521-20
Matrix : Leachate | Date Collected: 12/03/2007 1400
Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1548
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1548
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1548
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1548
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1548
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1548
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1548
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1646

Table F.52. TCLP Metals Results for CCC-Treated EM07-Cr-02

Client ID: 07310-028 (TCLP) | Sample ID : L07120521-24
Matrix : Leachate | Date Collected: 12/03/2007 1400
Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1607
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1607
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1607
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1607
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1607
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1607
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1607
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1653

Table F.53. TCLP Metals Results for CCC-Treated EM07-F-02

Client ID: 07310-030 (TCLP) | Sample ID : L07111902-02
Matrix : Leachate | Date Collected: 11/14/2007 0900
Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1526
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	11/21/2007	1526
CADMIUM, TOTAL		0.051		0.050	1.0	mg/l	BDL	11/21/2007	1526
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1526
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1526
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	11/21/2007	1526
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1526
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1729

Table F.54. TCLP Metals Results for CCC-Treated EM07-Fe-05

Client ID: 07310-032 (TCLP) | Sample ID : L07120521-26
Matrix : Leachate | Date Collected: 12/03/2007 1400
Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1610
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1610
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1610
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1610
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1610
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1610
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1610
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1654

Table F.55. TCLP Metals Results for CCC-Treated EM07-Fe-15

Client ID: 07310-034 (TCLP) | Sample ID : L07120521-28
Matrix : Leachate | Date Collected: 12/03/2007 1400
Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1614
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1614
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1614
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1614
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1614
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1614
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1614
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1655

Table F.56. TCLP Metals Results for CCC-Treated EM07-Fe-20

Client ID: 07310-036 (TCLP) | Sample ID : L07120521-30
Matrix : Leachate | Date Collected: 12/03/2007 1400
Date Received : 12/05/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1617
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1617
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1617
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1617
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1617
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1617
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1617
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/18/2007	1657

Table F.57. TCLP Metals Results for CCC-Treated EM07-K-03

Client ID: 07310-038 (TCLP) | Sample ID : L07120311-14
Matrix : Leachate | Date Collected: 11/28/2007 1530
Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1348
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1348
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1348
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1348
LEAD, TOTAL		0.12		0.10	5.0	mg/l	BDL	12/11/2007	1348
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1348
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1348
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1819

Table F.58. TCLP Metals Results for CCC-Treated EM07-K-06

Client ID: 07310-040 (TCLP) | Sample ID : L07120311-16
Matrix : Leachate | Date Collected: 11/28/2007 1530
Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1352
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1352
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1352
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1352
LEAD, TOTAL		0.11		0.10	5.0	mg/l	BDL	12/11/2007	1352
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1352
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1352
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1820

Table F.59. TCLP Metals Results for CCC-Treated EM07-Li-015

Client ID: 07310-042 (TCLP) Sample ID : L07112106-06
Date Collected: 11/19/2007 0930
Matrix : Leachate Date Received : 11/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1649
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1649
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/04/2007	1649
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1649
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1649
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1649
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1649
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1803

Table F.60. TCLP Metals Results for CCC-Treated EM07-Li-04

Client ID: 07310-044 (TCLP) Sample ID : L07111902-04
Date Collected: 11/14/2007 0900
Matrix : Leachate Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1529
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	11/21/2007	1529
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	11/21/2007	1529
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1529
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1529
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	11/21/2007	1529
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1529
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1731

Table F.61. TCLP Metals Results for CCC-Treated EM07-Mn-01

Client ID: 07310-046 (TCLP) Sample ID : L07120311-18
Date Collected: 11/28/2007 1530
Matrix : Leachate Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1355
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1355
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1355
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1355
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1355
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1355
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1355
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1821

Table F.62. TCLP Metals Results for CCC-Treated EM07-Mn-04

Client ID: 07310-048 (TCLP) Sample ID : L07120311-20
Date Collected: 11/28/2007 1530
Matrix : Leachate Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1359
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1359
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1359
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1359
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1359
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1359
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1359
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1823

Table F.63. TCLP Metals Results for CCC-Treated EM07-Na-05

Client ID: 07310-050 (TCLP) Sample ID : L07111902-06
Date Collected: 11/14/2007 0900
Matrix : Leachate Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1533
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	11/21/2007	1533
CADMIUM, TOTAL		0.11		0.050	1.0	mg/l	BDL	11/21/2007	1533
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1533
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1533
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	11/21/2007	1533
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1533
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1732

Table F.64. TCLP Metals Results for CCC-Treated EM07-Na-10

Client ID: 07310-052 (TCLP) | Sample ID : L07111902-08
Date Collected: 11/14/2007 0900
Matrix : Leachate | Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1536
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	11/21/2007	1536
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	11/21/2007	1536
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1536
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1536
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	11/21/2007	1536
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	11/21/2007	1536
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1733

Table F.65. TCLP Metals Results for CCC-Treated EM07-Na-20

Client ID: 07310-054 (TCLP) | Sample ID : L07111902-10
Date Collected: 11/14/2007 0900
Matrix : Leachate | Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1600
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1600
CADMIUM, TOTAL		0.053		0.050	1.0	mg/l	BDL	12/04/2007	1600
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1600
LEAD, TOTAL		0.16		0.10	5.0	mg/l	BDL	12/04/2007	1600
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1600
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1600
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1735

Table F.66. TCLP Metals Results for CCC-Treated EM07-Ni-001

Client ID: 07310-056 (TCLP) Sample ID : L07111902-12
Date Collected: 11/14/2007 0900
Matrix : Leachate Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1604
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1604
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/04/2007	1604
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1604
LEAD, TOTAL		0.11		0.10	5.0	mg/l	BDL	12/04/2007	1604
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1604
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1604
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1736

Table F.67. TCLP Metals Results for CCC-Treated EM07-Ni-02

Client ID: 07310-058 (TCLP) Sample ID : L07111902-14
Date Collected: 11/14/2007 0900
Matrix : Leachate Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1608
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1608
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/04/2007	1608
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1608
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1608
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1608
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1608
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1737

Table F.68. TCLP Metals Results for CCC-Treated EM07-P-0

Client ID: 07310-060 (TCLP) Sample ID : L07112106-08
Date Collected: 11/19/2007 0930
Matrix : Leachate Date Received : 11/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1703
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1703
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/04/2007	1703
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1703
LEAD, TOTAL		0.14		0.10	5.0	mg/l	BDL	12/04/2007	1703
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1703
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1703
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1804

Table F.69. TCLP Metals Results for CCC-Treated EM07-P-025

Client ID: 07310-062 (TCLP) Sample ID : L07111902-16
Date Collected: 11/14/2007 0900
Matrix : Leachate Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1618
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1618
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/04/2007	1618
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1618
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1618
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1618
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1618
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1741

Table F.60. TCLP Metals Results for CCC-Treated EM07-Si-30

Client ID: 07310-064 (TCLP) Sample ID : L07111902-18
Date Collected: 11/14/2007 0900
Matrix : Leachate Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1623
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1623
CADMIUM, TOTAL		2.5		0.050	1.0	mg/l	BDL	12/04/2007	1623
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1623
LEAD, TOTAL		0.10		0.10	5.0	mg/l	BDL	12/04/2007	1623
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1623
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1623
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1743

Table F.61. TCLP Metals Results for CCC-Treated EM07-Si-37

Client ID: 07310-066 (TCLP) Sample ID : L07111902-20
Date Collected: 11/14/2007 0900
Matrix : Leachate Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/L	BDL	12/04/2007	1627
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/L	BDL	12/04/2007	1627
CADMIUM, TOTAL		0.093		0.050	1.0	mg/L	BDL	12/04/2007	1627
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/L	BDL	12/04/2007	1627
LEAD, TOTAL		0.15		0.10	5.0	mg/L	BDL	12/04/2007	1627
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/L	BDL	12/04/2007	1627
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/L	BDL	12/04/2007	1627
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/L	DHR	12/06/2007	1744

Table F.62. TCLP Metals Results for CCC-Treated EM07-Si-50

Client ID: 07310-068 (TCLP) Sample ID : L07112106-10
Date Collected: 11/19/2007 0930
Matrix : Leachate Date Received : 11/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1707
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1707
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/04/2007	1707
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1707
LEAD, TOTAL		0.37		0.10	5.0	mg/l	BDL	12/04/2007	1707
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1707
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1707
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1805

Table F.63. TCLP Metals Results for CCC-Treated EM07-Zr-001

Client ID: 7310-070 (TCLP) Sample ID : L07111902-22
Date Collected: 11/14/2007 0900
Matrix : Leachate Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1630
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1630
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/04/2007	1630
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1630
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1630
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1630
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1630
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1747

Table F.64. TCLP Metals Results for CCC-Treated EM07-Zr-05

Client ID: 07310-072 (TCLP) Sample ID : L07111902-24
Date Collected: 11/14/2007 0900
Matrix : Leachate Date Received : 11/17/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1634
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/04/2007	1634
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/04/2007	1634
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1634
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1634
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/04/2007	1634
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/04/2007	1634
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1748

Table F.65. TCLP Metals Results for CCC-Treated EM07-NM-0025

Client ID: 07310-074 (TCLP) Sample ID : L07120311-22
Date Collected: 11/28/2007 1530
Matrix : Leachate Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1406
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1406
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1406
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1406
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1406
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1406
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1406
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1824

Table F.66. TCLP Metals Results for CCC-Treated EM07-BL-2

Client ID: 07310-076 (TCLP)
Sample ID : L07120311-24
Date Collected: 11/28/2007 1530
Matrix : Leachate
Date Received : 11/30/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
ARSENIC, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1410
BARIUM, TOTAL	<	0.20	U	0.20	100	mg/l	BDL	12/11/2007	1410
CADMIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	12/11/2007	1410
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1410
LEAD, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1410
SELENIUM, TOTAL	<	0.10	U	0.10	1.0	mg/l	BDL	12/11/2007	1410
SILVER, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	12/11/2007	1410
SW846 1311/7470A									
MERCURY, TOTAL	<	0.0020	U	0.0020	0.20	mg/l	DHR	12/06/2007	1825

Appendix G: Formulation and Testing of HAL Glasses

This section documents the data on Hanford High-Aluminum (HAL) glasses formulated and tested as a part of DOE EM-31 (previously EM-21) Office of Waste Processing International Glass Program to develop high waste loaded glasses for Hanford high-alumina high-level wastes. Selected results from this study have been published by Kim, et al. (2008) and Marra et al. (2010). This section provides all the data including those not published in these papers.

Table G.1 summarizes the target glass composition and the results of crystal identification and product consistency test (PCT) of all HAL glasses. Two glasses were selected and processed using the Steklo Metallicheskie Konstruktsii (SMK) melter system and the Electricheskaya Pech-5 (EP-5) melter system at Khlopin Radium Institute (KRI) in Saint Petersburg, Russia. Table G.2 summarizes the viscosity and electrical conductivity data as a function of temperature for these two selected glasses.

References

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J.C Marra, K.M. Fox, G.T. Jannik, E.B. Farfan, D. Kim, J.D. Vienna, J.A. Roach, A.S. Aloy, S.V. Stefanovsky, D.P. Lopukh, M.D. Bondarkov, K.D. Gerdes and A.M. Han. 2010. "The DOE Office of Environmental Management International Cooperative Program: Overview of Technical Tasks and Results,' in WM'10 proceedings, *HLW, TRU, LLW/ILW, Mixed, Hazardous Wastes & Environmental Management*, March 7-11, 2010, Phoenix, AZ.

Table G.1. Target Glass Composition and Results of Crystal Identification and Product Consistency Tests on HAL Glasses

Target Composition (in mass fraction)

#	Hal-01	Hal-02	Hal-03	Hal-04	Hal-05	Hal-06	Hal-07	Hal-08	Hal-09
Al_2O_3	0.26633	0.26633	0.26633	0.26633	0.25570	0.23972	0.24995	0.24995	0.24995
B_2O_3	0.20212	0.25213	0.20212	0.25213	0.15800	0.15192	0.14667	0.14997	0.14997
BaO	0.00060	0.00060	0.00060	0.00060	0.00060	0.00050	0.00060	0.00060	0.00060
Bi_2O_3	0.01270	0.01270	0.01270	0.01270	0.01220	0.01140	0.01190	0.01190	0.01190
CaO	0.03200	0.01200	0.03700	0.05201	0.03230	0.06081	0.05949	0.05999	0.09998
CdO	0.00030	0.00030	0.00030	0.00030	0.00030	0.00020	0.00030	0.00030	0.00030
Cr_2O_3	0.00580	0.00580	0.00580	0.00580	0.00560	0.00520	0.00540	0.00540	0.00540
F	0.01240	0.00740	0.00740	0.01740	0.00710	0.00670	0.00700	0.00700	0.00700
Fe_2O_3	0.06551	0.06551	0.06551	0.06551	0.06290	0.05901	0.06149	0.06149	0.06149
K_2O	0.00160	0.00160	0.00160	0.00160	0.01710	0.00140	0.00150	0.00150	0.00150
La_2O_3	0.00000	0.02500	0.00000	0.00000	0.01560	0.00000	0.00000	0.00000	0.00000
Li_2O	0.00190	0.02690	0.00190	0.00190	0.00180	0.03570	0.03459	0.03499	0.04999
MgO	0.00130	0.00130	0.00130	0.00130	0.00120	0.00120	0.00120	0.00120	0.00120
Na_2O	0.06481	0.03980	0.06481	0.06481	0.03820	0.09581	0.09518	0.09498	0.04999
NiO	0.00440	0.00440	0.00440	0.00440	0.00430	0.00400	0.00420	0.00420	0.00420
P_2O_5	0.06171	0.01170	0.08671	0.01170	0.11520	0.01050	0.01100	0.01100	0.01100
PbO	0.00450	0.00450	0.00450	0.00450	0.00440	0.00410	0.00430	0.00430	0.00430
SiO_2	0.25443	0.25443	0.22942	0.22942	0.26020	0.30503	0.29804	0.29404	0.28404
SO_3	0.00220	0.00220	0.00220	0.00220	0.00210	0.00200	0.00210	0.00210	0.00210
TiO_2	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
ZnO	0.00090	0.00090	0.00090	0.00090	0.00090	0.00080	0.00090	0.00090	0.00090
ZrO_2	0.00440	0.00440	0.00440	0.00440	0.00420	0.00390	0.00410	0.00410	0.00410
Total	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Crystal Identification

Visual observation of quenched glass	High vol% crystals	High vol% crystals	High vol% crystals	High vol% crystals	Undissolved materials	Clear	Clear	N/A	Clear
XRD after CCC treatment, vol%	N/A	N/A	N/A	N/A	N/A	Sp 0.73	Sp, Quartz	Visual, Some crystals on surface and bulk	Sp
XRD after 950°C heat treatment, vol%	N/A	N/A	N/A	N/A	N/A	Sp 0.73	Sp 1.12, Wuestetite	N/A	Sp 0.98

N/A: not analyzed

PCT normalized releases, g/L

PCT B, Q									0.182
PCT Li, Q									0.282
PCT Na, Q									0.159
PCT Si, Q									0.063
PCT B, CCC									0.597
PCT Li, CCC									0.414
PCT Na, CCC									0.198
PCT Si, CCC									0.023

XRD: X-ray diffraction; Q: quenched; CCC: canister centerline cooling; Sp: Spinel

Table G.1. Target Glass Composition and Results of Crystal Identification and Product Consistency Tests on HAL Glasses (Continued)

Target Composition (in mass fraction)

#	Hal-10	Hal-11	Hal-12	Hal-13	Hal-14	Hal-15	HAL-16	HAL-17	HAL-17M
Al_2O_3	0.24995	0.24995	0.24995	0.24995	0.26637	0.26635	0.25889	0.25889	0.25889
B_2O_3	0.14997	0.14997	0.17996	0.17996	0.17998	0.15211	0.16139	0.16139	0.16139
BaO	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00058	0.00058	0.00058
Bi_2O_3	0.01190	0.01190	0.01190	0.01190	0.01190	0.01272	0.01236	0.01236	0.01236
CaO	0.05999	0.05999	0.07998	0.07998	0.13999	0.06496	0.07331	0.07331	0.07331
CdO	0.00030	0.00030	0.00030	0.00030	0.00030	0.00027	0.00026	0.00026	0.00026
Cr_2O_3	0.00540	0.00540	0.00540	0.00540	0.00540	0.00579	0.00563	0.00563	0.00563
F	0.00700	0.00700	0.00700	0.00700	0.00700	0.00742	0.00721	0.00721	0.00721
Fe_2O_3	0.06149	0.06149	0.06149	0.06149	0.06149	0.06555	0.06371	0.06371	0.06371
K_2O	0.03999	0.03999	0.00150	0.00150	0.03700	0.00157	0.02723	0.02723	0.02723
La_2O_3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Li_2O	0.03499	0.04999	0.03499	0.03499	0.00000	0.04040	0.02754	0.04000	0.04000
MgO	0.00120	0.00120	0.00120	0.00120	0.00120	0.00130	0.00126	0.00126	0.00126
Na_2O	0.07259	0.05749	0.09498	0.06499	0.05000	0.08978	0.08750	0.06067	0.06067
NiO	0.00420	0.00420	0.00420	0.00420	0.00420	0.00444	0.00432	0.00432	0.00432
P_2O_5	0.01100	0.01100	0.01100	0.01100	0.01100	0.01169	0.01136	0.01136	0.01136
PbO	0.00430	0.00430	0.00430	0.00430	0.00430	0.00455	0.00442	0.00442	0.00442
SiO_2	0.27794	0.27804	0.24405	0.27405	0.21208	0.26290	0.24562	0.25999	0.25999
SO_3	0.00210	0.00210	0.00210	0.00210	0.00210	0.00222	0.00216	0.00216	0.00216
TiO_2	0.00010	0.00010	0.00010	0.00010	0.00010	0.00011	0.00011	0.00011	0.00011
ZnO	0.00090	0.00090	0.00090	0.00090	0.00090	0.00092	0.00089	0.00089	0.00089
ZrO_2	0.00410	0.00410	0.00410	0.00410	0.00410	0.00439	0.00426	0.00426	0.00426
Total	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

HAL-17M: HAL_17 glass from melter tests

Crystal Identification

Visual observation of quenched glass	Clear, possible crystals in bulk	Silver swirl on surface, bulk clear	Clear	Clear	Spots of undissolved in crucible, possible crystals in bulk	A few small crystals on surface	Low vol% crystals	Low vol% crystals	N/A
XRD after CCC treatment, vol%	Sp, Hydroxylapatite	Sp	Sp, Quartz	Sp	Sp, Hema	Sp, Np	Sp 2.3, Flapa 1.6, Np 2.6	Sp 2.4, Flapa 1.2	N/A
XRD after 950°C heat treatment, vol%	Sp 0.88	Sp 1.07	LiFe5O8 0.73	Sp 0.83	Hema 1.26, Sp 0.58, Flapa 1.03	Sp 1.22	Sp 1.2, Flapa 0.6	Sp 0.99	N/A

N/A: not analyzed

PCT normalized releases, g/L

PCT B, Q		0.387	0.532				0.342	0.118	0.222
PCT Li, Q		0.498	0.675				0.555	0.333	0.358
PCT Na, Q		0.379	0.605				0.490	0.260	0.329
PCT Si, Q		0.128	0.110				0.089	0.068	0.116
PCT B, CCC		0.215	0.604				0.083	1.618	0.168
PCT Li, CCC		0.311	0.554				0.395	0.767	0.302
PCT Na, CCC		0.205	0.372				0.159	0.986	0.269
PCT Si, CCC		0.100	0.024				0.069	0.001	0.106

XRD: X-ray diffraction; Q: quenched; CCC: canister centerline cooling; Sp: Spinel; Np: Nepheline; Hema: Hematite; Flapa: Fluorapatite

Table G.1. Target Glass Composition and Results of Crystal Identification and Product Consistency Tests on HAL Glasses (Continued)

Target Composition (in mass fraction)

#	HAL-18	HAL-19 (HAL-17 dup)	HAL-20	HAL-21	HAL-22	HAL-23	HAL-24	HAL-25
Al_2O_3	0.25889	0.25889	0.25889	0.25889	0.25889	0.25889	0.25889	0.25889
B_2O_3	0.18000	0.16139	0.16139	0.16139	0.16139	0.16139	0.20298	0.16139
BaO	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058
Bi_2O_3	0.01236	0.01236	0.01236	0.01236	0.01236	0.01236	0.01236	0.01236
CaO	0.08000	0.07331	0.04247	0.01163	0.04247	0.07331	0.07331	0.07331
CdO	0.00026	0.00026	0.00026	0.00026	0.00026	0.00026	0.00026	0.00026
Cr_2O_3	0.00563	0.00563	0.00563	0.00563	0.00563	0.00563	0.00563	0.00563
F	0.00721	0.00721	0.00721	0.00721	0.00721	0.00721	0.00721	0.00721
Fe_2O_3	0.06371	0.06371	0.06371	0.06371	0.06371	0.06371	0.06371	0.06371
K_2O	0.02723	0.02723	0.02723	0.02723	0.02723	0.02723	0.02723	0.02723
La_2O_3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Li_2O	0.02754	0.04000	0.04000	0.04000	0.04500	0.04000	0.04000	0.04500
MgO	0.00126	0.00126	0.03981	0.07836	0.03981	0.06319	0.00126	0.00126
Na_2O	0.06664	0.06067	0.06067	0.06067	0.08791	0.06067	0.06067	0.08718
NiO	0.00432	0.00432	0.00432	0.00432	0.00432	0.00432	0.00432	0.00432
P_2O_5	0.01136	0.01136	0.01136	0.01136	0.01136	0.01136	0.01136	0.01136
PbO	0.00442	0.00442	0.00442	0.00442	0.00442	0.00442	0.00442	0.00442
SiO_2	0.24117	0.25999	0.25228	0.24457	0.22004	0.19807	0.21840	0.22848
SO_3	0.00216	0.00216	0.00216	0.00216	0.00216	0.00216	0.00216	0.00216
TiO_2	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011
ZnO	0.00089	0.00089	0.00089	0.00089	0.00089	0.00089	0.00089	0.00089
ZrO_2	0.00426	0.00426	0.00426	0.00426	0.00426	0.00426	0.00426	0.00426
Total	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Crystal Identification

Visual observation of quenched glass	Low vol% crystals	A very thin slightly dark layer on the melt surface while pouring.						
XRD after CCC treatment, vol%	Sp 2.4, Flapa 1.5, Hema 0.4	Sp 2.1	Sp 3.2	Sp 3.4	Sp 3.6, Np 5.1	Sp 5.0	Sp 1.9	Sp 1.9, Np 10.2
XRD after 950°C heat treatment, vol%	Sp 1.2, Flapa 0.6	Sp 1.1	Sp 2.1	Sp 1.8	Sp 2.2	Sp 2.2	Sp 1.1	Sp 1.3

N/A: not analyzed

PCT normalized releases, g/L

PCT B, Q	0.208						0.953	
PCT Li, Q	0.422						0.974	
PCT Na, Q	0.331						0.967	
PCT Si, Q	0.053						0.140	
PCT B, CCC	0.478							
PCT Li, CCC	0.548							
PCT Na, CCC	0.363							
PCT Si, CCC	0.001							

Q: quenched; CCC: canister centerline cooling; Sp: Spinel; Np: Nepheline; Hema: Hematite; Flapa: Fluorapatite

Table G.2. Viscosity and Electrical Conductivity of Selected HAL Glasses

Viscosity

HAL-17	
T, °C	**Pa·s**
991	51.79
1041	24.17
1090	11.80
1140	6.38
1189	3.68
1240	2.10

HAL-24	
T, °C	**Pa·s**
912	38.39
963	19.64
1010	10.76
1057	6.09
1104	3.47
1151	2.09
1189	1.40

Electrical Conductivity

HAL-17			
T, °C	**at 100 Hz, S/m**	**at 1 kHz, S/m**	**at 10 kHz, S/m**
942	4.33	4.51	4.56
992	6.09	6.40	6.48
1043	8.16	8.63	8.77
1094	10.32	10.94	11.12
1143	13.22	14.03	14.26
1193	16.45	17.36	17.72
1242	19.99	21.10	21.49

HAL-24			
T, °C	**at 100 Hz, S/m**	**at 1 kHz, S/m**	**at 10 kHz, S/m**
937	4.07	4.25	4.29
1011	6.52	6.88	6.95
1085	9.68	10.25	10.38
1158	13.55	14.32	14.52
1234	17.87	18.79	19.04

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