



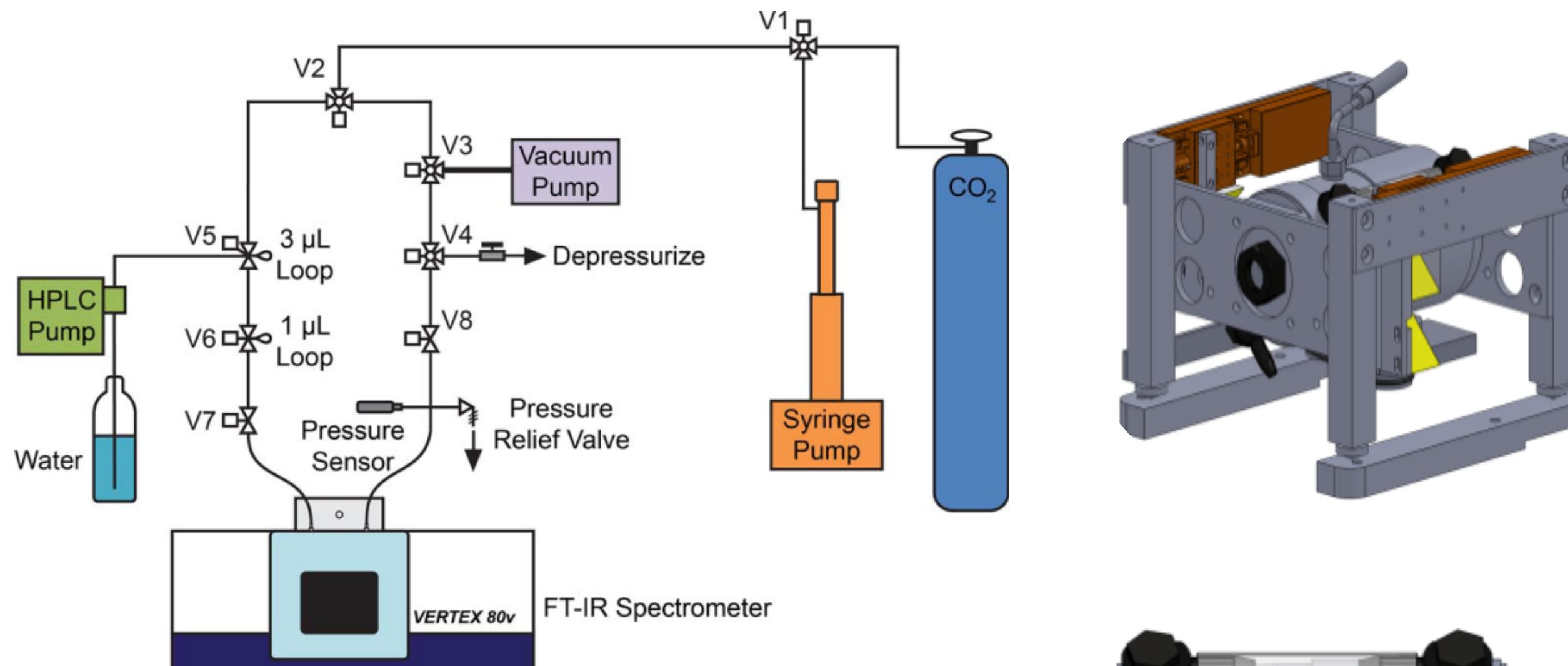
Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

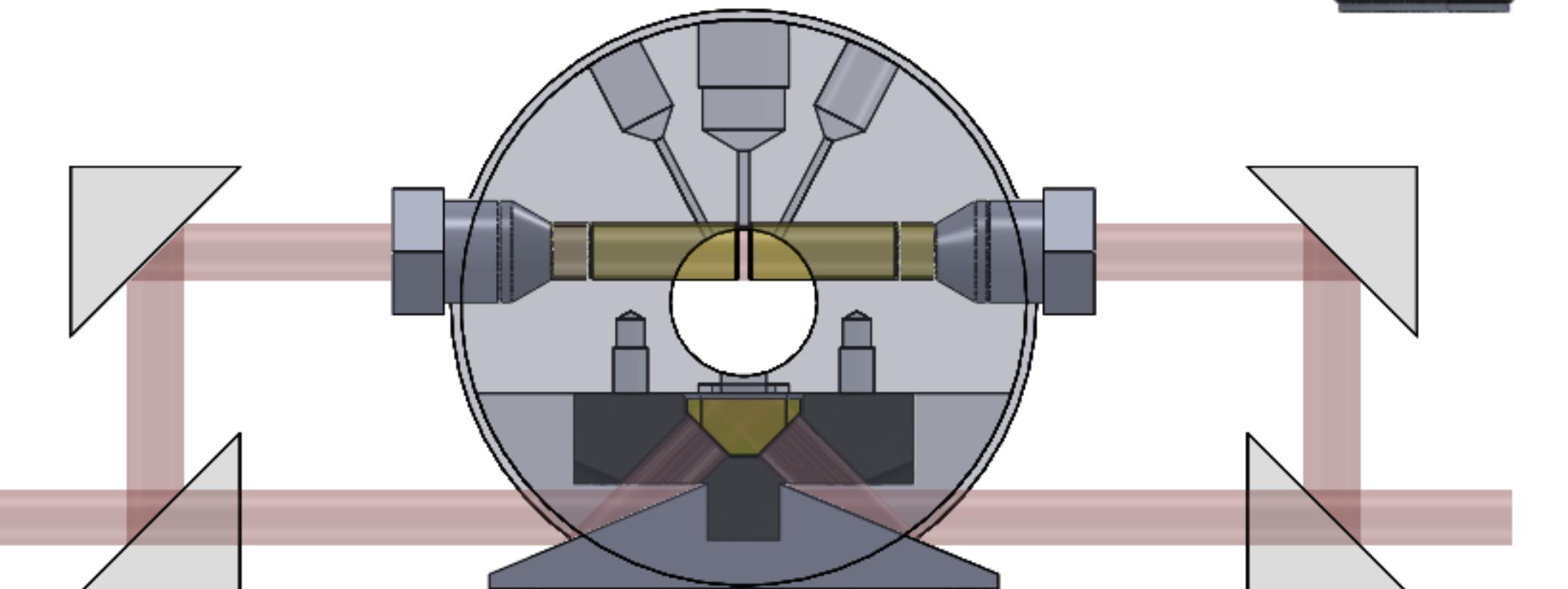
High-Pressure IR Titration Capability

John S. Loring and Christopher J. Thompson

Capability Description



Operating Conditions
200 bar
-20°C to 200°C

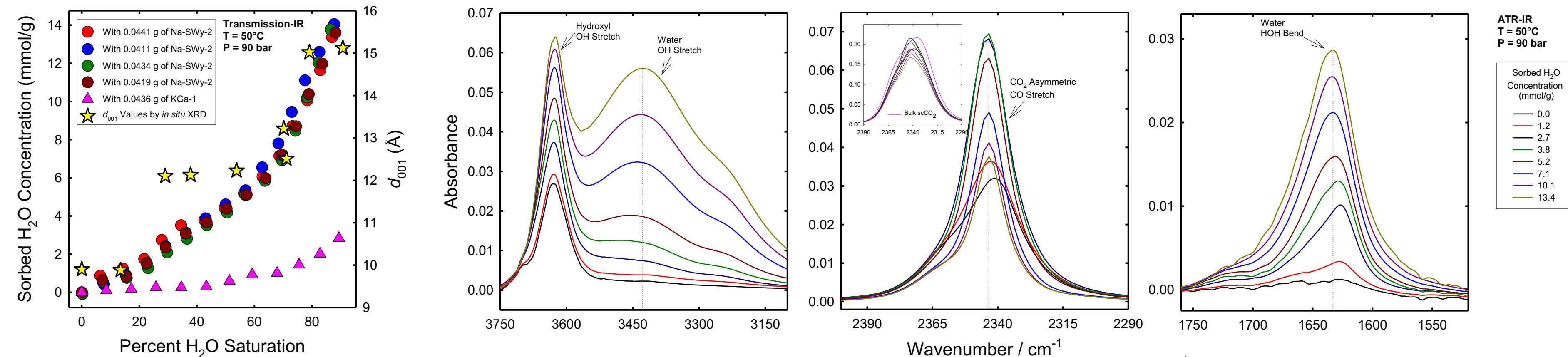


Key Features

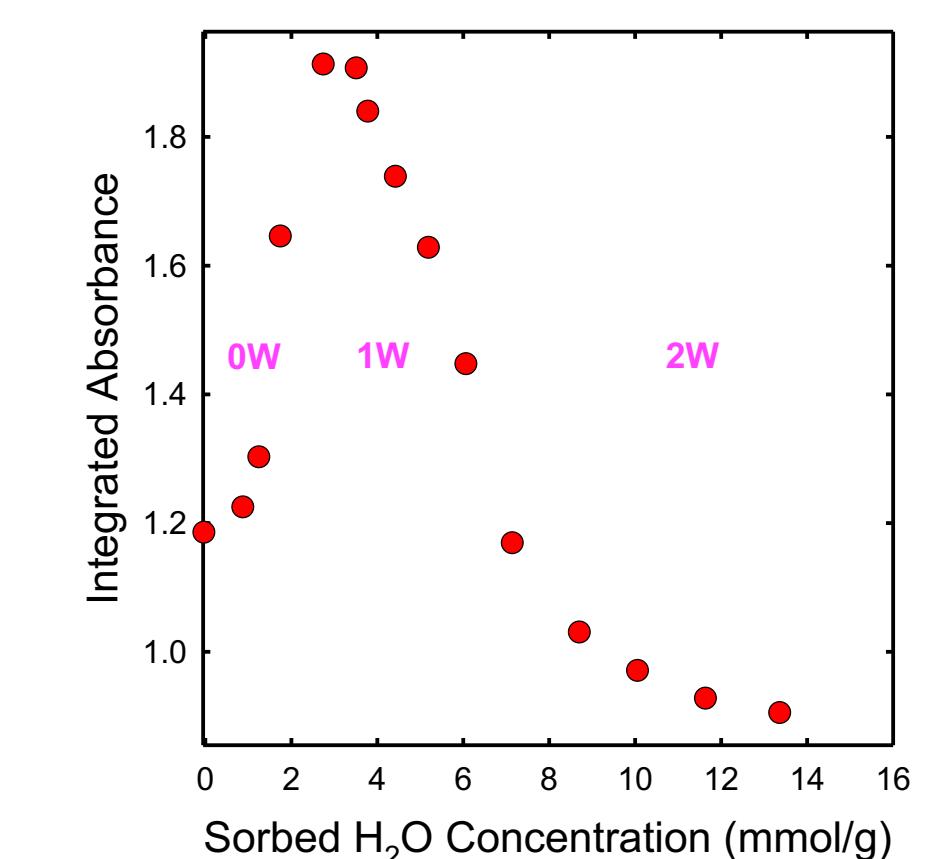
- First fully quantitative, automated system for *in situ* titrations of minerals at high pressures.
- Transmission mode for quantifying H₂O dissolved in high-pressure fluid
- Attenuated total reflection (ATR) mode for collecting spectrum of mineral as it reacts

Application

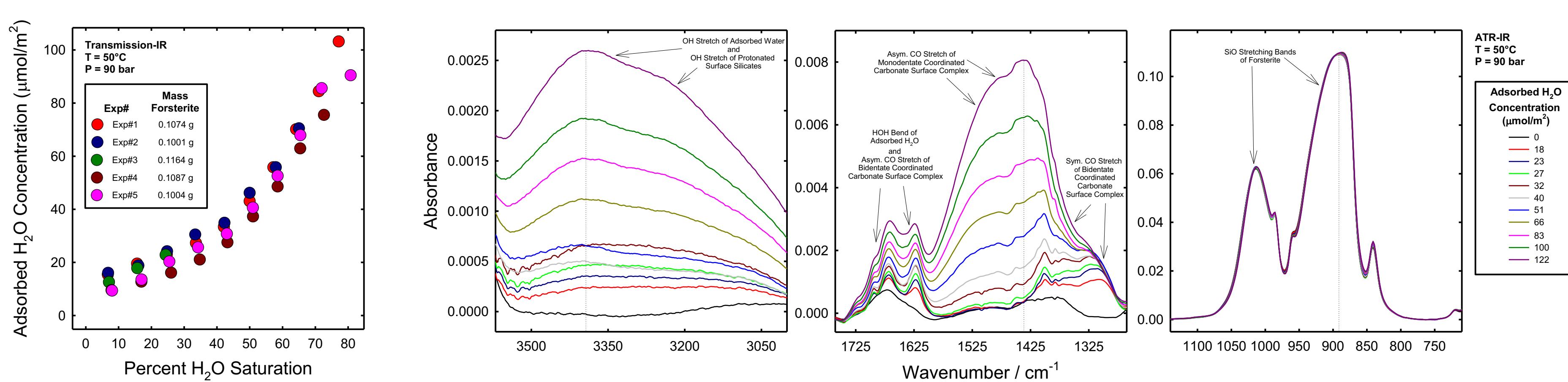
Montmorillonite Hydration and CO₂ Intercalation



- H₂O and CO₂ intercalation causes expansion, thereby increasing solid volume and possibly leading to fracture sealing.
- Increase in CO₂ absorbance from 0W to 1W suggests that water props the interlayer open so that CO₂ can enter.
- Decrease in absorbance with expansion from 1W to 2W suggests either water outcompetes CO₂ for coordinative sites or increased water-CO₂ interactions are less conducive to CO₂ residency in the interlayer.



Forsterite (Mg₂SiO₄) Carbonation



- Bidentate coordinated carbonate complexes predominate adsorbed H₂O concentrations below 27 μmol/m².
- Monodentate coordinated complexes become dominant above 27 μmol/m² and up to 76 μmol/m².
- Beyond 76 μmol/m² magnesite continuously precipitates, and particles are hundreds of times larger than the thickness of the adsorbed water films (7 to 15 Å).

