Goldschmidt2017 Abstract

Liquids at extreme conditions: An *in situ* high-pressure and temperature study of element speciation in silicate melts via synchrotron radiation

TRACY RUSHMER[1] JEREMY WYKES[1,2] GUIL MALLMANN[3]

[1]EPS, Macquarie University, Sydney, 2192 Australia, (Tracy.Rushmer@mq.edu.au, Jeremy.Wykes@mq.edu.au)
[2]Australian Synchrotron, Melbourne, VIC 3168, Australia
[3]RSES, ANU, Canberra ACT 2601, Australia (guil.mallmann@anu.edu.au)

The recent acquisition of a D-DIA type cubic multi-anvil for use at the Australian Synchrotron provides opportunities for conducting a wide range of in situ experiments at high pressure and temperature. With the recent advances in the measurement of physical properties (density, viscosity and structure) of silicate melts via in situ observation at high P-T using synchrotron light sources there has been important new data available on the response of silicate melt structure to increasing pressure, including how trace elements behave under these conditions. What is yet to be fully addressed is element speciation (i.e. valence state and coordination) in silicate melts as a function of pressure and redox conditions and which is critical to understanding their behavior. In-situ experiments are also required as it is unclear whether glasses retain the speciation of elements as they do in melt.

We have performed proof of concept experiments using the D-DIA apparatus and here we present data recorded in situ transmission U and Th L_3-edge XANES spectra of U and Th-doped silicate liquids at ~ 1.5 GPa and ~ 1400°C. In addition to U L3-edge x-ray absorption spectra collected in situ on quenched glass [1]. Data for thorium, which occurs exclusively as a tetravalent cation under terrestrial fO_2 conditions, were collected to monitor for changes in coordination. U-XANES spectra recorded for the liquid in situ and for the quenched glass are similar, which would suggest no major change in uranium coordination and/or valence state on cooling and/or decompression. Near future work will quantify pressure-induced coordination and/or valence changes for other multi-oxidation state elements in silicate melt via in situ XAS measurements.

[1] Mallmann, et al., (2016) *AGU*, MR13A-2418.