Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SIT02-P03 Room:Poster Time:April 29 18:15-19:30

Solution mechanism of water in depolymerized silicate melts

CHERTKOVA, Nadezda[1*] ; YAMASHITA, Shigeru[1]

[1]Okayama University, ISEI

It is known that the effect of dissolved water on the viscosity of silicate melts is larger for polymerized melts than for depolymerized melts [*e.g.*, 1, 2]. Direct spectroscopic measurements of melt structure and water speciation at high temperature provide information about the mechanism of water dissolution and its influence on the physical properties of the melts. While *in situ* measurements of water speciation were widely conducted for rhyolitic melts and their analogues [*e.g.*, 3, 4, 5], only limited data are available for depolymerized silicate melts.

We performed high-temperature near-infrared and Raman spectroscopic measurements of hydrous $Na_2Si_2O_5$ melts (2.3-8.1wt% H_2O) using externally heated diamond anvil cell (HDAC). $Na_2Si_2O_5$ composition was chosen as a structural analogue of basaltic melt (anhydrous NBO/T = 1). Experimental pressure was monitored with the pressure- and temperature-dependent Raman shift of ^{13}C diamond [6]. Near-infrared spectra of the homogeneous liquid phase, observed above 820 degree C, 1.7GPa in the $Na_2Si_2O_5$+2.3wt%H_2O system and above 700 degree C, 1.6GPa in the $Na_2Si_2O_5$+8.1wt%H_2O system, contain absorption peaks corresponding to molecular H_2O (at ~5200 cm^{-1}) and structurally bound OH groups (at ~4500 cm^{-1}). At 900 degree C and 1.6-1.9GPa the ratio of these peaks height remains approximately constant (2.6-2.2), implying a constant (structurally bound OH)/(molecular H_2O) ratio for this range of water contents. This observation differs from the regularities reported for more polymerized melts (rapid decrease of OH/H_2O with total water content) [*e.g.*, 4, 7]. At the same time no pressure effect on the ratio of 4500 cm^{-1} peak height to 5200 cm^{-1} peak was observed below 2.4 GPa.

References

[1] Whittington A., Richet P., Holtz F. (2000) Geochim Cosmochim Acta 64, 3725-3736.
[2] Giordano D., Russell J.K., Dingwell D.B. (2008) Earth. Planet. Sci. Lett. 271, 123-134.
[3] Sowerby J.R., Keppler H. (1999) Am. Mineral. 84, 1843-1849.
[4] Nowak M., Behrens H. (2001) Earth. Planet. Sci. Lett. 184, 515-522.
[5] Shen A.H., Keppler H. (1995) Am. Mineral. 80, 1335-1338.
[6] Mysen B.O., Yamashita S. (2010) Geochim. Cosmochim. Acta 74, 4577-4588.
[6] Mysen B.O. (2010) Geochim. Cosmochim. Acta 74, 4123-4139.
[7] Botcharnikov R.E., Behrens H., Holtz F. (2006) Chem. Geol. 229, 125-143.

Keywords: water speciation, hydrothermal diamond anvil cell, near-infrared spectroscopy, Raman spectroscopy