

## Solution mechanism of water in depolymerized silicate melts

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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  $\text{Na}_2\text{Si}_2\text{O}_5$  melts (2.3-8.1wt%  $\text{H}_2\text{O}$ ) using externally heated diamond anvil cell (HDAC).  $\text{Na}_2\text{Si}_2\text{O}_5$  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  $^{13}\text{C}$  diamond [6]. Near-infrared spectra of the homogeneous liquid phase, observed above 820 degree C, 1.7GPa in the  $\text{Na}_2\text{Si}_2\text{O}_5+2.3\text{wt}\%\text{H}_2\text{O}$  system and above 700 degree C, 1.6GPa in the  $\text{Na}_2\text{Si}_2\text{O}_5+8.1\text{wt}\%\text{H}_2\text{O}$  system, contain absorption peaks corresponding to molecular  $\text{H}_2\text{O}$  (at  $\sim 5200\text{ cm}^{-1}$ ) and structurally bound OH groups (at  $\sim 4500\text{ cm}^{-1}$ ). 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  $\text{H}_2\text{O}$ ) ratio for this range of water contents. This observation differs from the regularities reported for more polymerized melts (rapid decrease of OH/ $\text{H}_2\text{O}$  with total water content) [e.g., 4, 7]. At the same time no pressure effect on the ratio of  $4500\text{ cm}^{-1}$  peak height to  $5200\text{ cm}^{-1}$  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.

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