

Water speciation in silicate glasses and melts: Langmuir limited site model

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ABSTRACT

The distribution of dissolved water in a haplogranitic glass between molecular water and reacted OH groups, as measured by Sowerby and Keppler (1999) at temperature and pressure, is compared to a Langmuir model. In this model the number of reactive sites in the glass is limited, so as the total water content increases, the concentration of reacted OH groups saturates. The comparison between the model and experimental measurements is good with two fitting parameters. The total water solubility in $\text{NaAlSi}_3\text{O}_8$ melts as measured by Holtz et al. (1995) is the sum of molecular water dissolved from the gas phase and reacted OH groups; the concentration of OH groups calculated from these solubility measurements also fits the Langmuir model. The partial molar volumes for water in $\text{NaAlSi}_3\text{O}_8$ melts are constant above about 4 wt% total water, but decrease at lower water contents; this dependence can be understood from the speciation measurements.