

LETTER

The effect of fictive temperature on Al coordination in high-pressure (10 GPa) sodium aluminosilicate glasses

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ABSTRACT

Typical liquidus temperatures can be over 1000 °C greater than the glass transition temperatures for high-pressure aluminosilicate melts so the effect of temperature must be determined if glass data is to be used to approximate the structural speciation present in geologic melts. This study has investigated the effect of fictive temperature (T_f , taken as the temperature where the melt structure is the same as that of the glass) on the percentage of ¹⁵Al and ¹⁶Al species in two high-pressure (10 GPa) Na-aluminosilicate glasses (Na₃AlSi₇O₁₇ and NaAlSi₃O₈) where one glass of each composition was quenched from the high-pressure melt while the other was annealed near the glass transition temperature. The ²⁷Al MAS NMR spectra of the Na₃AlSi₇O₁₇ samples show that the higher T_f (quenched) glass contains more high-coordinated Al than the lower T_f (annealed, 475 °C) glass. However, the ²⁷Al spectra of the NaAlSi₃O₈ samples show the opposite temperature dependency, which in addition to the lack of NBO in this glass, may suggest differing mechanisms for the generation of high-coordinated Al.