

Environments around Al, Si, and Ca in aluminate and aluminosilicate melts by X-ray absorption spectroscopy at high temperature

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ABSTRACT

Structural data on silicate, aluminate, and aluminosilicate melts are difficult to measure and understand at high temperature. X-ray absorption spectroscopy (XAS) performed in situ at high temperature has been used to probe the local environment of low-Z elements (Al, Si, and Ca). For fully tetrahedral network glasses, $\text{CaAl}_2\text{Si}_2\text{O}_8$ (anorthite) and CaAl_2O_4 , the modifications in the Al *K*-edge spectra with increasing temperature can be attributed to a structural rearrangement of the network or to an increase of fivefold-coordinated Al. For the $\text{Ca}_3\text{Al}_2\text{O}_6$ composition, where Al is localized in a depolymerized tetrahedral site associated with non-bridging O atoms, XAS spectra at the Al *K*-edge are barely affected by temperature. Depending on the composition, Ca *K*-edge spectra investigated in these experiments allow us to follow changes in the distortion of the Ca sites in melts at high temperature. The structural modifications at both short and intermediate range upon melting are well shown by these XAS measurements.

Keywords: Melts, silicate, glasses, EXAFS