



Coordination changes in magnesium silicate glasses

C. J. Benmore

Intense Pulsed Neutron Source, Argonne National Laboratory, 9700 South Cass Ave. Argonne, IL 60439-4814

Glasses made from the magnesium silicate minerals enstatite (MgSiO_3) and forsterite (Mg_2SiO_4) and three intermediate compositions can be considered as analogues of quenched, end-member composition melts from the Earth and Lunar mantle. Combined neutron and X-ray diffraction data show an abrupt change in glass structure in the narrow compositional range 38% SiO_2 to 33% SiO_2 (Mg_2SiO_4). These structural changes reflect a change from a glass characterized by corner shared SiO_4 tetrahedra and an approximately equal mixture of MgO_4 and MgO_5 polyhedra, to one in which the average coordination of magnesium by oxygen is increased from 4.5 ± 0.1 to 5.0 ± 0.1 . Both these local environments are very different from that of their crystalline counterparts. The change in structure is associated with a discontinuous change in the rheological properties of these glass-forming liquids close to the forsterite composition.