Structure of jadeite composition (NaAlSi2O6) melt at high pressures

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Structural study on the molten jadeite (NaAlSi2O6) up to 3 GPa was carried out by in-situ X-ray diffraction experiments using the cubic-type high-pressure apparatus MAX 80 at Photon Factory, KEK, Tsukuba, Japan. Energy-dispersive X-ray diffraction method was applied to give the coherent scattering intensities in Q range from 0.7 to 14 A^-1.

At atmospheric pressure, both jadeite composition glass and melt take a stuffed tridymite-like structure, in which all aluminum and silicon are four-fold coordinated with oxygen to make six-membered ring of TO4 tetrahedrons and sodium stuffs in void space (Taylor and Brown, 1979). Room temperature compression of jadeite composition glass to 4.5 GPa shows substantial changes both in the radial distribution function and in the first sharp diffraction peak (FSDP), indicating that the TO4 tetrahedron is fundamental structure unit but the six-membered ring of TO4 tetrahedron shrinks to smaller ring with increasing pressure. On the other hand, expansion of T-O distance with increasing pressure was found in the high-pressure jadeite composition melts, which provides evidence for increase of coordination number of aluminum at least up to 2.5 GPa. Large changes of the FSDP also indicate significant modification of the intermediate range order in melts with increasing pressure and density.

Taylor M. and Brown Jr. G. E. (1979) Geochim. Cosmochim. Acta 43, 1467-1473.