

## Pressure-induced structural change in aluminosilicate melts

# Satoru Urakawa[1]; Takumi Kikegawa[2]

[1] Dept Earth Sci, Okayama Univ.; [2] IMSS, KEK

Viscosities of some silicate melts decrease with increasing pressure, contrary to normal liquids. We have also found the anomalous compression behavior in the basaltic melt up to 5 GPa by X-ray absorption density measurement technique, of which density rises with negative pressure derivative of bulk modulus. Topological change, such as size reduction of the member ring of  $\text{TO}_4$  tetrahedra, has been believed to cause these physical properties change in relatively low pressure. Recently, the evolution of aluminum coordination number from four to five or six with increasing pressure has also been elucidated in alkali and alkali-earth aluminosilicate glasses quenched under pressure by NMR spectroscopy. In order to clarify both topology and coordination changes in silicate melts, we have been studied the static structure of aluminosilicate melts at high-pressure and high-temperature by X-ray diffraction experiments using synchrotron radiation. Our study yields the evidence of ordering of intermediate range structure with increasing pressure in  $\text{Ca}_3\text{Al}_2\text{Si}_6\text{O}_{18}$  and  $\text{Mg}_3\text{Al}_2\text{Si}_6\text{O}_{18}$  composition melts, in which the first sharp diffraction peak (FSDP) in the diffraction pattern shifts toward higher momentum transfer and becomes sharp by compression. This indicates the size reduction and the increase of population of some specific member rings with pressure, respectively. Radial distribution function also reveals the structural change in short range order by using the diffraction data at the momentum transfer up to  $20 \text{ \AA}^{-1}$ . We found the degenerated T-O peaks splitting into two peaks up to 5 GPa, indicating the coordination change of aluminum with pressure. However, the resolution of the radial distribution function is not high enough to evaluate the detailed structure mainly due to the limitation of attainable momentum transfer in X-ray diffraction. Therefore, it is difficult to discuss the detailed structure only by X-ray diffraction analysis. In contrast to X-ray, neutron scattering length is independent of momentum transfer as well as elemental species. Thus, high resolution in distribution function is expected for neutron diffraction study on silicate melts. High-pressure and high-temperature neutron diffraction would advance the study on structure of silicate melts as well as their physical properties.