Pressure-induced structural change of Ca-aluminosilicate melts

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Structure of magma is fundamental to investigate its physical properties, such as viscosity and density, because physical properties is controlled by microscopic strcuture. Recently, structure of basaltic magma is predicted to be ablt to change with pressure up to 5 GPa by the NMR spectroscopy on $Ca_3Al_2Si_6O_{18}$ composition glass quenched under pressure, in which an average coordination number of aluminum increases from four to five. Here we reprot the results of in-situ X-ray diffraction study on the static structure of $Ca_3Al_2Si_6O_{18}$ composition melt up to 5 GPa and 2200 K.

High-pressure and temperature experiments were conducted using MAX80 at AR NE5C of Photon Factory. Energy dispersive X-ray diffraction method is applied to acquire the diffraction pattern from molten sample.

Pressure-induced stuructural change of $Ca_3Al_2Si_6O_{18}$ composition melt is observed in radial distribution functions as well as in diffraction patterns. The first sharp diffraction peaks (FSDP) shift to hgher Q side with increasing pressure, indicating the shirinkage of intermediate rage strutural units, sucha as ring structures composed of $SiO_4$and AlO_4 tetrahedra. The change of the first peak in the radial distribution function is prominet. A shoulder peakcorresponding to higher coordinated aluminum appears at higher pressure.