In-situ X-ray experiment on hydrous Mg-silicate melt under high temperature and high pressure

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It has been clarified that the composition of magma generated in the shallow part of mantle is enriched in SiO2 component under hydrous condition. It has been thought that this phenomenon happens in order that H2O may divide the network structure that consists of SiO4 tetrahedron in hydrous magma. Recent studies, however, have revealed that the composition of magma generated in the deep mantle is enriched in MgO component with increasing pressure. Although it is very important to clarify this mechanism, the experimental study on hydrous silicate melt under high pressure and high temperature has not been conducted so far due to its difficulty. In the present study, high-pressure and high-temperature X-ray diffraction experiment on hydrous silicate melt was performed to investigate its structure change as functions of pressure and melt composition up to the pressures corresponding to the lower part of the upper mantle.

In-situ X-ray experiments were performed using synchrotron X-ray radiation at SPring-8 and KEK. Information about the structure of melt was collected by high-pressure and high-temperature X-ray diffraction method. Hydrous sample was enclosed in Ag-Pd or diamond plus Pt capsules to prevent the loss of hydrous melt and transmit X-ray through the sample. Information about the short and the intermediate range structures can be derived by performing Fourier transform of the diffraction intensity profile obtained from high-pressure and high-temperature X-ray diffraction.

As the result, judging from the derived information about the intermediate range structure (FSDP), it seems that melt enriched in MgO component is no-polymerized comparing with silica-rich melt. The effects of pressure and the local structures in hydrous Mg-silicate melts will be introduced.