# Static structure of hydrous magnesium silicate melt under high-pressure and high-temperature

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Structures of hydrous magnesium silicate melts (Mg/Si=1.8 and 2.0 at 8-9 GPa, 1750K) and MgSiO3 glass (up to 14.7 GPa, 600K) were investigated by high-pressure X-ray diffraction experiments using synchrotron radiation. The interference function and the radial distribution function were derived from the several diffraction data. As the result, the first-neighbor distances rSi-O of the present hydrous magnesium silicate melts were 1.68A in both the melt composition of Mg/Si=1.8 and that of Mg/Si=2.0. These results may show that SiO4 tetrahedron, which is a fundamental structure unit of silicate melt and glass, change to polyhedron which has higher coordination number, CN, from CN=4 to 5 at around 9 GPa. On the other hand, Si-Si distance rSi-Si corresponding to the distance between SiOn polyhedrons had big difference between two hydrous magnesium silicate melts with the composition of Mg/Si=1.8 and with the composition of Mg/Si=2.0. rSi-Si of the melt with Mg/Si=1.8 was 3.11A, and that of the another melt with the composition of Mg/Si=2.0 was 2.94A. This difference shows that SiOn polyhedrons exist independently or not in those melts. Polyhedrons in the melt with the composition Mg/Si=2.0 were not polymerized because Mg2SiO4 forsterite (Mg/Si=2.0) has independent structure in terms of tetrahedrons. Thus the melt has the similar structure to its crystal phase. On the other hand, the melt with the composition of Mg/Si=1.8 is richer in composition of Si than Mg/Si=2.0, therefore it has some network structures in terms of SiOn polyhedrons.

Reliability of the present analysis was confirmed comparing the present result of MgSiO3 glass at ambient condition with that of Waseda and Toguri (1990), which report the result of MgSiO3 melt using angle-dispersive x-ray diffraction method at room pressure, 2000K. These were consistent each other, and the present analyses was found to be suitable. The result of MgSiO3 glass at 14.0 GPa, 600K shows that the change of rSi-Si is larger than that of rSi-O with increasing pressure; this suggests that the structure changes between SiO4 tetrahedrons involve densification of MgSiO3 glass at least up to 14.0 GPa, 600K.