# Preliminary study on two-phase rheology of the mixture of (Mg,Fe)SiO3 perovskite and magnesiowüstite

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Earth’s lower mantle is mainly composed of mixture of (Mg,Fe)SiO3 perovskite and magnesiowustite. Therefore, the nature of the mixture should control the dynamics of the lower mantle. However, most of previous works have been focused on the physical and chemical properties of each phase. Here, we propose the importance of morphology such as geometry and microstructure of the (Mg,Fe)SiO3 perovskite and magnesiowustite mixture.

We carry out two series of high pressure experiments using a Kawai-type apparatus at 24 GPa and 1400-2000 degree C: i) static experiment to observe the connectivity of weak phase (magnesiowustite) to assess the real viscosity of lower mantle rocks, ii) dynamic (pseudo-deformation) experiments to observe the crystallographic preferred orientation for understanding the deformation mechanism and for interpretation of seismic anisotropy. We used San Carlos olivine and forsterite powders as a starting material, which transformed to (Mg,Fe)SiO3 perovskite and magnesiowustite at the present high pressure and high temperature conditions. After experiments, the recovered samples are examined by SEM, EBSD, EDS and X-ray diffraction techniques. Especially, FE-SEM is used for more detailed microstructural observation.

From preliminary results, magnesiowustite surrounded by perovskite annealed at 2000 degree C showed the shape with straight grain boundaries. On the other hand, magnesiowüstite surrounded by perovskite annealed at 1700 degree C showed the convex grain boundary. This observation suggests that interfacial energy between perovskite and magnesiowustite depends on the temperature and/or Mg/Fe ratio.