Rheology of Dry and Hydrous Phases of the α and β Forms of $(Mg,Fe)_2SiO_4$	X17B1

J. Chen, T. Inoue, Y. Wu, D. J. Weidner and M. T. Vaughan (CHiPR, SUNY, Stony Brook)

Rheological properties of the different phases of olivine, both dry and hydrous, are important properties that constrain mantle convection and have implications regarding the origin of deep focus earthquakes. It is widely recognized that water considerably weakens olivine at confining pressures less than one GPa. However, in the β-phase, hydrogen is structurally bound, with uncertain implications on its ability to mechanically weaken this material.

We carried out rheology measurements on these phases by monitoring the diffraction peak broadening as a function of pressure, temperature and time. The cubic-type multi-anvil press SAM85 at the X17B1 beamline was employed in the experiments. The technique to derive strains of crystal grains produced by deviatoric stress in the high pressure cell has been described elsewhere.

The dry α-phase sample is San Carlos olivine, and the β-phase and hydrous β-phases were synthesized using the USSA2000 press at Stony Brook. Recovered samples were ground and repressurized at room temperature up to 9 GPa in SAM85, then temperature was increased to 600°C. FWHM analysis of the energy dispersive diffraction patterns showed that β-phase is generally stronger than the olivine (α) phase, and the hydrous olivine is much weaker than dry olivine by 400°C. Strength of the hydrous β-phase is similar to dry beta at this temperature and becomes slightly lower than dry beta by 600°C. Thus, structurally bound water in the β-phase may not significantly weaken this material.