

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

As one of the studies of the rheological properties of mantle minerals, we carried out a stress measurement for anhydrous and hydrous phases of ringwoodite in the T-cup press. In our previous study, we measured the stress of dry and hydrous phase of olivine, wadsleyite as a function of pressure, temperature and time [1]. We observed a difference in water weakening on the rheological property of olivine and wadsleyite. Olivine is weakened dramatically by introducing a small amount (1500 ppm in weight) water. However, hydrous wadsleyite is just slightly weaker than its anhydrous counterpart although the hydrous phase takes as much as 2.2 wt% water.

The samples were synthesized at 19 GPa and 1300°C using the USSA2000 press at Stony Brook. The water content of the hydrous phase was measured to be 3.8 wt% by secondary ion mass spectrometry (SIMS). The result is shown in Figure 1. No data were collected for the anhydrous phase at 400°C because no stress drop is expected based on the previous run for the hydrous phase. The behavior of the ringwoodite is similar to that of the wadsleyite at temperatures up to 400°C although there are somewhat greater experimental errors. Up to 600°C the yield strength drops by 29% and 39% in the anhydrous and hydrous phases respectively, and further drops of the yield strength are observed with further increase of temperature: 29% and 38% from 600°C to 800°C, and 20% and 48% from 800°C to 1000°C in the anhydrous and hydrous phase respectively. Both phases show stress relaxation as a function of time at each temperature. The strength of the hydrous phase at 1000°C is close to zero and the limited instrumental resolution results in larger scatter, and some data are scattered below the base level.

[1] J. Chen, T. Inoue, Y. Wu, D. J. Weidner and M. T. Vaughan, NLSL Report 1996 B-139.

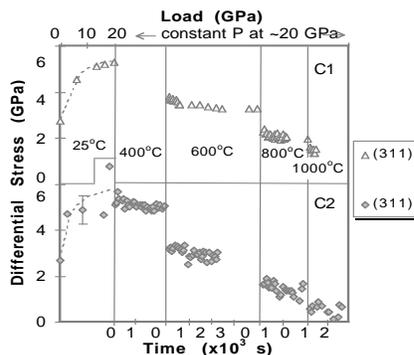


Figure 1. Stress in the anhydrous and hydrous phase of ringwoodite.