Geophysical Research Abstracts
Vol. 20, EGU2018-5611, 2018
EGU General Assembly 2018

Pressure dependence of creep in forsterite olivine: comparison of measurements from the D-DIA and Griggs apparatus

Shirin Kaboli (1), Pamela Burnley (1), Gang Xia (2), and Harry Green (2)

(1) University of Nevada in Las Vegas, Geoscience, Las Vegas, United States (pamela.burnley@unlv.edu), (2) Department of Earth Sciences, University of California Riverside, Riverside, CA, USA

In the last decade, the field of high pressure deformation studies has been significantly advanced by the advent of in-situ deformation experiments in which the stress within the sample is monitored via synchrotron x-ray diffraction. The diffraction data provide the opportunity to interrogate deformation processes in an entirely new way. One thing that has not to date been tested is how stress measurements made with in-situ x-rays compare with the more traditional method of measuring the load at the exterior of the sample with a load cell. The experiments reported here were conducted in an effort to address this question by deforming the same sample material, a synthetic forsterite olivine polycrystal, using a solid medium Griggs apparatus and a D-DIA apparatus. We present measurements of the creep strength of forsterite olivine at 1200 C from 1 – 7.5 GPa made using a Griggs apparatus at low pressures and D-DIA apparatus at high pressures. The diffraction data from the sample as well as an alumina piston in series with the sample was analyzed using an elastic plastic self-consistent model to produce stress values. We find that results from the two apparatus are comparable if the stress measurements made from the alumina piston in the D-DIA experiments are used as a proxy for the load that the olivine sample supports. The data indicate that the pressure dependence of creep (ΔV^*) cannot be described by a constant value over this pressure range, but changes from $\sim$15 cm3/mol at low pressure to closer to 4 cm3/mol at high pressure. These results are consistent with changes in the mix of deformation mechanisms operating in forsterite over this pressure interval as has been proposed by other workers.