



Si and O self-diffusion coefficient of forsterite as a function of water content

Tomoo Katsura (1), Hongzhan Fei (1), Michael Wiedenbeck (2), and Daisuke Yamazaki (3)

(1) Bayerisches Geoinstitut, University of Bayreuth, Germany, (2) Helmholtz-Zentrum Potsdam, Germany, (3) Institute for Study of the Earth's Interior, Okayama University, Japan

It has been considered that small amount of water should decrease mantle viscosity significantly from results of deformation experiments. However, difficulty of such experiments could lead to overestimation of the water effect. As mineral creep is controlled by diffusion of the slow species, we measured Si and O self-diffusion coefficient (D_{Si} and D_{O}) in forsterite single crystal at 8 GPa, 1600-1800 K, with water content ($C_{\text{H}_2\text{O}}$) ranging from < 1 up to ~800 ppm, showing that D_{Si} and D_{O} are proportional to $(C_{\text{H}_2\text{O}})^{(0.32 \pm 0.03)}$ and $(C_{\text{H}_2\text{O}})^{(0.06 \pm 0.14)}$, respectively. The small water content exponents suggests that the role of water on the upper mantle rheology is insignificant. The softening of the oceanic lithosphere cannot be caused by hydration.