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Experimental study on rheology of olivine at deep upper mantle conditions

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Among the upper mantle minerals, olivine is the most abundant phase and is considered to be the weakest phase with the lowest viscosity. Thus the rheology of the upper mantle is most probably dominated by that of olivine. Since most of the previous rheological studies have been conducted at relatively low pressures, effect of pressure on olivine rheology is still under debate. The reported values of activation volume for power-law creep based on recent high-pressure deformation experiments of olivine using D-DIA and RDA are scattered. There is no general consensus about the transition of lattice preferred orientation in the Earth's upper mantle condition. In the presentation, I review recent studies on high-pressure olivine rheology, including the high-pressure deformation experiments using D-DIA apparatus combined with synchrotron radiation conducted by our group, and discuss problems to be solved.

Keywords: Upper mantle, Rheology, Olivine, Deformation experiments