High-pressure and high-temperature deformation experiments using Kawai-type apparatus for triaxial deformation (KATD)

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Knowledge of rheological property of mantle constituent minerals is important for understanding of material behavior in the Earth's deep interior. Most of previous studies on rheology of mantle minerals with controlled deformation have been limited to low-pressure (less than 3 GPa) due to experimental difficulty. Recently, deformation-DIA apparatus (D-DIA) and rotational Drickamer apparatus (RDA) have been developed for deformation experiments at higher pressures (e.g. Wang et al., 2003; Yamazaki and Karato, 2001). However, reported experimental pressure condition using D-DIA is still limited to less than 10 GPa, and experiments at low differential stress condition (less than ~1 GPa) with RDA is still difficult.

We have installed new high-pressure deformation apparatus "Kawai-type Apparatus for Triaxial Deformation (KATD)" at Magma Factory, Tokyo Institute of Technology. The KATD is a modification of cubic-type Kawai-type multi-anvil apparatus with top and bottom differential rams. Since achievable maximum pressure using Kawai-type apparatus (with WC anvils) is ~30 GPa, deformation experiments up to ~30 GPa is expected to be possible using KATD. Deformation with very low stress level is expected to be possible using KATD because compression can be done quasi-hydrostatically.

In this presentation, basic performance of KATD and preliminary results of deformation experiments at high-pressure and high-temperature will be shown. In the most recent experiments, sintered $(Mg_{0.85}Fe_{0.15})O$ sample was successfully deformed up to shear strain of 1.8 at pressure of 15 GPa and temperature of 1473 K using hard Al_2O_3 piston.