I212-032 **Room: 303** **Time: May 20 11:00-11:15**

Stress relaxation test of olivine under Earth's deep upper mantle conditions

Yu Nishihara[1]; Ken-ichi Funakoshi[2]; Yuji Higo[2]; Noriyoshi Tsujino[3]; Takaaki Kawazoe[4]; Tomoaki Kubo[5]; Akira Shimojuku[5]; Hidenori Terasaki[6]; Norimasa Nishiyama[1]

[1] GRC, Ehime Univ.; [2] JASRI; [3] Dpt. Earth Plant. Sci.,Tokyo Inst. Tech.; [4] Ehime Univ. GRC; [5] Kyushu Univ.; [6] Inst. Mineral. Petrol. and Econ. Geol., Tohoku Univ.

Knowledge of rheological property of the deep Earth material is important for understanding of dynamics in the Earth's interiors. Among upper mantle minerals, olivine is the most abundant phase and is considered to be the weakest phase. Therefore, rheological property in the upper mantle is most probably dominated by that of olivine (e.g. Karato. 2008). In this study, we have conducted stress relaxation test of olivine at high pressure and high temperature using the newly developed high pressure stress measurement system at SPring-8, Japan. Through this study, we have investigated pressure dependence of low-temperature rheology of olivine in the deep upper mantle conditions.

Pre-sintered San Carlos olivine sample rod was packed within an octahedral MgO-Cr_2O_3 pressure medium with 10 mm edge length. The sample was inserted between dense Al_2O_3 pistons to yield high stress at high pressure. The pressure medium was compressed with six WC and two cBN anvils with 5 mm truncated edge length using a Kawai-type multi-anvil apparatus SPEED-1500 at SPring-8. Two-dimensional X-ray diffraction pattern was taken using monochromatic X-ray with energy of 40 keV and an imaging plate.

Two stress relaxation experiments (Run1 and 2) were carried out. In both experiments, pressure was first increased at room temperature, and then temperature was kept at 673, 873, 1073 and 1273 K with observation of stress. The annealing cycle was carried out once at ˜7 GPa in Run1 and three times at ˜4, ˜6 and ˜10 GPa in Run2. The stress and pressure were calculated from the five diffractions [(021), (101), (130), (131) and (112)] using equation proposed by Singh et al. (1998) with known thermoelastic parameters (Isaak, 1992; Abramson et al., 1997; Liu and Li, 2006).

Similar relaxation behavior was observed in all relaxation cycles. For example, in Run1, deviatoric stress [based on (130)] was decreased from 4.7 to 2.6 GPa by temperature increase from 300 to 673 K. Changes of stress value during annealing were 2.6 to 2.2 GPa at 673 K, 1.7 to 1.2 GPa at 873 K, 0.63 to 0.56 GPa at 1073 K and 0.20 to 0.20 GPa at 1273 K. Result of strain measurements by radiography suggests that plastic strain rate in sample is very small, less than 1 x 10^{-7} s^{-1}. Therefore, present results give constraints on lower limit of flow stress at strain rate of 1 x 10^{-7} s^{-1} at given P-T conditions. Based on the constraints, positive pressure dependence is suggested for plastic strength of olivine at low temperature (less than 1200 K).