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Venue: Meeting Room #486
Science Research Bldg. 1, 4th floor.
Ehime Univ.

Keywords:
1. Transient creep
2. Olivine
3. The Andrade model

In situ time-resolved X-ray observation of transient creep in olivine aggregates at upper mantle pressures

Transient creep of olivine aggregates has been studied by stress-relaxation experiments at pressures of 1.7–3.6 GPa and a temperature of 1020 K. Time-dependent deformation of olivine at small strains (<0.07) was monitored using a combination of a high-flux synchrotron X-ray and a CdTe imaging detector. The observed deformation was found to follow the Andrade creep function, viz., $\varepsilon = \sigma(1/G + \beta t^m + t/\eta_{ss})$ (ε: strain; σ: stress; G: elastic modulus; t: time; η_{ss}: steady-state viscosity; m and β: constants) with the time exponent m =0.13–0.24 and the coefficient β=0.003–0.004 $GPa^{-1}s^{-m}$. We have found that low viscosities of the uppermost mantle (in the range of 10^{17}–10^{18} Pa·s) reported by geodetic observations on early post-seismic deformation are well explained by the transient term of the Andrade model, without the assumption of water-weakening or partial melting of upper mantle peridotites. Time-dependency of uppermost mantle viscosity after a large crustal earthquake (within the timescale of 100 years) is found to be successfully described by the transient and steady-state terms of the model.