Creep strength of ringwoodite measured up to 1700 K at 17-18 GPa using a deformation-DIA apparatus

T. KAWAZOE[12]*, Y. NISHIHARA[2], T. OHUCHI[2], N. MIYAJIMA[1], G. MARUYAMA[23], Y. HIGO[4], K. FUNAKOSHI[45] AND T. IRIFUNE[26]

[1] Bayerisches Geoinstitut, University of Bayreuth, Bayreuth 95440, Germany (*correspondance: takaaki.kawazoe@uni-bayreuth.de)

[2] Geodynamics Research Center, Ehime Univ., Ehime 790-8577, Japan

[3] Earthquake Research Institute, University of Tokyo, Tokyo 113-0032, Japan

[4] Japan Synchrotron Research Institute, Hyogo 679-5198, Japan

[5] Research center for neutron science and technology, Ibaraki 319-1106, Japan

[6] Earth-Life Science Institute, Tokyo Institute of Technology, Tokyo 152-8550, Japan

Creep strength of ringwoodite is important for understanding complicated patterns of the mantle convection in and around the mantle transition zone. We measured the creep strength of ringwoodite at 16.9-18.0 GPa and 1300-1700 K during axial deformation with strain rates of 1.48-3.59 × 10^{-5} s^{-1} to strains of 13.2-24.9 % using a deformation-DIA apparatus with synchrotron X-ray. We characterized deformation microstructure and water content of recovered samples by scanning and transmission electron microscopies and infrared spectroscopy, respectively. Based on mechanical and microstructural observations, we infer that ringwoodite deformed by two deformation mechanisms: (1) exponential dislocation creep through the Peierls mechanism at 1300-1400 K and (2) power-law dislocation creep at 1500-1700 K. The creep strength of ringwoodite is apparently lower than those of bridgmanite [1-2], wadsleyite [3-4] and olivine [5-6]. The present result might imply that the lower part of the mantle transition zone is a low-viscosity layer. Further creep-strength data of these minerals are necessary to be determined above 13.5 GPa and high temperatures to determine viscosity structure in and around the lower part of the mantle transition zone at strain rates relevant to the mantle convection.

[1] Girard *et al*. (2016) Science **351**, 144-147. [2] Yamazaki *et al*. (2000) *PEPI* **119**, 299-309. [3] Kawazoe *et al*. (2011) Am. Mineral. **96**, 1665-1672. [4] Kawazoe *et al*. (2010) *JGR* **115**, B08208. [5] Karato & Jung (2003) Philos. Mag. **83**, 401-414. [6] Kawazoe et al. (2009) *PEPI* **174**, 128-137.