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In situ creep strength measurement on ringwoodite up to 1700 K at 17-18 GPa using a deformation-DIA apparatus

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KAWAZOE, Takaaki[1*] ; NISHIHARA, Yu[2] ; OHUCHI, Tomohiro[2] ; MARUYAMA, Genta[3] ; HIGO, Yuji[4] ; FUNAKOSHI, Ken-ichi[5] ; IRIFUNE, Tetsuo[2]
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[1]Bayerisches Geoinstitut, University of Bayreuth, Bayreuth D-95440, Germany, [2]Geodynamics Research Center, Ehime University, Ehime 790-8577, Japan, [3]Earthquake Research Institute, University of Tokyo 113-0032, Japan, [4]Japan Synchrotron Research Institute, Hyogo 679-5198, Japan, [5]Research Center for Neutron Science and Technology, Ibaraki 319-1906, Japan
[1]Bayerisches Geoinstitut, University of Bayreuth, Bayreuth D-95440, Germany, [2]Geodynamics Research Center, Ehime University, Ehime 790-8577, Japan, [3]Earthquake Research Institute, University of Tokyo 113-0032, Japan, [4]Japan Synchrotron Research Institute, Hyogo 679-5198, Japan, [5]Research Center for Neutron Science and Technology, Ibaraki 319-1906, Japan

Deformation experiments on polycrystalline $(Mg_{0.9},Fe_{0.1})_2SiO_4$ ringwoodite have been conducted in uniaxial geometry up to strains of 15.5 % at 17.3-17.9 GPa, 1500-1700 K and strain rates of 3.46-3.59 $\times$ 10^{-5} s^{-1} using a deformation-DIA apparatus at the synchrotron facility SPring-8. Stress magnitude was measured from azimuthal dependence of three diffraction peaks of ringwoodite (220, 311 and 400) by two-dimensional X-ray diffraction. Strain was calculated from X-ray radiographs of strain markers. Stress magnitude of ringwoodite at steady-state deformation, i.e. creep strength, was 400 MPa at 1500 K. The creep strength decreased to 130 MPa with increasing temperature to 1700 K. The creep strengths of this study are lower than those (4-6 GPa) observed at 3-10 GPa and room temperature using a deformation-DIA apparatus (Nishiyama et al., 2005) and those (1.7-2.8 GPa) determined at 21-23 GPa and 1800 K using a rotational Drickamer apparatus (Hustoft et al., 2013; Miyagi et al., 2014). Further deformation experiments and subsequent sample analyses should be performed to determine flow laws of ringwoodite and in turn to discuss viscosity at the lower part of the mantle transition zone.

キーワード: ringwoodite, creep strength, stress, strain, deformation-DIA apparatus, synchrotron X-ray
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