THE GEODYNAMICS SEMINAR №534

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Venue: Zoom

A link will be sent @grc-all within 30 minutes before the beginning of the seminar.

Rheology of bcc-iron at high-pressure and -temperature

Although many hypotheses have been proposed for origin of the seismic anisotropy in the Earth's inner core, there is no general consensus for its origin. The dominant mechanism of the inner core dynamics depends on the inner core age and viscosity, and there are several candidate mechanisms which includes anisotropic growth model and thermal convection model. Some recent computational mineral physics studies claimed that the iron-rich alloy in the inner core possibly has body-centered cubic (bcc) structure rather than hcp. Therefore, information of viscosity of bcc-iron is important for the accurate understanding of the inner core dynamics. In this study, we have studied rheology of bcc-iron based on high-pressure and high-temperature deformation experiments.

Uniaxial deformation experiments were carried out using a deformation-DIA apparatus SPEED-MkII-D installed on a beamline BL04B1 at SPring-8. Using polycrystalline iron aggregate as a starting material, deformation experiments were carried out at pressure of 2.0-6.0 GPa, temperature of 523-823 K, and strain rate of 0.8–5.7×10–5 s–1. The results show that power-law dislocation creep with stress exponent of ~5 is dominant except for at temperature above 723 K. When compared with rheology of hcp-iron at constant stress condition, viscosity of bcc-iron is lower by ~5 orders of magnitude. If the inner core mostly consists of bcc-iron, the viscosity in the inner core is estimated to be significantly lower than the previous estimates where hcp-iron was assumed to be the dominant inner constituent.

Keywords: 1. Bcc-Iron 2. Rheology 3. Inner Core

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