THE GEODYNAMICS SEMINAR № 611

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2024.06.14 (Fri.) 16:30 ~

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

Keywords:
1. Seismic anisotropy
2. deformation-induced crystallographic-preferred orientation
3. ε-FeOOH

Deformation-induced crystallographic-preferred orientation of ε-FeOOH

Ubiquitous presence of seismic anisotropy near subducted slab in the upper part of the Earth's lower mantle has been reported (e.g. Ferreira et al., 2019; Lynner and Long, 2015). Some of these anisotropy is not well explained by crystallographic-preferred orientation (CPO) of anhydrous major lower mantle minerals. Phase H ($MgSiO_2(OH)_2$), one of the dense hydrous magnesium silicates, is a candidate mineral which may produce the observed anisotropy, because hydrous minerals can be produced by reaction with water transported by subducted slab, and phase H is known to have strong elastic anisotropy (Tsuchiya and Mookherjee, 2015). In this study, we have conducted high-pressure and high-temperature deformation experiments on ε-FeOOH which has same crystal structure as phase H and is stable at relatively lower pressures.

Deformation experiments were conducted using D111-type apparatus installed at BL04B1, SPring-8. Uniaxial compression, tensile test, and simple shear deformation were carried out at 12 GPa and 773-973 K using pre-synthesized ε-FeOOH. CPO was determined by analyzing recovered samples using FE-SEM-EBSD. In the uniaxial compression and tensile test, the [010] and [001] axes, respectively, aligned along the direction of the uniaxial deformation axis. In the shear deformation geometry, the [010] and [001] axes aligned to be sub-parallel to the shear plane normal and shear direction, respectively. These results indicate that dominant slip system in ε-FeOOH is (010)[001] under the studied conditions. This suggests that phase H deformed in horizontal shear in the Earth's lower mantle yields shear wave polarization anisotropy of $V_{SV} > V_{SH}$ and trench-parallel splitting.

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