THE GEODYNAMICS SEMINAR №613

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Science Research Bldg. 1, 4th floor.
Ehime Univ.

Keywords:

1. δ-AlOOH
2. Microstructure
3. Crystallographic preferred orientation

Deformation-induced crystallographic preferred orientation of δ-AlOOH at high pressure and high temperature

Understanding the rheological properties of hydrous phases under extreme conditions is crucial for elucidating the mechanical behavior of subducting slabs and the associated seismic anisotropy within the Earth's mantle transition zone and lower mantle. δ-AlOOH, the high-pressure polymorph of diaspore, has an orthorhombic crystal structure with high elastic anisotropy. Unlike other hydrous minerals that decompose in the lower mantle, δ-AlOOH forms a solid solution with ε-FeOOH and phase H in hydrous crust and remains stable from 18 GPa to lowermost mantle conditions, coexisting with bridgmanite or post-perovskite. Its rheological properties profoundly influence dynamics in subduction zones in the deep mantle.

My recent work focuses on the rheological behavior of δ-AlOOH under high-pressure and high-temperature conditions. Deformation experiments were conducted on δ-AlOOH aggregates at approximately 21 GPa, 700-1000°C, with a strain rate of $1\text{-}5*10^{-5}\ s^{-1}$ in a dislocation creep regime, using both offline and synchrotron in-situ methods. The conditions are representative of the mantle transition zone. Analysis of the microstructure and crystallographic preferred orientation (CPO) of the recovered samples revealed that δ-AlOOH developed a pronounced (010) texture perpendicular to the compression direction, with [001] as the dominant slip direction.

The significant fabric in deformed δ-AlOOH could contribute to the ubiquitously observed seismic anisotropy near subducting slabs. In this presentation, I will share preliminary results from the well-controlled deformation experiments on δ-AlOOH and discuss their implications for shear-wave anisotropy in the mid-mantle.

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