Seismic Anisotropy of the D Layer induced by (001) Deformation of Post-Perovskite

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Abstract

Crystallographic preferred orientation (CPO) of post-perovskite (Mg,Fe)SiO3 (pPv) has been believed to be one potential source of the seismic anisotropic layer at the bottom of the lower mantle (D layer). But the natural CPO of pPv remains ambiguous in the D layer. Here we have carried out the deformation experiments of pPv-(Mg0.75,Fe0.25)SiO3 using synchrotron radial X-ray diffraction in a membrane-driven laser-heated diamond anvil cell from 135 GPa and 2500 K to 154 GPa and 3000 K. Our results show that the intrinsic texture of pPv-(Mg0.75,Fe0.25)SiO3 should be (001) at realistic P-T conditions of the D layer, which can produce a shear wave splitting anisotropy of _˜3.7% with VSH > VSV. Considering the combined effect of both pPv and ferropericlase, we suggest that 50% or less of deformation is sufficient to explain the origin of the shear wave anisotropy observed seismically in the D layer beneath the circum-Pacific rim.

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