

The sharpness and compositional effects on post-perovskite phase transition

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Seismological observations frequently show a sharp positive velocity jump above the CMB (D'' discontinuity). The velocity increases in a width ranging from 50 to 70-km, which corresponds to a pressure interval of 3 to 4 GPa. Moreover, the D'' discontinuity is observed at various depths 100 to 300-km above the CMB. The large variation in the depth of the D'' discontinuity could be caused by the combined effects of temperature and chemical composition. Here we precisely determined the post-perovskite phase transition boundary in a natural pyrolitic mantle (KLB-1 peridotite) and mid-oceanic ridge basalt (MORB) compositions by a combination of in-situ X-ray diffraction measurements and laser-heated diamond-anvil cell techniques. Present results together with our earlier studies based on the same pressure scale [1-3] demonstrate that post-perovskite phase transition occurs in a pressure interval of about 7 GPa in both pyrolitic mantle and MORB compositions. The width of phase transition obtained in this experimental study is slightly larger than that observed seismically at the D'' discontinuity. The pressure of phase transition is lower in MORB composition by about 5 GPa than that in pyrolitic mantle. The chemical heterogeneity caused by the accumulation of subducted MORB crust contributes to the complex topography of the D'' discontinuity.

References

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