# Fe alloy snow and fractional solidification at the lowermost outer core

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Refined seismological data shows a reduced compressional-wave gradient at the base of the outer core and seismic wave velocity asymmetry between the east-west hemispheres at the top of the inner core relative to the Preliminary reference Earth model (PREM) [1-6]. Based on recent high-pressure mineral physics data, we found that fractional crystallization of liquid Fe alloy (e.g., Fe-Si-O) with light element partitioning and a compositional gradient can explain the observed reduced velocity gradient at the base of the outer core. A fractionally crystallizing outer core implies the formation of a compacting cumulate pile at the boundary between the inner and outer cores, which may exhibit later variations between the east and west hemispheres. We propose that a slurry layer (F layer) and a compacting cumulate pile (F' layer) exist through Fe alloy snow and fractional solidification across the inner-core boundary [7]. Applying our model to seismic interpretations suggests the inner core has relatively high viscosity (~$10^{23}$ Pa s, depending on the age of the inner core). These results are important to understanding the mechanism of the inner core formation and subsequent evolution. In this presentation, we will use recent mineral physics data and geodynamical models to constrain the formation processes of the F layer and address some seismic and geodynamic features of the uppermost inner core.

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