



Perovskite / Post-Perovskite Phase Transformation : Effect on Grain Sizes and Orientations

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At P/T conditions of the D'' layer, bridgmanite transforms into its high-pressure phase of (Mg,Fe)SiO₃ post-perovskite (pPv). Observations of seismic anisotropy in D'' are inferred to arise from textures and microstructures within pPv. Specifically, mantle flow is thought to cause pPv to deform, creating lattice-preferred orientations. However, debates emerged in the literature whether experimentally observed textures were induced by plastic deformation of the sample or by phase transformation from a previous phase and whether this could explain the observed patterns of anisotropy in the lowermost mantle.

Here, we will focus on the mechanism of transformation on a low-pressure fluoride analogue system (NaCoF₃) for which it was suggested that pPv could inherit texture from the parent perovskite (Pv) phase. This inheritance of texture, combined with lattice-preferred orientation in pPv, could explain the observed patterns of anisotropy in the lowermost mantle.

We rely on a novel experimental method, Multigrain Crystallography, to characterize thousands of crystals in a polycrystalline material in-situ, as transformation proceeds. Here, we monitor individual grains during the Pv/pPv transition in NaCoF₃ with P/T conditions up to 25 GPa and between 600-1500 K. We follow the distributions of grain sizes and orientations while the sample transforms from the Pv to the pPv structure, and when it transforms back from pPv to Pv. These results allow us to decipher the transition mechanism between both phases, whether it is martensitic or not, and the effect of the transformation on microstructures and grain size distributions, with important implications for our understanding of D'' dynamics and anisotropy.