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High-pressure, high-temperature deformation of $CaGeO_3$ (perovskite)±MgO aggregates: Elasto-ViscoPlastic Self-Consistent modeling and dynamics in the lower mantle

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As the largest rocky layer in the Earth, the lower mantle plays a critical role in controlling convective patterns in our planet. Current mineralogical models suggest that the lower mantle is dominated by (Mg,Fe)SiO_3 perovskite (SiPv; about 70 – 90% in volume fraction) and (Mg,Fe)O ferropericlase (Fp). Knowledge of rheological properties and textures of the major constituent minerals is critical in understanding dynamic processes of the deep Earth, and relating seismic observations to mineralogy. While individual properties of these phases have been studied, fewer informations on polyphase aggregates are available. Fundamental understanding about the stress-strain interactions among the phases and their effect on the bulk rheology still remains to be properly addressed. We examine stress/strain partitioning and rheological properties of a two-phase polycrystal $CaGeO_3$ perovskite (GePv) and MgO, deformed in the D-DIA at controlled speed $\sim$1 – 3×10-5 s-1 at high pressures and temperatures (between 3 to 10 GPa and 300 to 1200 K), with bulk axial strains up to $\sim$30%. We use Elasto-Visco Plastic Self-Consistent modeling (EVPSC) to reproduce lattice strains and textures measured in-situ with synchrotron X-ray diffraction. We compare the results to those on an identical deformation experiment with a single phase (GePv) polycrystal. We will discuss stress distributions between the two phases in the composite, texture developments, relationships with active slip systems, and finally the implications for rheological and seismic properties of the lower mantle.