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Shockless compression of hydrated silicate glasses[1] JEAN-PAUL DAVIS, Sandia National Labs , ALISHA N. CLARK, STEVEN D. JACOBSEN, Northwestern University, J. MATTHEW LANE, KYLE R. COCHRANE, JOSHUA P. TOWNSEND, Sandia National Labs, ADAM R. SARAFIAN, Corning, Inc. —
Recent work suggests that Earth's mantle transition zone (MTZ, 410-660 km, 12-28 GPa) may store significant amounts of water. Low seismic velocities observed at the upper and lower boundaries of the MTZ may reflect the production of hydrous silicate melts from dehydration reactions during mantle convection. Quantifying this connection will require experimental data on the physical properties and equations of state for both hydrous and anhydrous silicate melts at relevant pressures to help understand melt fraction and volatiles content. Measurements on solid amorphous silicate glasses can provide insight to the behavior of molten silicates because both states exhibit anomalous behavior thought to arise from similar mechanisms. We performed quasi-isentropic compression experiments using Sandia's Thor small pulser on $MgSiO_3$ and $NaSiO_3$ glasses, both hydrous ($\sim$1.5 wt%) and anhydrous ($\sim$0.05 wt%), to as high as 30 GPa longitudinal stress. Analysis of velocimetry data from these experiments gives compressibility along a thermodynamic path closer to a planetary adiabat than the isothermal path probed by static experiments. We investigate the effect of composition on anomalous compressibility and densification, comparing to models and computations.

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