Abstract Submitted
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Shock compression of preheated silicate liquids: 30 years of progress[1] PAUL ASIMOW, California Institute of Technology — Tom Ahrens and his students pioneered, beginning around 1981, the technique of determining silicate liquid equations of state for geophysical applications using shock compression of pre-heated, encapsulated samples. In the last decade, we have ported this technique to the Caltech two-stage light gas gun and extended several pre-heated liquid Hugoniots to over 125 GPa. We now have enough compositions studied to perform several tests of the theory of linear mixing or, assuming linear mixing, to describe any liquid in the five-component CaO-MgO-FeO-Al_2O_3-SiO_2 system. This data allows us to identify liquid compositions likely to be negatively or neutrally buoyant in the lower mantle and to form a preliminary description of the dynamics of partial melting of solid lower mantle or initial crystallization of a deep mantle magma ocean. The most robust and surprising feature of all studied liquids, which places very strong constraints on microscopic models for silicate liquid compression behavior, is anomalous increase of the Grüneisen parameter upon compression, with remarkably consistent $q = d\ln\gamma/d\ln V = -1.75 \pm 0.25$.

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