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Dynamic Freezing of Liquid Cerium Under Shock-Ramp Compression MICHAEL DESJARLAIS, CHRIS SEAGLE, ANDREW PORWITZKY, Sandia National Laboratories, BRIAN JENSEN, Los Alamos National Laboratory — We have performed dynamic loading experiments on the Z machine to probe the melt curve and corresponding solidification of polycrystalline cerium following shock melt and subsequent ramp compression. Subtle signs of freezing are found in a small but statistically significant bump in the sound speed suggestive of an elastic wave. Analysis of the sound speed data indicates a very low shear to bulk modulus ratio, characteristic of very ductile material, and a Poisson ratio of approximately 0.45. Density functional calculations exploring a compression isentrope initiating on the Hugoniot exhibit spontaneous freezing to the body centered tetragonal ϵ-Ce phase at pressures very close to the experimental observation of a bump in the sound speed. Corresponding elastic constant calculations performed on full DFT molecular dynamics simulations find values for the longitudinal and bulk sound speeds, shear modulus, and Poisson ratio in very good agreement with experiment.

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