Abstract Submitted
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Melting Curves of Tin, Iron, and Tantalum from In-Situ X-Ray Diffraction[1] RICHARD KRAUS, FEDERICA COPPARI, DAYNE FRATANDUONO, AMY LAZICKI, DAMIAN SWIFT, JON EGGERT, GILBERT COLLINS, Lawrence Livermore National Laboratory — The melting curve represents a tremendous rheological transition, from a material with strength to one without. This transition is critical to the evolution of the Earth, as the latent heat from solidification of Earth's inner core helps to drive the magneto-dynamo in the liquid outer-core. The sound velocity along the Hugoniot has been used as a diagnostic of melting, however, the interpretation of the data has sometimes come into question and diamond anvil cells are limited in pressure and temperature. Here we present melting and re-solidification experiments at the Omega and Omega EP laser facilities. We use in-situ x-ray diffraction as a diagnostic of melting along the principal Hugoniots of iron and tantalum. We also present data on the re-crystallization of tin on the nanosecond timescale after re-compression from the Hugoniot state. We use signal from both solid diffraction and diffuse scattering from the liquid to constrain melting and solidification. We are able to show that melting and solidification can occur on nanosecond timescales and that these techniques can be used to determine the equilibrium ultra-high pressure melting curves of a wide range of materials.

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