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Forsterite Shock-and-Release: Temperature and Density on the Liquid-Vapor Curve[1] ERIK DAVIES, MEGAN DUNCAN, SARAH STEWART, DYLAN SPAULDING, U. California Davis, SETH ROOT, DAVID BLISS, Sandia National Labs, RICHARD KRAUS, Lawrence Livermore National Lab, STEIN JACOBSEN, Harvard — We present experimental results on forsterite that probe the extreme conditions during melting and vaporization of rocky planets. Previous work probed the principal Hugoniot of forsterite. Here, we examine release to the liquid-vapor curve. Flyer plate impact experiments were performed on the Z-Machine at Sandia National Laboratories where planar, supported shock waves are generated in single crystal samples. Between the sample and window is a gap of known distance into which the sample expands upon shock breakout. Free expansion leads to a density plateau at the liquid-vapor phase boundary, generating a liquid wall that impacts a standard window. The density of the liquid flyer is derived from the measured liquid flyer velocity and shock velocity in the window. Temperature on the liquid-vapor phase boundary is measured by releasing the sample from the shocked state into vacuum and measuring the thermal emission spectrum of the liquid wall. These experiments directly access the liquid-vapor curve, allowing for more accurate predictions of melting and vaporization in planetary impact events.

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