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**Nanosecond freezing of gallium metal under extreme effective cooling rates. Part 1: Experiments** JUSTIN BROWN, BRIAN STOLTZFUS, Sandia National Laboratories , JONATHAN BELOF, PHILIP MYINT, Lawrence Livermore National Laboratory — Despite considerable interest in the timescales associated with first-order phase transitions, dynamic experiments probing the limits of transformation rates remain sparse. We present results for the first experimental measurements of the dynamic freezing of a metal on nanosecond timescales. Experiments were performed using the pulsed-power machine Thor, which utilizes precision shaping of the current pulse to shocklessly compress thin liquid gallium samples at a range of loading strain rates ($10^6$ – $10^7$ $s^{-1}$) and peak pressures (20 – 45 GPa). Velocimetry measurements of the rear surface of the cell shows clear evidence of freezing under a subset of loading conditions. We demonstrate how these data can be integrated with a recently developed theoretical description of nucleation and growth to advance our understanding of the dynamic solidification of metals. Results from this model are presented in the following accompanying talk. SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525.

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