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High-resolution phase contrast imaging of jet formation in shocked cerium to examine material strength BRIAN JENSEN, SHENG LUO, FRANK CHERNE, GUY DIMONTE, GUILLERMO TERRONES, DANIEL HOOKS, KYLE RAMOS, JOHN YEAGER, KRIS KWIATKOWSKI, TSUTOMU SHIMADA, Los Alamos National Laboratory, KAMEL FEZZAA, Argonne National Laboratory — Understanding the dynamic properties of metals has been a long-standing scientific challenge. Experiments are needed to locate phase boundaries, to obtain equation-of-state data within those boundaries, and to examine properties such as material strength in the relevant phases. Efforts have been underway in recent years to examine the multiphase equation-of-state for cerium largely because of its complex phase diagram that exists at relatively moderate pressures and temperatures. To date, experiments have been performed to determine the Hugoniot, the shock-melt transition, and to examine the low-pressure phases through the critical point. In the current work, we present novel data that uses ultrafast, high-resolution phase contrast imaging (PCI) to examine jet-formation in cerium for impact stresses that span the alpha-phase up to the melt boundary. These experiments were performed using a recently developed capability at the 32-ID beamline of the Advanced Photon Source that couples the PCI method with an impact system to obtain real-time, spatially resolved images during dynamic compression. Experimental results will be presented and compared with recent efforts that use more traditional shock-release and double-shock loading to examine strength.

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