Title: High-resolution phase contrast imaging of jet formation in shocked cerium to examine material strength


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High-resolution phase contrast imaging of jet formation in shocked cerium to examine material strength

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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 γ–α phases for stresses that span 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 α-phase up to the melt boundary. These experiments were performed using a recently developed capability at 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.