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Mechanical response of metals under dynamic loading off the principal Hugoniot and isentrope

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Controlled dynamic loading of materials on phase-space paths off the principal Hugoniot and isentrope provide a stringent test of equation of state models in regions not typically experimentally constrained. Maturation of hardware design and pulse-shaping capabilities for shock-ramp experiments at Sandia's Z Machine have been exploited to test the mechanical response of a wide range of metals on ramp compression initiated from a well-defined Hugoniot state. A range of 1-8 km/s impact velocities are possible before initiating a ramp wave in a test sample. Capabilities and challenges of this type of experiment will be presented along with recent data on platinum, tin, cerium, and tantalum. Results of these experiments will be discussed in relation to existing equation of state data and models, and the future outlook for experimental constraints on material response on controlled off-principal loading paths. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.