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Title:	Design and analysis of x-ray driven shock wave equation-of-state experiments on the National Ignition Facility
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Abstract

The equation-of-state (EOS) is important for describing and predicting material properties in the field of high energy density physics. Especially important is the EOS of materials compressed and heated from ambient conditions by shockwaves. For most materials, experimental data at high pressures, much above 10 Mbar, is sparse. The large energy and power of the National Ignition Facility readily enable EOS experiments in a new regime, at pressures on order of 100 Mbar. We describe a platform for EOS measurements using planar shockwaves driven by x rays within a hohlraum target. The EOS is determined by an impedance matching method, using a reference material of known EOS. For transparent materials, the shock velocity is measured directly by optical interferometry, while for opaque materials, the measurement is done by timing the entrance and exit of the shock and correcting for time variations with an adjacent transparent reference. We describe the computational design and analysis of experiments. Predicted shock velocities and transit times are used to set the target layer thicknesses and interferometer timing. Data from several NIF shots are compared to post-shot calculations. New, high pressure EOS data is presented for several materials.

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