SHOCK05-2005-020033

Abstract for an Invited Paper
for the SHOCK05 Meeting of
the American Physical Society

Isentropic Compression Equation of State Analysis

JON EGGERT, LLNL

Dynamic off-Hugoniot measurements (re-shock, multi-shock, ring-up, quasi-isentropic) have long interested high-pressure scientists. Recent advances in ramp-wave loading using magnetic, laser, and graded-density impactor drives have inspired new interest in determining absolute, quasi-isentropic, equation-of-state (EOS) information from dynamic experiments into the multi-Mbar regime. These new experiments promise the potential to obtain an absolute EOS at many pressures along a quasi-isentrope in a single experiment. Such an experiment requires stringent experimental design including, a) highly accurate free surface or interface velocities measured for two or more sample thicknesses, b) extremely accurate relative timing of the velocity measurements, c) sufficiently planar drive that more than one sample thickness is driven by a single pressure drive, and d) the ramp drive must not generate a shock within the thickest sample step. The primary challenges to analyzing such experiments include, wave interactions, strength, phase transitions, and time-dependent (non-simple wave) effects. An ideal analysis should, a) give $P(\rho)$ independent of any a priori assumed parameterization, b) directly relate uncertainties in $P(\rho)$ to experimental uncertainties, and c) evaluate and address kinetic material effects that cause deviations from self-similar wave propagation. With these criteria in mind I will review several approaches to analyzing these quasi-isentropic compression experiments.