

Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Optical methods for determining the shock Hugoniot of Solids¹

FORREST SVINGALA, MICHAEL HARGATHER, GARY SETTLES, Penn State University — Traditionally, the shock Hugoniot is measured on a point-by-point basis by a series of high-velocity impact experiments. Observations are typically confined to pointwise pressure or velocity measurements at the free-surfaces of the sample. In this work, shock waves are initiated in transparent polyurethane and opaque polyurea samples using exploding bridgewires, aluminum ballistic projectiles, and gram-scale explosive charges. Shock waves and material motion are observed optically by shadowgraphy using a high-speed-digital camera recording at up to 10^6 frames/s. Ballistic impact, producing a constant-strength shock wave, is combined with these optical techniques to obtain a single shock Hugoniot point per test. A gram-scale explosive charge produces a shock wave in the material sample that is initially strong, but attenuates as it transits the polymer sample. With optical access to the entire sample, multiple shock and particle velocity combinations may be observed in a single test, allowing the measurement of a shock Hugoniot curve in fewer experiments than by traditional methods. These techniques produce data in general agreement with an extrapolation of published Hugoniot data for polyurethane and polyurea.

¹Work funded by the Office of Naval Research.

Forrest Svingala
Penn State University

Date submitted: 11 Feb 2013

Electronic form version 1.4