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High strain rate response of an elastomer. TONG JIAO, RODNEY CLIFTON, STEPHEN GRUNSCHEL, Brown University, BROWN UNIVERSITY TEAM — Pressure-shear plate impact experiments have been conducted to study the mechanical response of an elastomer (polyurea) at very high strain rates: 10^5 - 10^6 s^{-1}. Thin samples are cast between two hard steel plates. Longitudinal waves reverberating through the sample are used to determine the slope of the isentrope at compressive stresses greater than, say, 500 MPa - the pressure at impact. Release wave experiments, combined with plane wave simulations, are used to extend the isentrope into the tensile regime. Because the shearing resistance of polyurea depends strongly on pressure, two approaches are used to investigate the regime of high shearing rate and low pressure. First, an unloading longitudinal wave reflected from the rear surface of the target assembly is made to arrive at the sample midway through its loading by the incident shear wave. As a result, the sample is sheared at high strain rates and both high and low pressure during a single experiment. Second, the thickness of the flyer and front plates are selected such that the compressive pulse passes through the cast-in-place sample before the shear wave arrives, allowing the shearing resistance to be measured at zero pressure. Results of these experiments and their simulation will be presented.

Tong Jiao
Brown University

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