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Pressure-Sensitivity and Constitutive Modeling of an Elastomer at High Strain Rates 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:$10^5 - 10^6\, s^{-1}$. To measure the pressure-sensitivity of polyurea's shearing resistance, an impact configuration was designed to reduce the pressure during the shear wave loading of the sample by having an unloading longitudinal wave reflected from the rear surface of the target assembly arrive at the sample at the midpoint of the shear wave pulse. A similar impact configuration was designed to reduce the pressure on the sample before the shear wave arrives by having the unloading longitudinal wave arrive even earlier. In the first case the sample is sheared at high strain rates at both high and low pressure during a single experiment. In the second case the sample is sheared at high strain rates and low pressures. Based on experimental data, a constitutive model has been developed. This model features a hyperelastic spring working in parallel with an elastic spring and a viscoplastic dashpot in series. The viscoplastic dashpot is modeled by means of a thermal activation model in which the activation energy is taken to be pressure dependent. Good agreement between the measured and computed wave profiles is obtained over the entire range of pressures investigated in the experiments.

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