Thermal Effects in Shaped Charge Jets†

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ABSTRACT

A shaped charge provides an example of a device in which material is subjected to extremely high strain-rates and hydrostatic pressures. Using a high explosive, a solid shell undergoes extreme deformation, transforming into a high velocity jet. Predicting the performance of a given shaped charge design requires that the constitutive behavior of the solid liner be accurately represented in regimes of large strain (600%), high strain-rate (10^6/sec), and large hydrostatic pressure (100 GPA). Critical to evaluating shaped charge performance is the accurate calculation of temperatures in the jet. This can be used to predict whether or not melting may occur in the jet, leading to potential jet breakup and degrading performance. The pressure and strain-rate dependence in the inelastic constitutive equations significantly affect the predicted jet temperatures. Experimental data and numerical simulations will be used to discuss important aspects of the constitutive equations required for accurately modeling the formation of a shaped charge jet and evaluating its performance.

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