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Shock-Induced Chemical Reaction in Structural Energetic Materials VINDHYA NARAYANAN, XIA LU, SATHYA HANAGUD, Georgia Institute of Technology — Various powder mixtures like intermetallic mixtures and mixtures of metals and metal oxides have potential applications as structural energetic materials (SEMs). Technologies of varying the compositions and the powder sizes and their synthesis are being investigated to provide multiple desirable characteristics, like high strength and high energy content. One of applications of SEMs requires assuring the absence of chemical reaction when only strength is needed in applications that involve shock effects. In this paper, we formulate a model for SEMs for their application in shock conditions, in the framework of nonequilibrium thermodynamics model and continuum mechanics. A mixture of Al and $KClO_3$ and binders is selected as the example for SEMs. A mixture model, pore collapse, and plasticity model are included. By adapting energy barriers for reaction as a function of temperature, particle size, pressure and pressure gradient and introducing a relaxation mechanism in the reaction model, shock-induced chemical reaction model is developed. The variation of the relaxation mechanism with pressure and other effects is also modeled. Numerical tools are formulated to simulate gas-gun tests of energetic intermetallic nanocomposites. The initiation and propagation of chemical reactions are studied. The time and spatial dependency of chemical reaction on the shock wave conditions are investigated.

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