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Mesoscale Predictions for the Thermomechanics of Granular Energetic Composites

Michael W. Crochet, Keith A. Gonthier

Louisiana State University, Baton Rouge, USA

A finite-element analysis is performed to characterize both the grain and bulk scale thermomechanical response of explosively (RDX) coated aluminum (Al) microspheres due to mild and strong impact. The bulk material response is given by the average manifestation of the grain-scale predictions over representative elementary volumes. Emphasis is placed on accurately describing and numerically resolving stress, strain, and temperature fluctuations occurring near intergranular contact surfaces and near internal Al-RDX interfaces for various values of RDX mass fraction. The commercial software package ABAQUS/Explicit was used to model the grain geometry and materials and simulate dynamic loading conditions. A two-dimensional model of the grains is utilized, and the compaction process is simulated as a rigid piston-cylinder device. Preliminary results for the grain-scale temperature field were obtained for a representative case; the data indicates that thermal diffusion effectively reduces RDX temperatures significantly at the piston interface, where the largest local temperatures occur.

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