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EXPLOSIVE DISPERSAL OF SOLID PARTICLES

ZHANG,F.; THIBAULT,P.A.; FROST,D.L.; MURRAY,S.B.

When a heterogeneous explosive containing solid particles explodes, numerical simulations indicate that the particles can, under certain circumstance, overtake the interface between the explosion products and the air and the primary shock front (Lanovets et al. 1991). The mechanism for this phenomenon lies in the competition between the inertia of the particles and the decay of the blast wave. In this paper, we study this mechanism by systematically varying the particle parameters and the charge energy and geometry. The particles are assumed to be chemically inert and particle parameters include the particle size, the material density and the volume fraction. The charge energy is varied by changing the initial density and the heat of combustion of the explosive. Spherical and cylindrical charges are investigated over a range of charge diameters and length-diameter ratios.

The numerical study is conducted using an Eulerian fluid dynamic multiphase model for a particle system immersed in an inert or combustible fluid. This model is based on the theory of Baer and Nunziato (1 986) for dense granular explosives which is extended to also include dilute suspension of particles. The model is implemented using a second order Godunov TVD-type scheme for the gas phase and a second order McCormack-FCT scheme for the particle phase.

Experiments are carried out using centrally initiated spherical charges consisting of packed beds of iron beads saturated with sensitized nitromethane. Both the bead size and the mass of the explosive are varied over an order of magnitude (from 100 um to 1 mm and from 200 g to 2 kg, respectively). The dispersal of the particles is tracked directly using flash x-ray radiography, beyond the point at which the particles penetrate the shock front. A comparison is made between the experimental particle and shock trajectories and the modeling results.