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Numerical simulation of explosively-dispersed reactive powder RYAN HOUIM, University of Florida — The ignition and combustion of reactive powders dispersed by shock waves, blasts, and high-speed gas-dynamics flows are important to many scenarios related to national security, explosion safety, and even space exploration. The processes that couple the gas dynamics, particle dispersal of compacted granular media, and combustion are not well understood. Our previous work developed a kinetic-theory granular multiphase flow model and numerical method for simulating layered dust explosions. Here we demonstrate that this approach can be used to simulate the dispersal and combustion of reactive particles by a high-explosive charge. The geometrical configuration of the simulations consists of a high-pressure gas at 1.4 GPa that is surrounded by an annular layer of densely-packed reactive particles. The simulation results show many features observed in experiments of explosively-dispersed reactive particles including the formation of particle fingers. The dispersed particles ignite and burn in a non-premixed combustion mode where the mixing of fuel and oxidizer is performed by velocity slip between the particles and the shock-compressed air. The results also show that the burning of the particles produce acoustic waves that increase the pressure and impulse of the blast.

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