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Ignition and Combustion of TNT-Dispersed Aluminum Powder[1]
JACOB W. POSEY, AARON KNUDTSON, RYAN W. HOUIM, University of Florida — A multidimensional numerical study was conducted to explore the ignition and combustion of aluminum powder dispersed by a TNT charge. The simulations used a high-order numerical method for a compressible reactive gas that is coupled to an Eulerian kinetic-theory-based granular multiphase model. The model for the particles accounts for compaction waves, particle collisions, etc. and is valid up to the packing limit. Scenarios where an annular shell of highly packed monodisperse Al powder surrounding the TNT charge were considered. The results show the formation of particle fingers as the particles are radially dispersed by the expanding TNT detonation products. Particle inertia initially separate the Al particles from the TNT fireball, which prohibits ignition. Al particles under 10 μm-diameter ignite when they interact with the afterburning TNT fireball, which is the only location that exceeds the Al ignition temperature. The inner edge of the Al dust cloud comes into contact with the fireball during the reshock phase of the blast when the flow reverses. Particles greater than 30 μm-diameter Al particles did not ignite because their inertia launched them too far from the TNT fireball.

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