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Experimental Investigations of Multiphase Explosions JOEL CARNEY, JAMES LIGHTSTONE, THOMAS MCGRATH, NSWC Indian Head — Understanding the interaction of solid particles with the expanding gases of a detonating explosive is of great importance to blast applications. The addition of solid fuel particles in general reduces the detonation velocity, but their prompt (0 to 20 ms) combustion in the detonation products and surrounding air enhances the blast performance. Access to oxidizer gases being essential, the degree to which these fuel particles burn heavily depends on their dispersal throughout the explosion field. To investigate the factors affecting the dispersal of fuel particles separate from those controlling their combustion, we analyzed the dispersal of equivalent mock inert particles. Solid glass spheres embedded in detonating small explosive charges were tracked using high-speed digital shadowgraphy. Two different particle sizes, 3 and 30 μm, and different mass fractions in the explosive compositions were considered. Reactive aluminum particles in the range of 1 to 120 μm in diameter were also analyzed. During the first 50 μs of the expansion, the general trend for both reactive and inert particles is for the smaller particles to expand near the leading shock wave to a greater extent than the larger particles. The results are consistent with the numerical model applied here, highlighting the role of simple factors such as particle size and density in the early time expansion and mixing of fuels for enhanced blast applications.

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