Abstract Submitted
for the SHOCK11 Meeting of
The American Physical Society

Experimental Study of the Interaction of a Planar Shock with a Dense Field of Particles JUSTIN WAGNER, STEVEN BERESH, SEAN KEARNEY, WAYNE TROTT, JAIME CASTANEDA, BRIAN PRUETT, MELVIN BAER, Sandia National Lab — A novel multiphase shock tube has recently been developed to study particle dynamics in gas-solid flows having particle volume fractions that reside between the dilute and granular regimes. The particle field is generated by a gravity-fed method that results in a spanwise curtain of 100-micron spherical particles producing a volume fraction of about 15 percent. Interactions with incident shock Mach numbers of 1.67, 1.95, and 2.1 are reported. High-speed schlieren imaging simultaneous with high-speed wall pressure measurements are used to reveal the complex wave structure associated with the interaction. After the impingement of the incident shock, transmitted and reflected shocks are observed, which lead to differences in particle drag forces across the streamwise dimension of the curtain. Shortly thereafter, the particle field begins to propagate downstream and disperse. The trajectories of the upstream and downstream edges of the particle field at different Mach numbers are shown to be similar when normalized by the velocity of the flow induced by the incident shock. Furthermore, a control volume analysis is utilized to estimate the drag associated with the particles and is compared to drag estimates based on the schlieren imaging.

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Date submitted: 18 Feb 2011 Electronic form version 1.4