ENHANCED LOADING DUE TO REFLECTED HETEROGENEOUS BLAST

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Interaction of a heterogeneous explosive blast with a single-wall structure involves many complex phenomena such as shock-particle interaction, shock-fireball interaction, and particle reflection, fragmentation and reaction in the shock-heated air and fireball. This fundamental configuration is used to understand the more complex loads observed in near-field, semi-confined urban environments. The purpose of this paper is to evaluate the physical mechanisms responsible for enhanced loading during reflected heterogeneous blast. Numerical modeling is conducted with the Chinook code, using the multiphase capability with group Lagrange particles. Physical models for phase change, aerodynamic breakup and impact fragmentation are employed. A hybrid kinetic-diffusion aluminum reaction model is applied to the particle combustion in the detonation products and in air. The heterogeneous explosive is spherical in shape and consists of packed aluminum particles (Valimet H-50) saturated in liquid nitromethane. Reference charges of spherical C4 explosive serve as a baseline for comparison. The nominal 1.8 kg charges were detonated 1.0 and 0.75 m from the wall, which was assumed to be rigid and non-responding. Gauges on the wall are used to evaluate the enhanced reflected blast, including particle reaction supporting the radially-expanding Mach stem. Flow fields in the near-field wall-reflection region illustrate the shock interaction with the wall, explosively-dispersed particles, and fireball interface, which contribute to the enhanced loading. Preliminary modeling results indicate that particle melting during dispersal and aerodynamic breakup in the wall-reflected shock enhance the aluminum reaction rate, while impact fragmentation does not significantly influence the heterogeneous blast loading.