TERMINAL VELOCITY OF LIQUIDS AND GRANULAR MATERIALS ACCELERATED BY A HIGH EXPLOSIVE

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ABSTRACT

The explosive dispersal of a layer of solid particles or a layer of liquid surrounding a spherical high-explosive charge generates a turbulent, multiphase flow. Shock compression of the material layer during the initial acceleration may partially consolidate the material, leading to the formation of jet-like structures when the layer fragments and sheds particles upon release. Similarly, wavedynamic release of a shock-compressed liquid shell causes the nucleation of cavitation sites, leading to the radial breakup of the shell and the formation of jets upon expansion. In the current study, the maximum terminal velocity of a wide variety of materials during explosive dispersal has been measured using high-speed videography. Charges were constructed using thin-walled glass bulbs of varying diameters and contained a central C4 burster of varying mass surrounded by the granular material or liquid to be dispersed. This permitted the variation of the ratio of the material mass to the burster mass *(M/C)* from values between 4 and 300. Results indicate that material velocity broadly correlates with predictions of the Gurney model. For liquids, the terminal velocity is accurately predicted by the Gurney model. For granular materials, Gurney over-predicts the terminal velocity by between 25% and 60%, depending on the *M/C* ratio of the charge, with larger *M/C* charges demonstrating larger deficits. These deficits are explained by energy dissipation from the collapse of voids in the dry granular materials. Velocity deficits are insensitive to the degree of jetting and granular material properties. Empirical corrections to the Gurney Model improved agreement with the dry powder experimental velocities.