EFFECT OF MATERIAL ON FRACTURE OF EXPLOSIVELY COMPACTED AND DISPERSED GRANULAR MATERIAL

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Abstract: The blast wave from a spherical high explosive charge may be attenuated in the near field by surrounding the explosive with a layer of inert granular material. If the layer is comprised of a packed bed of dry solid particles, after charge detonation, the particles are first compacted by the shock. The compact then expands radially and fractures into fragments that shed particles, forming billowing jets [1]. Mesoscale computations are carried out with a multiphase hydrocode to investigate the fracture and fragmentation of the particle shell. With brittle ceramic particles, fractures emanate from the inner surface of the consolidate, propagate radially outward and bifurcate, producing a bimodal fragment size distribution (see Figure 1). In contrast, simulations with ductile metal particles exhibit the typical tensile and shear fracture modes associated with fragmentation of a metal casing [2], producing a monomodal fragment size distribution. Both behaviours are consistent with the fragment distributions observed experimentally with radiography. The fracture dynamics influence the loading from fragment impact on nearby structures.

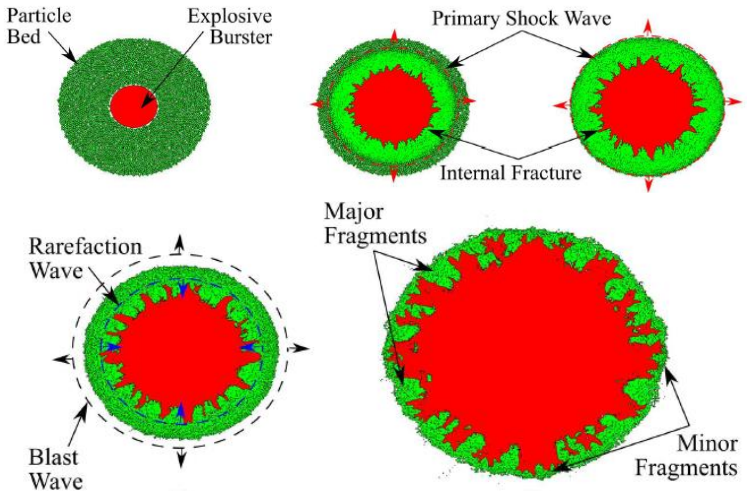

Figure 1: Mesoscale multiphase simulation results of the explosive dispersal of a layer of brittle ceramic particles producing a bimodal fragment size distribution.

[1] D. L. Frost, "Heterogeneous/particle-laden blast waves," *Shock Waves*, vol. 28, no. 3, pp. 439-449, May 2018.
[2] D. E. Grady, M. M. Hightower, "Natural fragmentation of exploding cylinders," *EXPLOMET 90*, pp. 713-721, San Diego, CA, Aug. 12-17, 1990.