Abstract Submitted
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Fragmentation of explosively driven Al-W granular composite rings[1] KARL OLNEY, PO-HSUN CHIU, University of California, San Diego, CHRIS BRAITHWAITE, ANDREW JARDINE, ADAM COLLINS, Cavindish Laboratory, Cambridge, DAVID BENSON, VITALI NESTERENKO, University of California, San Diego — Al oxidation has a chemical potential nearly 5 times that of traditional high explosives, however, the oxidation rate scales with the Al particle size. To oxidize on a time scale of ∼1ms, Al particle size needs to be on the order of 20microns. Continuum theory and experiments of homogeneous materials show that fragments generated under typical loading conditions have much larger sizes (order 1-10mm). Using a highly heterogeneous material with constituents that have drastically different shock impedances (such as Al and W) provides additional mesoscale mechanisms that allow for further pulverization of the material into smaller fragments. Explosively driven expanding ring experiments were conducted on Al-W granular composite rings and recovered fragments showed a significant reduction in the fragment size compared to a homogeneous sample. Examination of the fragments under SEM showed a propensity for fragments to be composed of a cluster of Al and W particles with little plastic deformation in the interior Al. Hydrocode simulations were conducted to gain an insight into this clustering behavior. Understanding of the mesoscale mechanisms may be used to generate mesostructures that could tailor the size of generated fragments based on the loading conditions.

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