Abstract Submitted
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Mechanisms of fragmentation and microstructure of debris generated during explosive testing of Al-W granular composite rings PO-HSUN CHIU, KARL OLNEY, University of California, San Diego, CHRIS BRAITHWAITE, ANDREW JARDINE, ADAM COLLINS, GREGORY FRITZ, ADAM STOVER, Cavendish Laboratory, Cambridge, DAVID BENSON, VITALI NESTERENKO, University of California, San Diego — Al oxidation has a potential energy release 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 20 microns. Highly heterogeneous materials with constituents having drastically different densities and shock impedances (e.g., Al and W) may provide additional mesoscale mechanisms to pulverize the material into much smaller fragments. Explosively driven expanding ring experiments were conducted with Al-W granular composite rings with different morphologies (axial/elongated particles of W, bonded/unbonded Al particles processed using cold and hot isostatic pressing). Recovered fragments showed a significantly reduced fragment sizes compared to a homogeneous sample. Examination of the fragments using 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 useful to generate more efficient mesostructures and tailor the size of generated fragments based on the loading conditions. Funding was provided by ONR MURI N00014-07-1-0740 (Program Officer Dr. Clifford Bedford)

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