Abstract Submitted
for the SHOCK17 Meeting of
The American Physical Society

The role of porosity and annealing in the impact fragmentation of an aluminum reactive material[1] JOSEPH HOOPER, Naval Postgraduate School — A reactive fragment has a unique structural requirement to survive explosive launch but then fragment catastrophically and combust upon impact. Suitable materials for this application tend to be metal composites with high ductility in compression but elastic-brittle behavior in tension. Characterizing the dynamic fragmentation of such materials is key for understanding their lethality. Here we consider a prototypical aluminum reactive frag material, formed via cold isostatic pressing of micron-scale powder followed by annealing. Samples were gun-launched into a target and recovered in a soft-catch medium of artificial snow, allowing for excellent recovery down to micron sizes and minimal contamination. Recovered fragment distributions were analyzed and compared to standard energy-balance theories. We study the effect of compaction pressure and annealing conditions on the fragmentation behavior at 500-800 m/s impacts, and find a particularly strong effect from short annealing periods. Though dynamic fracture occurs entirely along original particle boundaries in this material, recovery processes within the Al microstructure during annealing lead to a rapid decrease in the extent of fragmentation.

[1]This work was funded by the Office of Naval Research, program director Cliff Bedford.

Joseph Hooper
Naval Postgraduate School

Date submitted: 20 Feb 2017 Electronic form version 1.4