Abstract Submitted
for the SHOCK17 Meeting of
The American Physical Society

Characterization of Hypervelocity Metal Fragments for Explosive Initiation JOHN YEAGER, PATRICK BOWDEN, Los Alamos National Laboratory, DANIEL GUILDENBECHER, JOSEPH OLLES, Sandia National Laboratories — The off-normal detonation behavior of two plastic-bonded explosive (PBX) formulations was studied using explosively-driven aluminum fragments moving at hypersonic velocity. Witness plate materials, including copper and polycarbonate, were used to characterize the distribution of particles, finding that the aluminum did not fragment homogeneously but rather with larger particles in a ring surrounding finer particles. Digital holography experiments were conducted to measure three-dimensional shape and size of the fastest-moving fragments, which ranged between 100 and 700 microns and traveled between 2 and 3.5 km/s. Crucially, these experiments showed variability in the fragmentation in terms of the number of fragments at the leading edge of the fragment field, indicating that both single and multiple shock impacts could be imparted to the target material. Lower density PBX 9407 (RDX-based) was initiable at up to 4.5 inches, while higher density PBX 9501 (HMX-based) was only initiable at up to 0.25 inches. This type of data is critical for safety experiments and hydrocode simulations to quantify shock-to-detonation transition mechanisms and the associated risk-margins for these materials.

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Date submitted: 23 Feb 2017 Electronic form version 1.4