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Reactivity and Fragmentation of Aluminum-based Structural Energetic Materials under Explosive Loading NICK GLUMAC, MICHAEL CLEMENSON, JOSE GUADARRAMA, HERMAN KRIER, University of Illinois — Aluminum-cased warheads have been observed to generate enhanced blast and target damage due to reactivity of the aluminum fragments with ambient air. This effect can more than double the output of a conventional warhead. The mechanism by which the aluminum reacts under these conditions remains poorly understood. We undertake a highly controlled experimental study to investigate the phenomenon of aluminum reaction under explosive loading. Experiments are conducted with Al 6061 casings and PBX-N9 explosive with a fixed charge to case mass ratio of 1:2. Results are compared to inert casings (steel), as well as to tests performed in nitrogen environments to isolate aerobic and anaerobic effects. Padded walls are used in some tests to isolate the effects of impact-induced reactions, which are found to be non-negligible. Finally, blast wave measurements and quasi-static pressure measurements are used to isolate the fraction of case reaction that is fast enough to drive the primary blast wave from the later time reaction that generates temperature and overpressure only in the late-time fireball. Fragment size distributions, including those in the micron-scale range, are collected and quantified.

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