# BLAST EFFECTS OF REACTIVE-METAL-CASED CHARGES

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As an explosive cased with structural reactive metal materials detonates, fragmentation of the case can deliver both high speed kinetic energy fragments and a secondary energy release through fragment combustion. A number of previous studies have indicated that the combustion of reactive metal fragments can enhance the air blast. The mechanisms of blast or combustion enhancement due to reactive case fragments, however, strongly depends on the rate and scale of mixing, which may originate in the reactive materials involved and casing configuration. The current paper portrays these effects using a number of reactive casing materials. The casing configurations include layered or laminate bimetallic composites and porous metals, compared with baseline solid continuum metal cases. Air blast characteristics of laminate composites and porous metals were experimentally investigated in a 23.2 $m^3$ closed chamber. While the porous metal casings were produced through the sintering press technique, the laminate composite casings were made of metal foils, 50 to 100 micrometers in thickness, rolled to form a cylindrical shell. The shell was then compacted into a casing with a density larger than 99% TMD through an explosive formation technique. Charges were prepared using 1 to 2 kg C4 explosive packed in the cylindrical casing to a given metal-to-explosive mass ratio, with a charge length-to-diameter ratio of about 1.5. To characterize the blast performance, a high-speed video was used to depict the case fragmentation and charge explosion process and pressures were measured through pressure transducers on the chamber wall. The pressure history showed a double-shock front structure with an accelerating precursor shock of high amplitude followed by the primary blast, suggesting considerable early-time reaction of small fragments. Significant enhanced explosion pressure (QSP) was observed as compared with baseline charges in solid metal casing, consistent with the larger fireball recorded for the laminate or porous-material-cased charges. The residue was recovered, in combination with pressure results, to be further analyzed to distinguish the reaction products and properties as well as their effect on air blast. Numerical modeling has also been conducted to gain the understanding of the heating and reaction mechanisms of the fragments from the bimetallic and porous metal casings and to evaluate both the fragment combustion and momentum/kinetic energy effects.

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