NEAR-FIELD REFLECTED TEMPERATURE OF HETEROGENEOUS EXPLOSIVES

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The energy release of a condensed explosive can be further tailored through the addition of energetic metal particles, which react with the detonation products and surrounding air effectively when confinement is involved. In order to gain insight into this tailored energy release process in near-field wall confinement and assess the threat from these heterogeneous explosives, the reflected local temperature near the wall was measured using a two-colour ratio optical pyrometric technique developed in Ref. 1. These measurements were conducted during a series of tests involving urban confinement configurations using various steel wall shapes. The figure below shows one of the urban-street configurations and early phase explosion event of a 5 kg C4 control charge. The collecting optics of the pyrometer, located about 60 m away from the event, were aligned in parallel with the wall surface. The focal point was along the plane cutting across the charge diameter and perpendicular to the wall at a height equal to that of the charge centre, where the resulting measurement volume was about 4 cm in diameter. The wall two-colour temperature for the configuration depicted below was measured at about 2300 K for 5 kg C4 and reached 2800 K for 5 kg isopropyl nitrate with magnesium particles. The reflected temperature did not show significant changes when compared with the fireball temperature as measured along the charge centre simultaneously. While the light intensity did show variations, the temperature remained fairly constant after reflection. Systematic optical pyrometric measurements were carried out for a series of 2 to 5 kg charges of isopropyl nitrate with magnesium particles and C4 control charges under various wall configurations. The same pyrometers were also used but with optical collectors located physically on the wall surface, allowing observation of a localized physical volume within the fireball. The results are compared with those described above where the collecting optics, located far from the event, may integrate the light before and beyond the plane of focus.

Ref 1. "Optical Pyrometry of Fireballs of Metalized Explosives," S. Goroshin, D. Frost, F. Zhang, paper to be presented at the 18th MABS