SECONDARY COMBUSTION OF HIGH EXPLOSIVE DETONATION PRODUCTS - EXPERIMENTAL CHARACTERIZATION OF THERMAL EFFECTS

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ABSTRACT

The study of weapons dedicated to hard target defeat is still an important issue. To assess destructive effects and to develop accurate prediction tools, a good understanding of the weapon / target interaction is a prerequisite. This article focuses on the secondary order phenomena in time, occurring when a conventional blast – fragment weapon detonates. To be more precise, we focused on the secondary turbulent combustion between detonation products and air, in open space or in a closed volume.

In such a study, thermal effects measurement is still a difficult task. This is the reason why CEG keeps on developing several experimental configurations to characterize the "fireball" dynamics.

First, we developed an approach based on "small – scale" bunker experiments, in which the ratio of experimental value of explosive mass over chamber volume is about 0.06 kg/m^3. Both TNT and HMX-based high explosives were tested, in order to vary the oxygen balance, and thus the afterburning phenomena. We used the spectral analysis of recorded over-pressure time-history in the bunker to provide a first order estimate of local temperatures.

CEG also developed with Paris X University - Laboratoire d'Energétique et d'Economie d'Energie - a non-intrusive two-colour infra-red pyrometer to measure the temperature of hot gases in an expanding fireball. These devices are described in this article, as well as first experimental results, which are qualitatively in good agreement with published data in opened literature.

These two kinds of experiments - closed volume problem or spherical detonation in free field - allowed us to develop engineering model and to compare thermal effects of classical condensed high explosive, and also provided useful physical data to validate new hydro codes or analytical models.