Parameters of detonation of nano-dispersed low-density high explosives based on PETN, RDX, and HMX.

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Brief summary:

Parameters of detonation of bulk nano-dispersed mixtures of PETN, RDX, and HMX with sodium bicarbonate are presented. Such high explosive mixture has very low initial density (~ 0.5 g/cm^3) and low detonation velocity (~ 2 km/s). In combination with a small critical diameter of ~ 2 mm, such formulation is very promising for use in explosion welding of thin foils.

Abstract.

Experiments on SR investigation of detonation samples of bulk nano-dispersed mixtures of PETN, RDX, and HMX with sodium bicarbonate (soda) were carried out at an experimental station of the VEPP-3 accelerator at Budker Institute of Nuclear Physics SB RAS. Such high explosive (HE) mixture has very small initial density of ~ 0.5 g/cm^3 and low detonation velocity of ~ 2 km/s. When combined with a small critical diameter of ~ 2 mm, such compound is very promising for use in explosion welding [1]. All samples of the high explosive mixture were prepared by a special technology at VNIIEF (Sarov). The technology allows producing nanopowders with particle sizes of ~ 10-100 nm due to recrystallization of the initial high explosives (PETN, RDX, and HMX). The resulting nano-dispersed powder is rarefied with a phlegmatizer (sodium bicarbonate) to a ratio of 35/65.

The experiments were carried out in two set-ups: longitudinal and transverse measurement of X-ray absorption. In the latter case, the DIMEX-3 detector [2] was placed across the direction of detonation. The measurement procedure is given in [3,4]. The first experiments yielded the density distributions at the leading edge in detonation of this composition. The values of density in the Neumann peak (1.1-1.25

g/cm^3) were obtained at a detonation velocity of 2-2.2 km/s. The width of the chemical reaction zone was ~ 3.0 mm. The transverse measurement of the absorption yielded the volume distributions of the density, pressure, and field of the velocities of the expansion of the detonation products. For the sake of comparison, the same experiments were carried out with mixtures of soda and standard high explosives with particle sizes of 10-30 μm. The detonation parameters in these formulations were the same, whereas the critical diameter increased to 20 mm.

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