THE EFFECT OF THE BIMODAL FRACTION DISTRIBUTION OF NITRAMINE-CLASS HE ON PLASTIC EXPLOSIVE COMPOSITION DETONABILITY

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Action of high explosives (HE) and explosive compositions (EC) in thin layers is of significant practical interest. When an HE comes into action specifically in thin layers, the key influencing factors are the ones associated with the explosive filling properties, size and imperfection of its particles, density and inhomogeneity of the EC parts, presence of the shell and its acoustic stiffness [1].

In practice, it is not always easy to make a batch of HE with the required particle size distribution. Technically, it would be easier to add some amount of the fine fraction to the coarse one in the explosive filling, in other words, to use a bimodal distribution of fractions in the explosive filling.

The present paper is intended to study how the bimodal distribution of fractions in the explosive filling influences the plastic EC detonability. To analyze its effect, the nitramine class HE compositions with various mass ratios of coarse and fine fractions, i.e. 95:5, 90:10, 85:15, 80:20, 70:30, 60:40, and 50:50 were fabricated. To improve the reprocessing performance, the obtained HE compositions were mixed with polyisobutylene.

The EC detonability was determined by the wedge and air-gap methods. Break-up of the detonation process was registered by the witness plate. Figure 1 shows detonability and density of the EC particle packaging.

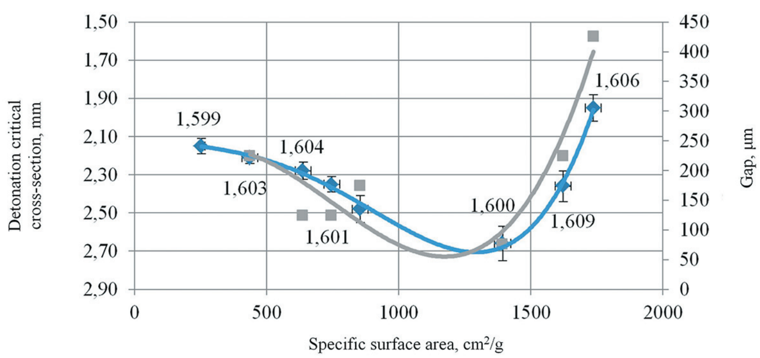

Fig. 1. Overlaying curves illustrating changes in detonability determined by the wedge and air-gap methods

With the fine fraction of up to 30%, the EC detonability deteriorates and then subsequently improves with the fine fraction increasing from 30 to 50%.

Explanation for this type of the obtained dependence of detonability on the fine fraction may be given by means of a parallel (similarity) between the influence of the hot-spot formation mechanism after the detonation initiation (shock-wave sensitivity) and the way these mechanisms influence the break-up of detonation (detonability).

Noteworthy is the fact that the packaging density of rods produces no effect on detonability. Detonability of rods with the lowest packaging density was lower or similar to the rods with higher packaging density. That is why an attempt was made to provide a relation between detonability and density of the particle packaging [2].

For this purpose, we built an ideal Dinger-Funk particle size distribution curve to illustrate the maximum design density of the EC particle packaging and the curves for the particle size distribution of the studied HE compositions. Figure 2 shows the curve built for a bimodal composition with the 70/30 coarse-to-fine fraction distribution that is the nearest to the ideal particle-size distribution curve. So, the indicated curve corresponds to the maximum density of the RDX particle packaging and, as a consequence, to the minimum porosity. The obtained results are indicative of the correlation between the parameters of the EC filling packaging density and detonability.

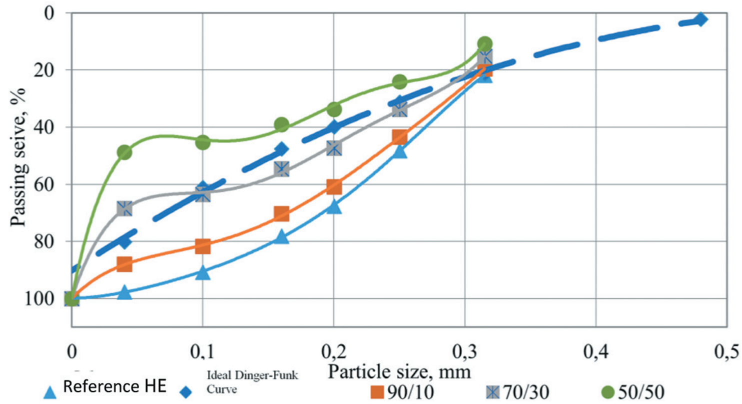

Fig. 2. Ideal Dinger-Funk particle size distribution curve (dashed line) and particle size distribution curves for the reference HE and the bimodal compositions with ratios 90/10, 70/30, and 50/50

References

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