

EFFECT OF ADDITIVE PARTICLE SIZE ON IMPACT SENSITIVITY OF ULTRA- AND NANOSCALE AMMONIUM PERCHLORATE

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Abstract: The article discusses the results of studies of impact sensitivity of solid mixed explosive systems based on ultra- and nanodisperse ammonium perchlorate (AP). The substances of inorganic nature were used as additional components (additives) to perchlorates. They were selected for the possibility of their use as phlegmatizers or AP sensitizers. The main focus of the work is on the study of the dependence of the sensitivity indicators (critical energies and pressures) of explosive mixtures on the dispersion of the powders from which the charges tested for impact were made. The experiments to determine the sensitivity of mixtures to impact were carried out on a K-44-2 impact tester in devices with a free outflow of matter according to the critical energy method without recording the impact pressure. The latter was calculated from the data on the critical impact energies and the corresponding charge thicknesses. A number of interesting results have been obtained that open up possibilities for controlling the sensitivity of mixtures to impact not only due to variations in their component composition but also due to changes in the particle sizes of the initial powders.

Keywords: ammonium perchlorate; mixtures; impact; sensitivity; critical explosion conditions; powder dispersion

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Table Caption

Critical parameters of initiation of mixtures based on ultra- and nanodisperse AP

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References

1. Afanasiev, G. T., and V. K. Bobolev. 1968. *Initsirovanie tverdykh vzryvchatykh veshchestv udarom* [Initiation of solid explosives by impact]. Moscow: Nauka. 1971. 178 p.
2. Bobolev, V. K., I. A. Karpukhin, and V. A. Teselkin. 1971. Mechanism of initiation of an explosion by impact in mixtures of ammonium perchlorate with combustible additives. *Combust. Expl. Shock Waves* 7(2):221–223.
3. Karpukhin, I. A., V. K. Bobolev, Y. M. Balinets, *et al.* 1979. Certain features of impact excitation of an explosion and the detonation capability of an oxidizer–fuel mixtures. *Combust. Expl. Shock Waves* 15(2):234–239.
4. Gogulya, M. F., M. N. Makhov, A. Yu. Dolgoborodov, *et al.* 2004. Mechanical sensitivity and detonation parameters of aluminized explosives. *Combust. Expl. Shock Waves* 40(4):445–457.
5. Teselkin, V. A. 2008. Effect of particle size of the components on the mechanical sensitivity metallized explosives. *Russ. J. Phys. Chem. B* 2(5):609–616.
6. Ponafidin, R. V., and A. V. Dubovik. 2018. Chuvstvitel'nost' k mekhanicheskim vozdeystviyam smesey okfola-3,5 s oksidami zheleza i alyuminiya [Sensitivity to mechanical actions of mixtures okfol-3,5 with ferric and aluminum oxides]. *Uspekhi v khimii i khimicheskoy tekhnologii* [Advances in Chemistry and Chemical Technology] 32(10):132–134.
7. Dubovik, A. V., N. V. Dmitriev, and O. V. Leontiev. 2019. O mekhanicheskoy chuvstvitel'nosti smesey vzryvchatykh veshchestv s tverdymi komponentami [On the mechanical sensitivity of mixtures of explosives with solids particles]. *Goren. Vzryv (Mosk.) — Combustion and Explosion* 12(1):117–121.
8. Dubovik, A. V. 2011. *Chuvstvitel'nost' tverdykh vzryvchatykh sistem k udaru* [Sensitivity of solid explosives systems to impact]. Moscow: Mendeleev University of Chemical Technology Publs. 276 p.
9. Dubovik, A. V. 2021. Teoreticheskiy analiz metoda ispytaniy tverdykh vzryvchatykh veshchestv na chuvstvitel'nost' k mekhanicheskim vozdeystviyam — razrushayushchaya obolochka [Theoretical analysis of the method of

testing of solid explosives for sensitivity to mechanical acting — failing shell]. *Goren. Vzryv (Mosk.) — Combustion and Explosion* 14(3):130–142.

10. Andreev, K. K., and A. F. Belyaev. 1960. *Teoriya vzryvchatykh veshchestv* [Theory of explosives]. Moscow: Oborongiz. 596 p.

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