

THE STUDY OF SENSITIVITY TO IMPACT OF MIXTURES OF AMMONIUM NITRATE WITH ALUMINUM ASD-4

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Abstract: The results of drop-weight experiments with impact on pressed charges for mixtures of ammonium nitrate with aluminum middle dispersion ASD-4 brand in the entire range of changes on the concentrations of components are presented. Data processing was performed using the critical pressure method. It is shown that the dependence of initiating pressures on the metal content in the mixture has a characteristic minimum near the stoichiometric composition, the presence of which indicates the chemical interaction of components or products of their primary thermal decomposition in the centers of mechanical heating of charges upon impact. The critical explosion initiation pressures are calculated using two different models: the mechanism of chemical interaction of components in the oxidizer–fuel system and the mechanism of initiation due to friction heating of aluminum solid particles that introduce the reaction into the surrounding explosive. It is established that the experimental data are satisfactorily described by both theoretical approaches, each valid in the field of its significance.

Keywords: explosive; impact; explosion; sensitivity; sensitization

DOI: 10.30826/CE20130312

Figure Caption

Dependences of calculated (I — based on the theory of chemical interaction of components [4]; 2 — based on the theory of frictional heating of solid particles [6]) and experimental (signs) P_{cr} values on the composition of the AN–Al mixture

Acknowledgments

The work was supported by the subsidy given to the N. N. Semenov Federal Research Center for Chemical Physics of the Russian Academy of Sciences to implement the state assignment on the topic No. 44.8 “Fundamental studies of conversion processes of energetic materials and development of scientific grounds of controlling these processes” (Registration No. AAAA-A17-117040610346-5).

References

1. Dubnov, L. V., N. S. Baharevich, and A. I. Romanov. 1988. *Promyshlennyye vzryvchatyye veshchestva* [Industrial explosives]. 3rd ed. Moscow: Nedra, 1988. 358 p.
2. Bobolev, B. K., I. A. Karpuhin, and V. A. Teselkin. 1971. Mechanism of initiation of an explosion by impact in mixtures of ammonium perchlorate with combustible additives. *Combust. Explo. Shock Waves* 7(2):221–223.
3. Karpuhin, I. A., V. K. Bobolev, Yu. M. Balinets, *et al.* 1979. Certain features of impact excitation of an explosion and the detonation capability of an oxidizer–fuel mixture. *Combust Explo. Shock Waves* 15(2):234–239.
4. Dubovik, A. V. 2011. *Chuvstvitel'nost' tverdykh vzryvchatykh sistem k udaru* [Sensitivity of solid explosive systems to impact]. Moscow: Mendeleev University of Chemical Technology Pubs. 276 p.
5. Afanas'ev, G. T., and V. K. Bobolev. 1968. *Iniitsirovanie tverdykh vzryvchatykh veshchestv udarom* [Initiation of solid explosives by impact]. Moscow: Nauka. 174 p.
6. Dubovik, A. V., N. V. Dmitriev, and V. O. Leont'ev. 2018. Chuvstvitel'nost' k udaru smesey VV s tverdymi komponentami [Impact sensitivity of explosive mixtures with solid components]. *Vzryvnoe delo* [Explosion Technology]. 120/77:54–66.

Received August 14, 2020

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