

**Dmitriev Nikita Viktorovich**

**«EFFECT OF DISPERSED ADDITIVES ON THE IMPACT SENSITIVITY  
OF HIGH-ENERGY SUBSTANCES»**

**Relevance of the topic of work**

High-energy substances are actively used both in the defense industry and in the civilian sector, primarily in the mining industry and construction. At the same time, the active use of energy-saturated substances is directly associated with the constant danger of unwanted operation, which can lead to major emergencies. Since the beginning of the previous century, due to insufficient study of high-energy materials (TNT, HMX, etc.) or the main components of explosive compositions (ammonium nitrate), accidents related to the production, storage, transportation, operation and disposal of substances have repeatedly occurred. Studying the influence of external influences has become necessary to ensure safety and develop rules for the use of energy-saturated substances and materials. Sensitivity to these effects is a qualitative and quantitative indicator of the safety of substances and materials. Sensitivity to impact, as the most common external mechanical impact, requires special attention. With the development of the need to obtain high-energy materials more effective for human needs, additives began to be used, including dispersed ones, capable of significantly increasing the energy potential of the main substances, among which aluminum has become the most widely used, which also led to an increase in accidents due to the increased danger of such compounds. Currently, the share of secondary aluminum is growing in the field of industrial explosives, due to economic benefits. Various carbon additives are actively used as combustion modifiers for solid rocket fuels. Powders of various metals and their oxides are considered as new promising combustion modifiers. At the same time, it is worth remembering that each additive also contributes to impact sensitivity, taking into account its inherent physicochemical and morphological properties.

Today, the UN regulatory documents (recommendations on the transport of dangerous goods and annexes to them), the European Union (ADR) specify safety requirements for explosives, including sensitivity to mechanical impacts. In the

technical regulation of the Customs Union 028/2012 "On the safety of explosives and products based on them" in Article 5 it is said about the classification of substances by hazard and safety requirements for transportation, production and use of substances. The normative document prescribes to include in the technical documentation of the substance or product explosion safety indicators, which directly relate to impact sensitivity.

**Objective:** to study the effect of various additives on impact sensitivity for high-energy substances

Tasks:

Compare the results of the study of impact sensitivity obtained by the critical pressure method with the methods of GOST 4545-88;

Determine the influence of particle size and the method of production of aluminum powder on the impact sensitivity of high-energy substances;

Study the effect of the microstructure of ammonium nitrate on its impact sensitivity;

Study the effect of allotropic modifications of carbon on the parameters of initiation of mixed explosives; Determine the impact sensitivity of model rocket fuel compositions containing transition metal oxides and aluminum

**Scientific novelty.**

The absence (leveling) of the effect of the phlegmatizing component of okfol-3.5 on the impact sensitivity of mixtures based on it with combustible additives was experimentally established.

It was established that nanodispersed aluminum powders have a qualitatively similar sensitizing effect both in "oxidizer - combustible additive" mixtures and in mixtures without an oxidizer.

For the first time, the impact sensitivity indices of industrial explosive compositions with the addition of recycled aluminum of the AGP brand were determined.

For the first time, the effect of transition metal oxides, considered as possible combustion catalysts, on the impact sensitivity of high-energy substances was determined.

**Practical and theoretical significance of the work.**

Currently, there is a great demand for aluminized industrial high-energy substances, as well as for the use of powerful high-energy substances in the civilian sphere. Information on the impact sensitivity of high-energy substances and compositions based on them can have a positive effect on reducing the number and consequences of accidents in the production of industrial and conversion explosives.

**Postulates presented in the thesis::**

1. Applicability of the critical pressure method for studying impact sensitivity based on the high correlation index of the recalculation of the lower limit of impact sensitivity according to GOST 4545-88 with the results of experimental studies using the critical pressure method;
2. Results of studying the effect of the dispersion of aluminum additives on the impact sensitivity of explosive mixtures.
3. Results of the study of the influence of microstructural features of ammonium nitrate on the impact sensitivity of industrial explosive compositions based on it.
4. Results of the study of the influence of transition metal oxides as combustion modifiers on the impact sensitivity of high-energy substances.
5. Results of the study of the influence of high-energy substance additives on the impact sensitivity of model rocket fuel compositions.