Thematic Section: Research into New Technologies. **Full Paper**
Subsection: Physical Chemistry of Explosives. *Reference Object Identifier* – ROI: jbc-01/18-54-5-125
The Digital Object Identifier – DOI: 10.37952/ROI-jbc-01/18-54-5-125
Submitted on April 06, 2018.

A new method for determination of deflagration point of explosives

© **Anastasia V. Abizyaeva**,[1] **Ekaterina S. Vasilyeva**,[1]*+
Alexander M. Pyzhov,[2] and **Dmitry A. Sinitsyn**[2]
[1] *Department of Technology of Solid Chemical Substances. Samara State Technical University. Molodogvardeyskaya St., 244. Samara, 443100. Samara Region. Russia. Phone: +7 (846) 337-08-20. E-mail: katich.1995@mail.ru*
[2] *Department of Chemistry and Technology of Organic Nitrogen Compounds. Samara State Technical University. Molodogvardeyskaya St., 244. Samara, 443100. Samara Region. Russia. Phone: +7 (846) 337-08-89. E-mail: argel33@mail.ru*

*Supervising author; +Corresponding author

Keywords: explosive materials, heat sensitivity, deflagration point, standard method for determination, new method, increased accuracy of visual fixing.

Abstract

The article presents an experimental study on the development of practical methods for assessing the sensitivity of energetic materials (EM) to various types of thermal effects to which they are exposed during their formation, storage and official use.

The article shows the results of studies on the development of a new methodology for estimating the deflagration point, which, in Russia, is characterized by the sensitivity of EM to long-term thermal effects. In the most general sense, deflagration point is defined as a temperature of the media surrounding the EM, at which, with a certain time delay, the process of chemical decomposition of EM is fixed, accompanied by visible phenomena – the release of decomposition products, light or sound effects.

For the first time, the possibility of increasing the accuracy of the experimental estimation of the deflagration point of high-explosives (HE) was estimated. The research was carried out by such powerful HE's of different classes as pentaerythritol tetranitrate (PETN) and cyclotrimethylenetrinitramine (RDX).

The technique used in GOST R 22.2.07-94 (Detonating powder. Method for determination of flash point) was taken as the basis of the experimental procedure for estimating the deflagration point of EM. To increase the accuracy of visual fixation of the appearance of gaseous products at the initial moment of chemical decomposition of HE at different temperatures, it was proposed to enhance the visible effect of this stage of the process by using oxidizing properties of the EM decomposition products. A combustible componenet – several granules of high-porous activated carbon – on a metal grid was placed above the test substance. As a result of the active reaction of nitric acid vapors and nitrogen oxides with excess carbon of the combustible component, an aerosol (smoke) of the products of the interaction formed, which significantly increased the visual effect of this stage of the process.

The developed method for estimating the HE deflagration point can be used, after additional experimental testing, in the student's laboratory course and for carrying out research on the theory of explosives.

References

[1] Physics of explosion. S.G. Andreyev, A.V. Babkin, [et al.]. L.P. Orlenko (Ed.). 3rd, revised edition. In 2 Vols. Vol. 1. *Moscow: FIZMATLIT*. **2002**. 832p. (russian)
[2] D.S. Avanesov. Laboratory manual on physical and chemical tests of explosives. *Moscow: Oboronizdat.* **1959**. 167p. (russian)
[3] A.G. Horst. Gunpowder and explosives. *Moscow: Mashinostroenie.* **1972**. 208p. (russian)
[4] V.A. Rekshinsky, A.M. Pyzhov, A.A. Gidaspov. Sensitivity of energetic materials for thermal and mechanical impact. *Samara: Samara State Technical University.* **2010**. 101p. (russian)
[5] *GOST R 22.2.07-94.* Detonating powder. Method for determination of flash temperature.
[6] V.Yu. Avdeev, E.V. Yurtayev, A.A. Gidaspov, Yu.V. Moshchensky, T.P. Seryogina. Determination of flash point of high-explosives and critical temperature of thermal explosion according to heat patterns. *Bulletin of the Kazan National University of Science and Technology*. **2013**. Vol.1. No.24. P.48-50. (russian)

[7] K.K. Andreyev. Thermal decomposition and combustion of explosives. *Moscow: Nauka.* **1966**. 344p. (russian)
[8] Theory of explosives. K.K. Andreyev, A.F. Belyaev, A.I. Gol'binder, and A.G. Horst (Eds.). *Moscow: Oborongiz*. **1963**. 580p. (russian)
[9] A.V. Strelkova, A.M. Pyzhov, V.A. Rekshinskiy, I.K. Kukushkin, and P.P. Purygin. Generation of sulfur aerosol by pyrotechnic compositions. *Butlerov Communications.* **2015**. Vol.41. No.1. P.106-111. DOI: 10.37952/ROI-jbc-01/15-41-1-106
[10] F.A. Baum, L.P. Orlenko, K.P. Stanyukovich, [et al.]. Physics of explosion. *Moscow: Nauka.* **1975**. 704p. (russian)
[11] K.K. Andreyev, A.F. Belyaev. Theory of explosives. *Moscow: Oborongiz.* **1960**. 596p. (russian)