Effect of prescription configuration on properties nanothermite composition Bi_2O_3/Al/1Me-3H

Gordeev Vladimir V.,[1*] Kazutin Maxim V.,[1] Kozyrev Nicolay V.[1]

[1] *Institute for Problems of Chemical and Energetic Technologies SB RAS, Socialisticheskaya 1, 659322, Biysk, Russia*

** E-mail: gordeev.vladimir92@yandex.ru*

Nanothermites are considered as a promising material for the creation of micro-sized pyrotechnic devices. However, the high sensitivity of nanothermites to friction and electrostatic discharge complicates their application. Phlegmatic materials are used to reduce the sensitivity of pyrotechnic mixtures. In the case of nanothermite mixtures, the introduction of these materials leads to a significant reduction in combustion performances. The use of additives of a different nature allows you to preserve or improve the combustion performances of nanothermites, and in some cases reduce the sensitivity of the composition, but the available data do not allow us to form an unambiguous concept of the effect of additives on the properties of nanothermites, which complicates the understanding of the mechanism of combustion nanothermite/additive systems.

In this work, a nanothermic pair of Bi_2O_3/Al with the addition of high-energy 1-methyl-3-nitro-1,2,4-triazole (1Me-3H) material was studied, with different formulation compositions: I – the ratio of the components of the mixture corresponded to the maximum calculated heat of explosion of the composition (Q) at a given content of 1Me-3H; II – the ratio of the components of the mixture corresponded to the maximum calculated pressure value (P) developed during combustion composition in a closed volume; III – the ratio of the components of the Bi_2O_3/Al nanothermite (88/12%) corresponding to the maximum calculated value of Q and remained constant in the mixture; IV – the ratio of nanothermite components Bi_2O_3/Al (86/14%), corresponding to the maximum calculated value of P and remained constant in the mixture.

For prescription configurations I, III, IV, it is possible to increase the relative explosion force (F) of the composition by 22-29 % compared to the base nanothermite pair. In the case of the prescription configurations II, the explosion force of the composition is at the level of the base mixture with an additive content of up to 7%, after which there is a decrease in F. Combustion rate compositions for configurations I, II remain at the level of the base nanothermite, and for configurations III and IV characterized by an increase in the rate of combustion by 100-200 m/s. Combustion rate of the studied compositions in a thin layer (0.1 mm), regardless of the prescription configurations, remains at the level of the basic nanothermic composition.

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