SELF-IGNITION OF COMPOSITE ENERGETIC MATERIALS CONTAINING NITRATE ESTERS: COMPARISON OF CALCULATED AND EXPERIMENTAL DATA

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Abstract: Temperatures of the environment T_S leading to self-ignition of NEPE propellant samples in the form of cylinders with a diameter and height from 20 to 150 mm are calculated at thermal explosion delay periods τ corresponding to the experimental ones (HIACT, China). In the experiments, the temperatures T_S were 90, 100, 110, and 120 °C. The kinetic parameters required for the calculation were previously determined by the present authors using differential scanning calorimeter for a model energetic material of similar composition containing a mixture of nitrate esters, one of the components of which is nitroglycerin. It is shown that one of the main reasons for the differences between the calculated and experimental temperatures T_S at the same values of τ may be the migration of active decomposition products from fuel samples into the environment. A qualitative analysis of the migration process is given.

Keywords: composite energetic material; nitrate esters; thermal explosion; migration; delay period

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Figure Captions

Figure 1 Dependence of the difference between the calculated and experimental values of T_S on the sample diameter: empty signs — calculation according to option 1; filled signs — calculation according to option 2 (see explanations in the text); and *1* and *2* — the best approximation of these data by second-order polynomials

Figure 2 Dependence of the total rate of neutralization of chain carriers (active particles) on the diameter of the samples at temperatures T_S of 110 (*1*), 100 (*2*), and 90 °C (*3*)

Table Caption

Experimental data and calculation results for the self-ignition temperature T_S

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