PROPERTIES OF PLASTICIZED COMPOSITIONS BASED ON NITROCELLULOSE AND POLYTRIAZOLE POLYMER MIXTURE

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Abstract: The thermodynamic compatibility, mechanical properties, thermal stability, and combustion patterns of plasticized compositions based on nitrocellulose (NC) and 1,2,3-polytriazole are studied. The polytriazole has a positive enthalpy of formation and is considered as a partial substitute for NC in double-based propellants to overcome a number of drawbacks associated with NC properties. Polytriazole is fully compatible with nitroether plasticizer: 25% NC replacement with polytriazole resulted in strain increase, almost the same thermal stability, and the decrease of the burning rate pressure dependence. Thermodynamic calculations show that partial replacement of NC with polytriazole leads to the combustion temperature lowering while maintaining the energetic characteristics at a high level.

Keywords: polytriazole; nitrocellulose; thermal analysis; thermodynamic compatibility; burning rate

DOI: 10.30826/CE25180211 **EDN:** RKHDDA

Figure Captions

Figure 1 The formula of C1Z6 1,2,3-polytriazole (PT)

Figure 2 Interferogram (*1* — composition; *2* — interdiffusion area; and *3* — nitroglycerine (NGC)) (*a*) and concentration profile (*b*) of NGC in the interdiffusion zone with the NC : PT : NGC = 1 : 1 : 2 composition

Figure 3 Nitroglycerin concentration in the composition containing polytriazole on bulking time dependence

Figure 4 Thermogram of (NC + PT) : NGC = 23 : 77 bulking sample composition. The heating rate is 10 K/min

Figure 5 Thermograms: (*a*) NC : NGC = 1 : 1; (*b*) NC : PT : NGC = 1 : 1 : 2; *1* — thermogravimetric analysis; and *2* — differential scanning calorimetry. The heating rate is 10 K/min

Figure 6 SDTA-thermograms of compositions: (*a*) powder A (NC : NGC = 1 : 1); (*b*) NC : PT : NGC = 1 : 1 : 2; *1* — 2.5 °C/min; *2* — 5; *3* — 10; *4* — 15; and *5* — 20 °C/min

Figure 7 Burning rate vs. pressure: *1* — PT; *2* — NC (12% N); *3* — NC/NGC (60/40); and *4* — PT/NGC (60/40)

Figure 8 Burning rate vs. pressure: *1* — PT; *2* — NC : PT : NGC = 1 : 1 : 2; and *3* — NC : NGC = 1 : 1

Table Captions

Table 1 Variations of the glass transition temperature and heat capacity of compositions containing 50% NGC

Table 2 Mass loss, temperature, and thermal effects of NC : NGC and NC : PT : NGC samples. The heating rate is 10 K/min

Table 3 The maximum exothermic peak of SDTA temperature (°C) at different heating rates

Table 4 The activation energy and the equation for the dependence of the reaction rate constant on the decomposition temperature of the studied compositions

Table 5 Mechanical characteristics of composites based on a NC/PT mixture containing 50% NGC

Table 6 Parameters of sample combustion

Acknowledgments

The authors would like to thank Dr. A. B. Sheremetev, the head of laboratory No. 20 of the Zelinsky Institute of Organic Chemistry of the Russian Academy of Sciences, for the synthesis of polytriazole polymer.

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Received December 2, 2024
After revision January 30, 2025
Accepted February 18, 2025

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