EFFECT OF IONIZING RADIATION ON THE PROPERTIES OF COMPONENTS AND THE COMBUSTION RATE OF HIGH-ENERGY CONDENSED SYSTEMS BASED ON THEM

P. Kalmykov[1], E. Popenko[1,2], A. Sergienko[2], K. Sidorov[1,3], M. Mikhailenko[3], B. Tolochko[3], and Y. Chernousov[4]

[1]Federal Research and Production Center "Altai," 1 Socialisticheskaya Str., Biysk 659322, Altai Territory, Russian Federation
[2]Biysk Technological Institute (branch) of Altai State Technical University named after I. I. Polzunov, 27 Trofimova Str., Biysk 659305, Altai Territory, Russian Federation
[3]Institute of Solid State Chemistry and Mechanical Chemistry of the Siberian Branch of the Russian Academy of Sciences, 18 Kutateladze Str., Novosibirsk 630128, Russian Federation
[4]Institute of Chemical Kinetics and Combustion named after V. V. Voevodsky of the Siberian Branch of the Russian Academy of Sciences, 3 Institutskaya Str., Novosibirsk 630090, Russian Federation

Abstract: The effect of radiation-chemical modification of energy-intensive compounds of poly-N-methyl-5-vinyltetrazole (PVMT) and cyclic nitramines that are hexanitrohexaazaisowurtzitane (CL-20) and octogen (HMX) was studied with various doses of ionizing radiation (from 20 to 120 kGy) on the data of thermal decomposition, surface morphology of crystals, and combustion of high-energy condensed systems (HECS) based on them. It has been shown that irradiation of PVMT polymer with various doses of radiation has virtually no effect on thermal stability; however, its intrinsic viscosity decreases monotonically with irradiation dose. During the thermolysis of irradiated samples of CL-20 and HMX, the stages of early decomposition appear and their total exothermic thermal effect of decomposition is much lower than the heat release level of the initial unirradiated samples. Evaluation of the specific features of combustion of the nitroethertetrazole binder using the irradiated PVMT polymer showed that the burning rate is significantly reduced. The combustion of experimental VEKS compositions containing cyclic nitramines with different doses of irradiation showed that the burning rate of compositions with irradiated CL-20 increases and the burning rate of compositions with irradiated HMX remains virtually unchanged.

Keywords: radiation-chemical modification; poly-N-methyl-5-vinyltetrazole (PVMT); burning binder; cyclic nitramines CL-20 and HMX; thermal stability; thermolysis; thermal effect of decomposition; burning rate

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Figure Captions

Figure 1 The differential thermal analysis (DTA) (*1*) and thermogravimetric analysis (TGA) (*2*) curves for CL-20 unirradiated (*a*) and irradiated with 80 kGy (*b*)

Figure 2 The DTA (*1*) and TGA (*2*) curves for HMX unirradiated (*a*) and irradiated with 80 kGy (*b*)

Figure 3 Dependence of the burning rate of original (*1*) and irradiated (*2*) NET representatives on temperature

Figure 4 Burning rate dynamics of HECS with CL-20 (*a*) and HMX (*b*) at pressure 10 MPa as the function of the irradiation dose

Table Caption

Table 1 Particle dispersion of components

Table 2 Characteristics of original and irradiated PVMT

Table 3 Thermal conversions of original and irradiated ε-CL-20

Table 4 Thermal conversions of original and irradiated HMX

Table 5 Combustion characteristics of nitroehertetrazole fuel binder (NET) at ± 50 °C

Table 6 Influence of radiation-chemical modification of the PVMT polymer on the burning rate of NET binder

Table 7 Combustion characteristics of HECS with irradiated cyclic nitramines

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Contributors

Kalmykov Peter I. (b. 1951) — Candidate of Science in chemistry, associate professor, head of laboratory, Federal Research and Production Center "Altai, 1 Socialisticheskaya Str., Biysk 659322, Altai Territory, Russian Federation; post@frpc.secna.ru

Popenko Elena M. (b. 1954) — Candidate of Science in chemistry, associate professor, Biysk Technological Institute (branch) of Altai State Technical University named after I. I. Polzunov, 27 Trofimova Str., Biysk 659305, Altai Territory, Russian Federation; senior expert, Federal Research and Production Center "Altai," 1 Socialisticheskaya Str., Biysk 659322, Altai Territory, Russian Federation; emp@bti.secna.ru

Sergienko Alexey V. (b. 1970) — Candidate of Science in technology, assosiate professor, Biysk Technological Institute (branch) of Altai State Technical University named after I. I. Polzunov, 27 Trofimova Str., Biysk 659305, Altai Territory, Russian Federation; abc@bti.secna.ru

Sidorov Kirill A. (b. 1982) — senior engineer, Federal Research and Production Center "Altai," 1 Socialisticheskaya Str., Biysk 659322, Altai Territory, Russian Federation; group manager, Institute of Solid State Chemistry and Mechanical Chemistry of the Siberian Branch of the Russian Academy of Sciences, 18 Kutateladze Str., Novosibirsk 630128, Russian Federation; post@frpc.secna.ru

Mikhailenko Mikhail A. (b. 1979) — Candidate of Science in chemistry, senior research scientist, Institute of Solid State Chemistry and Mechanical Chemistry of the Siberian Branch of the Russian Academy of Sciences, 18 Kutateladze Str., Novosibirsk 630128, Russian Federation; mikhailenko@solid.asc.ru

Tolochko Boris P. (b. 1952) — Doctor of Science in chemistry, senior research scientist, Institute of Solid State Chemistry and Mechanical Chemistry of the Siberian Branch of the Russian Academy of Sciences, 18 Kutateladze Str., Novosibirsk 630128, Russian Federation; tolochko@inp.nsk.ru

Chernousov Yuriy D. (b. 1948) — Candidate of Science in technology, senior research scientist, Institute of Chemical Kinetics and Combustion named after V. V. Voevodsky of the Siberian Branch of the Russian Academy of Sciences, 3 Institutskaya Str., Novosibirsk 630090, Russian Federation; chern@catalysis.ru