THERMOCHEMICAL PROPERTIES OF CL-20 DERIVATIVES

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Abstract: High energy capacity and moderate sensitivity are two of the most important requirements for modern energetic materials. The studies of the properties of synthesized energetic compounds have shown that an increase in energy almost always leads to an increase in the sensitivity of substances. The powerful explosive CL-20 (hexanitrohexaazaisowurtzitane has $\rho = 1.97$ g/cm^3 and $D = 9.44$ km/s) and its derivatives obtained earlier do not meet safety requirements for sensitivity. To achieve the desired goal of creating highly efficient polycyclic multinitramine framework structures with reduced sensitivity, a new family of energetic compounds was designed and synthesized by incorporating an alkylnitramine moiety into the pentanitrogen hexaazaisowurtzitane framework. The main method for determining the enthalpies of formation of high-energy compounds is combustion calorimetry. Using this method, combustion enthalpies were obtained and the enthalpies of formation of energy-saturated compounds in the standard state were calculated for N,N-bis[(2,6,8,10,12-pentanitro-2,4,6,8,10,12-hexaaza-isowurtzitan-4-yl)-methyl]-nitramide [$C_{14}H_{16}N_{24}O_{22}$], 2-nitro-1-[(2,6,8,10,12-pentanitro-2,4,6,8,10,12-hexaazaisowurtzitan-4-yl)methyl]-(nitramino)methylguanidine [$C_9H_{13}N_{17}O_{14}$], and N-methyl-N-[(2,6,8,10,12-pentanitro-2,4,6,8,10,12-hexaazaisowurtzitan-4-yl)-methyl]-nitramide-[$C_8H_{11}N_{13}O_{12}$].

Keywords: calorimetry; enthalpy of combustion; enthalpy of formation; CL-20 derivatives

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Table Caption

Thermochemical properties of CL-20 derivatives

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