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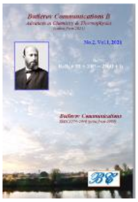

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Energy content of detonation synthesis nanodiamond

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Abstract

A theoretical and experimental study of the energy content of detonation synthesis diamonds (DND) has been carried out. Detonation synthesis nanodiamonds are a unique material that combines the properties of diamonds and the advantages of nanostructures. Synthesis of nanodiamonds occurs in explosion chambers as a result of detonation of carbon-containing explosives with a negative oxygen balance. The objects of study are DALAN powders obtained from pressed charges of explosives with a composition of hexogen/graphite in a ratio of 80/20%, and DND obtained from cast charges of a composition of TNT/hexogen in a ratio of 40/60%. Diamond is formed in the zone of chemical reactions, while the sizes of microcrystallites are, depending on the thermodynamics of synthesis, from 2 to 20 nm. The parameters of the microstructure, the value of the specific surface area and the values of the thermal effect of oxidation of the samples of detonation nanodiamonds obtained under various synthesis conditions are determined experimentally. The dependences of the combustion heat and surface energy density on the specific surface area of the particles are obtained. It is shown that the presence of a large number of uncompensated bonds on the surface of particles leads to an increase in energy content and reactivity in comparison with natural and synthetic diamonds. It was found that the larger the surface of the particles, the more heat is spent on its production and released during combustion. A linear increase in the heat of combustion is observed depending on the specific surface area of the particles. The crystal lattice of the DND is compressed in comparison with the standard. Internal elastic stresses (microdistortions of the crystal lattice) reach 70 GPa, and the stored

energy reaches 2980 J/m^2, which is 2-3 orders of magnitude higher than for artificial diamonds of static synthesis.

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