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Kinetics of nanodiamond formation as a part of detonation process

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The ultradispersed diamond (UDD) obtained by a detonation method from mixture of trinitrotoluene and hexogen (TNT/RDX) (**A.Lyamkin, E.Petrov, A.Ershov, G.Sakovich, A.Staver, and V.Titov, 1988; N.R.Greiner, D.S.Phillips, J.D.Johnson and F.Volk, 1988**) constitutes structurally a non-uniform system. 10-20% UDD mass consists of different functional groups (**G.Sakovich and et al., 1990; A.Vereschagin and et al., DRM, 1993, 3, 160-162**). Formation of the UDD is performed in the reaction zone (**V.Titov and et al., 1989**). Therefore, the functional groups and heteroatoms of the UDD contain actually almost direct information about chemical processes of the reaction zone (**E.Mironov, A.Koretz, and E.Petrov, DRM 2002, 11 (3-6), 872-876**). There were broadly applied methods of isotope atoms for investigation of the UDD formation (label - the carbon atom of the methyl group of TNT molecule - **V.Titov and et al., 1989; V.Anisichkin and et al., 1988, 1990**; label - carbon

atom of benzene ring of TNT and carbon atom of hexogen (RDX) molecule – **N.Kozyrev, G.Sakovich and et al., 1991; N.Kozyrev and et al., - 1990**). These methods and UDD consideration as a small diamond crystal did not allow unambiguously to interpret results of these experiments and understand process of the UDD formation. Therefore, it was necessary to examine these groups and consequently chemical processes of the reaction zone for explanation of the UDD formation. This investigation of the functional groups was performed by methods of infrared (IR) and ultraviolet (UV) spectroscopy.

Taking into account of results of the labeled atoms experiments there were investigated the next UDD samples in this work. Firstly, the samples were synthesized from explosive mixture with various ration of hexogen (RDX): trinitroresorcin - hexogen (TNR/RDX) in mass ratio 70/30, 20/80 and et al. Secondly, there was difference in the structure of the original aromatic explosive: trinitrobenzene - hexogen (TNB/RDX), trinitrophenol – hexogen (TNP/RDX), trinitrotoluene – hexogen (TNT/RDX), and others in various mass ratios.

The obtained experimental results allowed to suppose that there was relationship between original explosive structure and spectral features of the UDD in some cases. As a matter of fact, this result confirmed necessity of interaction of destruction products of the aromatic explosive and hexogen (RDX) or octogen (HMX) (**V.Anisichkin 1994; A.Ershov and et al 2000; V.Anisichkin, A.Ershov and et al. Proc. 12 Detonation Symp. 2002**). The process of interaction of heterogeneous explosives destruction products is impossible during this interval of time in case of uniform (equilibrium) distribution of energy (**V.Titov and et al 1989**). Analysis of obtained experimental results demanded to introduce ideas of irregular (non-equilibrium) energy distribution during detonation destruction of explosives. The basics of this distribution were explosophoric groups (**Van'T Hoff 1878, 1881**).

The proposed approach allowed to find an inaccuracy in work (**R.Mc.Guire, D.Ornellas and I.Akst. Symp. H.D.P. – Paris, 1978**).

This approach advanced to understanding of Eyring's kinetics (**H.Eyring and et al. 1949; H.Eyring. Science 1978. V.199, 740-743**).

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