About creation of technology of "pure" synthesis of detonation nanodiamonds

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Physical bases of nanodiamonds synthesis [1].

1. From comparison of the phase diagramme for nanocarbon with pressure and temperature of a detonation for alloys TNT/RDX follows that these parametres are in area of liquid sp3 nanocarbon ($p > 16.5$ GPa, above a line of threefold points) where nanodrops are formed and then crystallised at cooling by extending detonation products (DP) at $p < 16.5$ GPa, i.e. synthesis goes under the scheme gas - liquid - crystal. The temperature grows in a zone of chemical reaction of a detonation wave, therefore here carbon crystallisation is basically impossible.

2. Influence of the scale factor (weight of a charge and a cover) affects two competing processes – amorphization and crystallisation, and also nanoparticles interaction with formation of strong units. Depending on time these units transform from fractal structures to porous and non porous abrasive polycrystals. The great speed of interaction is caused by microturbulence in DP and small distances between nanodrops. Fast nanoparticles cooling in areas of liquid sp3 nanocarbon and nanodiamonds freezes growth of nanodrops and their crystallisation. Thus the volume of amorphous nanocarbon increases.

The ND output and their quality is also influenced by the form of a charge and its microstructure.

Manufacture condition for ND [2]. A potential market capacity of ND is really great. Nevertheless, the ND market is not created. The reasons are: small volume of detonation nanodiamonds (ND) is necessary for creation of optimum technology, high cost and low unstable ND quality.

Features of new technology of "pure" ND synthesis [2].

1. Explosions of charges in weight of 20 kg in the automated chamber with laser initiation of charges and protection of walls of the chamber against fast-flying ND particles. As a result ND doesn't have non carbon impurity, and the cost price of ND decreases in 4-5 times in comparison with use of charges in weight of 1 kg (for production 24 t/year).

2. The absence of metal impurity allows to refuse acid clearing, having replaced it with cheaper gas-phase oxidation of not diamond carbon. Such replacement reduces the cost price of ND even in ~ 3 times.

[1] V.V. Danilenko. EXPLOSION: physics, engineering, technology. M. Energoatomizdat, 2010, 784 p., chapter 16.
[2] V.V. Danilenko. *Superhard Materials* № 5, 15 (2010).