DETONATION NANODIAMONDS AS A NEW CARBON NANOSTRUCTURE FOR NANOTECHNOLOGY

A.Ya. Vul'

Ioffe Physical-Technical Institute of the Russian Academy of Sciences

E-mail: alexandervul@mail.ioffe.ru

Development of nanotechnology requires the production of dispersed particles of a material with characteristic sizes of a few nanometers. Detonation nanodiamond (DND) has a crystalline core of about 4 nm. The goal of presentation is to give a short review on technology, properties and applications of DND produced by detonation of carbon explosive materials discovered in USSR in the 60-s. The presentation based on the latest results of Ioffe Institute nanodiamond group [1,2].

It has been recently shown by Ioffe Institute group as well as other scientists the DND cluster consists of a diamond core (sp^3 hybridized carbon) covered by a carbon-onion shell (sp^2 hybridized carbon). It has been experimentally shown that the sp^3/sp^2 depends strongly on conditions of detonation synthesis and can be changed by heat treatment in different atmosphere.

It has been difficult to isolate the crystalline cores primarily because of the well-known high tendency for nano-sized particles to aggregate into clusters of submicron size due to the high specific surface area. DND usually forms a hierarchical fractal structure. However, it was recently suggested that stirred-media milling with micron-sized zirconia beads is an effective method for making from DND stable aqueous suspension of 4 nm particles.

Besides well-known applications of DND for polishing material, metal-nanodiamond coatings, and polymer composites and rubbers new applications are discussed in the last time. Among them we would like to emphasized composites with high thermal conductivity, field electron emission, seeding at growing of CVD diamond films, production of new magnetic materials and materials for bio-medical applications. In this connections the most important step is development of industrial scaled technology for production of the stable nanodiamond particle suspension and the technology of surface functionalization of the single 4 nm diamond particle. The applications mentioned above are discussed in presentation.

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References:

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