Carbon Composites Based on Nanodiamonds

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Cardon composite materials based on nanodiamonds have been produced by chemical synthesis. The composite (NDC - Nano Diamond Composites) has a structure comprising carbon nanofragments of two types: nanodiamond particles (medium size 4-6 nm) and nano-sized graphite-like matrix connecting them to a composite. By varying of preparation conditions it is possible to prepare materials with different effective thickness of the graphite-like matrix on the surface of nanodiamond particles (from 0.2 to 1 nm). Thus, it provide a nanostructure which has two carbon phases of different crystalline structure.

The NDC materials are high-porous carbon composite bodies: pore volume is ranging from 30 to 60 vol.%, and effective pore size of 8-10 nm. The narrow pore-size distribution and, hence, uniformity of pores properties throughout material volume makes it possible to consider nanopores as a third nanophase of the composite. Thus, NDC have three types of volume distributed nanofragments: diamond nanoparticles, graphite-like carbon and pores. The possibility to vary the contents of different components in materials in a wide range makes NDC a suitable model material for study of effects of different nanophases on materials properties.

Studies on NDC properties have shown that they have interesting thermal and electrophysical properties. For example, they have semiconductive type of electrical conductivity with activation energy in the range of 0.05-0.2 eV with absence of Hall potential.

Because of its structure, providing high concentration of sites for diamond film growth, NDC material is a good substrate for growing of diamond films. High level of electrical conductivity provided by the graphite-like matrix and low electron emission threshold levels makes nanocomposites interesting for study of mechanism of field electron emission and for planar emitters.

Pores of NDC can be filled by some sabstanses (liquids, melts, etc.) including bioactive preparates. In the composites some new chemical and physical effects have been observed.

Thus, the preparation technology for NDC provides composite materials for prospect applications important ranges and variation of properties. The principles used in the preparation of the described materials provide future development of nanocomposites based on nanodiamonds.