Superhard composite material based on nanodispersed carbon

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Earlier it has been shown by us that in the conditions of high pressures (4-5 GPa) and temperatures (950-1200°C) formation of a superhard carbon phase in Fe-C nanocomposite material occurs not only from fullerenes, but also from other cheaper nanodispersed carbon materials, as fullerene soot, multiwall nanotubes, fullerene black [1].

In the present work it has discovered that the samples sintered based on concentrated fullerene soot with a small additive Fe (C_{fs}-10 wt.% Fe) contain three modifications of superhard carbon grey phase (Fig.1). Dominant modification with microhardness up to 78 GPa plays a role of binding being in a liquid state at sintering.

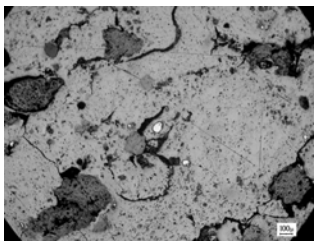

Figure 1: Microstructure of sintered sample: 90% fullerene soot +10% Fe

Appearance of a liquid phase in the conditions of high-energy consolidation of nanodispersed carbon at high pressure can be caused by displacement of graphite-liquid-steam-diamond interfaces in area of lower pressures and temperatures on the constitution diagram of carbon. It is known that with increase of dispersity of particles, or crystallites temperature of phase transition can be decrease.

Mechanism of formation of superhard carbon phase from melt at high pressure can be used for control of structure formation process of new superhard materials with use inexpensive nanocarbon components as fullerene soot, multiwall nanotubes, fullerene black. Last actually is not used scrap of fullerenes manufacture.

[1] Okatova G.P., Svidunovich N.A., Kuis D.V., Urbanovich V.S., Oychenko V.M., Korzhenevsky A.P., *Chemistry and Chemical Technology* **53**(10), 90 (2010).