Water Mediated Modification of Structure and Physical Chemical Properties of Nanocarbons

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Carbon nanoparticles (NP) play an important role in biological and geochemical processes and affect the environmental situation as they provide a building material for soils and sediments and carry organic pollutants. They are poorly understood because small concentrations of nanocarbon in water are difficult to identify and because NPs are highly active, their activity can manifest itself in low concentrations. The large-scale use of carbon NPs and the good prospects of fullerenes in medicine and biotechnology show that problems in nanocarbon-water interaction are acute.

Nevertheless the research studies and application are hindered by poor solubility of carbons. However, hydrophobic nature of carbons is in contradiction with a considerable amount of water incapsulated in shungite (Sh) and characteristic variations in structure and properties of nanographite and activated carbon fibres, consisting of nanographitic domains, upon sorption of water molecules.

In many potential uses carbon NPs interact with water in the form of aqueous dispersions but colloids with such particles (fullerenes, fullerene soot and nanodiamonds) could only be obtained upon their modification. An essential role in modification was shown to play by oxygen-containing groups on the surface of carbons.

It was shown, that Sh nanoparticles consist of curved graphene stacks with size of about 1 nm. The elements look like "bowls" formed by curved 2-5 nm thick fullerene-like layers. As the elements have a dipole moment, they are supposed to be responsible for the amphiphilicity of Sh's nanoparticles, and can re-orient in the presence of a polar medium (water). Hence this is likely to be main reason of NPs stabilization in water.

The present paper reports on experimental results on study of aqueous dispersions of Sh and their stabilization in comparison with other carbons using TEM, X-ray diffraction, DTG and NMR methods. Some observations of physical chemical modification of water saturated NPs are also presented.

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