Structure of amorphous carbon produced by high-voltage electric discharge technology in organic liquids

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New high-energy electric discharge technologies for production of carbon nanomaterials, containing fullerene-like clusters of the C_{60}-C_{70} type, nanotubes, nanodiamonds and amorphous carbon (AC), using the methods of electrical explosion of graphite rods and electric breakdown of organic liquids (EBOL) are elaborated [1, 2]. The EBOL technology gives an opportunity to produce an AC in amounts required for industrial application.

The structure of the synthesized from different organic liquids (benzene, hexane, cyclohexane, etc.) carbon powders is studied by the electron microscopy, Raman spectroscopy and X-ray analysis. Raman spectra are typical to AC materials and they are characterized by a large intensity ratio I_D/I_G (0.9), what indicates on significant structural disorder. The synthesized AC powders possess a complex hierarchical structure with a size of individual components of the order of 30-50 nm and specific surface area of 150 m^2/g. It is found, the Raman spectra of AC produced from cyclohexane (C_6H_{12}) are similar that of nanodiamonds. This fact testifies to the diamond-like type of short-range order, what was confirmed by the RDF calculations. We found that the type of short-range order of AC produced by EBOL technology is primarily determined by the degree of hybridization of carbon atoms in the molecule of the working liquid: in the case of hydrocarbons with sp^2-hybridization, AC have the graphite-like type of short-range order, in the case of working liquid with sp^3-hybridization - diamond-like one. A structure of the organic molecule plays an important role, because AC with predominance diamond-like type of short-range order is synthesized only in the case of cyclohexane, a molecule which is similar to a hexaatomic ring in the crystalline structure of diamond.

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[1] Rud A.D., Kuskova N.I., Ivaschuk L.I., Zelinskaya G.M., Biliy N.M., *Fullerenes, Nanotubes and Carbon Nanostructures* **19**(1), 1536 (2010).

[2] Kuskova N. I., Rud A.D., Baklar V.Yu., Ivaschuk L.I., *Zhurnal Tekhnicheskoi Fiziki* (in Russian) **80**(9), 57 (2010).