Nanocomposites and nanomaterials

ESR, optical and structure study of biomorphous carbon matrix

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The fundamental and applied aspects of the study of biomorphic carbon materials are intensively developing in recent years. Such materials are pseudomorphic to the initial biological objects on the micro-, meso-, and macroscale. The base for their production is the process of pyrolysis of plant material, on the basis of which it is easy to obtain various nanostructures, for example, carbon nano-onions for fluorescence bioimaging [1], or use them for the synthesis of SiC ceramics [2] etc. In this study pyrolysis of various plant samples was carried out at T≈900 °C. This leads to the decomposition of organic substances within the plant material, the rearrangement of biopolymers contained in the plants and finally the gradual formation of pure carbon frame.

The structure and composition of the resulting carbon matrices were studied using Raman spectroscopy. All Raman spectra consist of D and G bands at ~1355 and ~1580 cm^{-1} belonging to sp^2-hybridized carbon. The width and intensity of these bands depend on the base material, temperature and time of pyrolysis.

The electronic properties of the samples were studied by electron spin resonance (ESR) method. The ESR line shape varies from the symmetric Lorentz line to the asymmetric Dyson line, latest is characteristic for conductive materials. The ESR line width reflects the porosity of the carbon matrix and is controlled by the oxygen content, decreasing sharply in the evacuated samples.

1. *Ghosh M., Sonkar S.K., Saxena M., Sarkar S.* Carbon Nano-onions for Imaging the Life Cycle of Drosophila Melanogaster // Small.- 2011.-**7,** N 22.-P. 3170-3177.
2. *Kiselov V.S., Yukhymchuk V.O., Valakh M.Ya. et al.* Biomorphous SiC ceramics prepared from cork oak as precursor // Journal of Physics and Chemistry of Solids.-2016.-**91**.-P. 145-151.