Nanocomposites and nanomaterials

Paramagnetic properties of fullerene derived nanomaterials and their polymeric composites: interaction with molecular oxygen

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Magnetic properties of nanocarbon structures are of great interest, displaying a variety of properties, caused, including their interaction with molecular oxygen [1,2]. A special direction of nanotechnology is application of nanocluster carbon materials: fullerenes, fullerene soot (FS) and fullerene black (FB) as fillers.

In this work by using the EPR method we have investigated the dynamics of the paramagnetic properties of FS, FB, and their polymer composites Phenylon C-2/ FS, FB. For the first time in this work it is observed the effect of the drastic growth of the EPR signals of FB, FS and composite samples under pumping out at temperatures T = 100÷170 °C. It is found, that the effect is caused by the blocking of the defect transformation mechanism into non-paramagnetic state due to their interaction with molecular oxygen. It is shown that ensemble of paramagnetic centers in the FB, FS and the composite is a heterogeneous. It consists of various subsystems with different efficiency of the broadening mechanisms (due to interaction with oxygen). As a result, a super Lorentz EPR line is observed.

Finally, we found the kinetic characteristics of the processes of the restoration of equilibrium after the placed the evacuated powder samples into contact with the environment, and proved the reversibility of effect. In the bulk composite samples the above processes are much slower due to their low gas permeability at RT.

1. *A.I. Shames, V.Yu. Osipov, A.Ya. Vul', Y. Kaburagi, T. Hayashi, K. Takai, T. Enoki*. Spin–spin interactions between p-electronic edge-localized spins and molecular oxygen in defective carbon nano-onions // CARBON. 2013.-**61. -** P. 173–189.
2. *L.J. Dunne, A.K. Sarkar, H.W. Kroto, J Munn, P Kathirgamanathan, U. Heinen, J. Fernandez, J. Hare, D.G. Reid, A D Clark*. Electrical, magnetic and structural characterization of fullerene soots // J. Phys.: Condens. Matter. 1996.-**8**. **-** P. 2127–2141.