Nanocomposites and nanomaterials

Synthesis, electrical and magnetic properties of composites magnetite/carbon nanotube and magnetite/activated carbon

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Composites were synthesized by high temperature solid-phase synthesis, based on the decomposition of the salt or mixture of crystallohydrates containing ions Fe^{2+}, Fe^{3+} in an inert atmosphere. Composites were a single-domain nanoparticles Fe_3O_4 (NPM) grown on the surface of carbon nanotubes (CNT), synthetic coal SCN and SCS and technical coal BAU.

Original NPM and composites NPM/CNT, NPM/SCN, NPM/SCS and NPM/BAU was investigated by X-ray analysis (XRD), transmission electron microscopy (TEM), X-ray photoelectron spectroscopy, gas adsorption, impedance spectroscopy and sample vibrating magnetometry (SVM). The field dependence of the specific magnetization composites were obtained. NPM mass concentration on value of saturation magnetization composites, average size NPM to data by XRD, size distribution NPM to data by TEM and SVM was determined. The processes of growth NPM analyzed. On the surface of carbon nanotubes NPM have the ellipsoidal shape and preferred angles between the axis OX and large axes NPM are ± 70º was shown. Value crystallographic anisotropy constant and absolute size single-domain NPM calculated based on the value of the coercive force. Frequency dependence of conductivity and permittivity including frequency of 9 GHz were obtained. Results were analyzed from the perspective of the theory of percolation. The porous structure of the magnetosensitive composites was investigated by low temperature nitrogen adsorption-desorption. Sorption and desorption isotherms composites specific surface area and volume of micropores was obtained. An adsorption activity magnetosensitive composite with activated carbon was measured by adsorption of the dye methylene blue (MB) in aqueous solutions at 25°C. MB adsorption equilibrium curves for the composites were obtained. Adsorption isotherms were obtained in experiment they were type Langmuir. Γ_∞ constants of Langmuir curves and adsorption isotherms of the cations Ni^{2+}, Cu^{2+} and Pb^{2+} composites were obtained.