Nanocomposites and nanomaterials

Local structure, thermal stability and pyrolysis processes of natural nanostructured materials (coal): spectroscopic studies

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Carbonization (pyrolysis) of natural coal is used to remove volatile substances, percentages of which are characterized by size V_{daf}. Pyrolysis is one of the ways of efficient coal use, especially in the chemical industry. The study of the local structure of coal, porosity, electrical and magnetic properties, is important to understand the carbonization process.

In this paper, by using methods such as scanning electron microscopy (SEM), energy dispersive analysis, Raman spectroscopy and electron paramagnetic resonance (EPR) investigated the local structure, magnetic and electronic properties and thermal stability of various types a coal.

Characteristic D and G bands for carbon structures were recorded in the Raman spectra, which are the result of the vibrational modes of sp^2-hybridized carbon atoms. It was also found that the process of structure graphitization begins after vacuum annealing at 400 – 750°C.

Thermal stability was investigated. The dependence of the optimum laser power on annealing temperature coal samples was found.

EPR line width depends on the interaction of carbon atoms with a molecular O_2 in open pores of coal. Vacuum annealing at 500 – 750°C results in partial graphitization of the samples, changing their porosity and conductivity. It was found an increasing concentration of paramagnetic centers from 10^{19} to 10^{20} per gram after vacuum annealing, which indicates the start of structure carbonization [1]. EPR line changes its shape from symmetrical Lorentzian to asymmetrical Daysonian at an annealing temperature of 700^0C, which indicates a significant conductivity of the sample.

1. *Mrozowski S.* Esr studies of carbonization and coalification processes part II: biological materials // *Carbon.* – 1988.-**26**, N 4.-P. 531-541.