

Applicatopn of gas chromatography for studies of oxidation kinetics of nanocarbon materials

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The issue of heat resistance of nanocarbon materials and reaction mechanisms of its interaction with air oxygen is still open for scientists, producers and end users of the instrument, polycrystalline and composite materials based on these materials. The basic research methods of heat resistance are gravimetric. For detailed investigation of oxidation process of carbon materials it's necessary to consider the ration of reaction products that characterize the stages of process. The present work was appointed to application of gas chromatography method for obtaining such information.

Utilizing this method the oxidation kinetic of nanodiamond powders and carbon nanotubes synthesized by Ukrainian company ALIT was studied. The oxidation mixture was composed from 20% oxygen and 80% argon, gas expense was 0.2 l/min. Before the start of reaction (till the experiment temperature was achieved and gas reaction mixture was put into reactor) the reactor with the samples was blown thorough with argon at 0.16 l/min.

The oxidation process of carbon nano materials was studied by the reaction products. The quantitative ratio of CO and CO₂ in the reaction products was obtained during the reaction.

For studies of heat resistance in isothermal conditions the model of sample “carbon in cylindrical cup” was used. Kinetic parameters of the reaction were calculated based on the macro-kinetic equation, which accounts also the influence of external and internal mass-transition [1].

The kinetic parameters calculated based the data of chromatography analysis are in good correspondence with the results of gravimetric method when utilizing identical sample model.

As a result of studies of oxidation process of powders of nanodispersed diamonds and carbon nanotubes by the reaction products with utilization of gas chromatography the presence of both carbon oxides in the products of their oxidation was proved. The quantitative ration of CO and CO₂ in the reaction products during the reaction was obtained. The reasonability to use the gas chromatography method for studies of oxidation kinetic of nanocarbon materials was shown.

[1] G.P. Bogatiyeva, M.A. Marinich, V.Ya. Zabyga, G.G. Zapyuk, A.M. Panova, G.A. Bazaliy, *Superhard materials №5*, 26 (2008).