OBTAINING OF NANOPOROUS CARBON BY PYROLYSIS OF ALUMINIUMCHLORHYDROCARBON COMPOUNDS

Ibragimov H. D. *, Rustamov M. I., Seidov N. M., Kuliev A. D., Ibragimova Z. M., Kolchikova I. V.

Institute of Petrochemical Processes, National Academy of Sciences of Azerbaijan, Khojaly ave., 30, Baku, 1025, Azerbaijan

E-mail: ibragimov-khikmet@rambler.ru

Introduction

Among the main methods of obtaining of carbon nanotubes and nanofibers the pyrolysis of hydrocarbons has received widespread in recent times. Pyrolysis of hydrocarbons does not require such high temperatures, which are necessary in the sublimation of graphite and can be carried out in conventional chemical reactors. In a number of works methane, ethylene, ethanol, etc. / 1-3 / have been used as a source of hydrocarbons.

This paper is devoted to the study of the method of preparation of ordered nanoporous structures of the products of interaction of aluminum with halogenated hydrocarbons.

Results and discussion

We have created a fundamentally new approach to the synthesis of nanometer sized carbon materials, such as the pyrolysis of synthesized aluminum-halogen hydrocarbons under certain conditions in an inert environment, resulting in the splitting of the latter on the volatile matter and carbon.

Identification of carbon products of the reaction was carried out by X-ray phase analysis using X-ray diffractometer Dron-3M; for determining the dispersion of the obtained particles atomic-force spectroscopy and X-ray analysis was used. Size and shape of carbon-containing nucleus of studied nanocomposites were confirmed by AFM on scanning atomic force microscope of grade NC-AFM. The morphology of the surface of carbon nanocomposites and relief of samples with nano-fractal entities were studied. AFM analysis of samples identified morphologically very different-shaped structure of the surface, evidenced also at micrometric level through optical microscopy of high-resolution. Microphotographs were performed using polarization microscope МИН-8. X-ray phase analysis revealed that the bulk of the reaction products are highly dispersed carbonaceous mass. At difractograms peaks belonging to carbon, as a rule, merge into a broad halo with maximums, characterized by d = 3,41-3,42 Å, usually applied in the literature to UNF /4/. At the same time, in some experiments there is a noticeable soot-formation and formation of high-disperse graphite. Calculations made of difractograms by Scherer equation, pointed to the existence in the reaction products of particles of carbon assigned to UNF in the 1.5 - 21 nm. However, in some cases one can observe the aggregates of larger sizes. In addition, there are substructures located at some distance from the surface and having a nanocrystalline structure, the size of crystallites varies within tens of nanometers. Past AFM-studies of relief of the surface in two-dimensional (2D) and three-dimensional (3D) scales are presented in Fig. 1 and Fig.2.

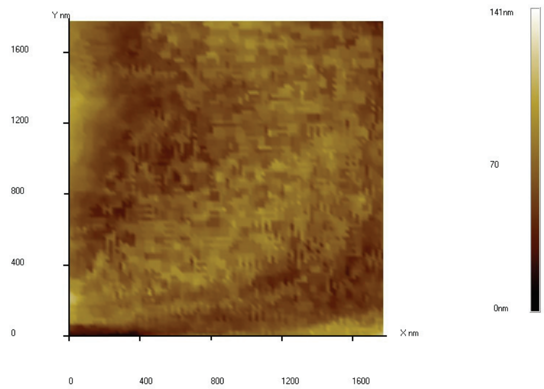

Fig.1.AFM-image of the carbon surface in the 2D-scale

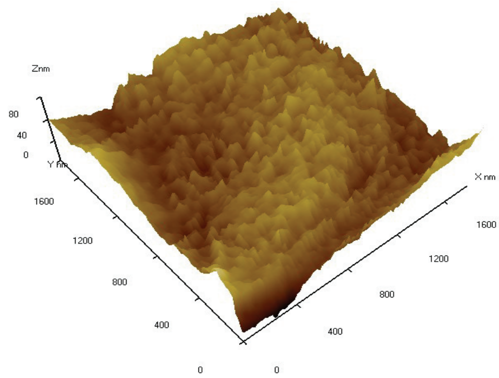

Fig.2.AFM-image of the carbon surface in the 3D-scale

It was found that changing some parameters, namely, the temperature of the process, possibly varying size and porosity of nanoparticle samples.

Conclusions

Referring to the results of experiments, the possibility of purposeful synthesis of nanoparticles with desired properties and prospects of using nano-composites for a number of practical recommendations, such as trapping of gases and metals in oil products, an active heat shield, etc.

References

1. Khodos I.I., Tarasov B.P., Kasumov Yu.A., *et al.* Proceedings of 7-th International Conference on Nanostructured Materials (NANO 2004), (June 20-24, 2004, Wiesbaden/ Germany), p.56.

2. Трефилов В.И., Щур Д.В., Тарасов Б.П. и др. Фуллерены – основа материалов будущего. Киев: АДЕФ, 2001.

3. Maruyama S., Kojima R., Miyauchi Y., Chiashi S., Kohno M. Low-temperature synthesis of high-purity single-walled carbon nanotubes from alcohol. Chem. Phys. Lett. 2002; 313: p.229-234.

4. Пешнев Б.В., Николаев А.И., Кузьмичева Г.М., Асилова Н.Ю., Подлесная М.В. Формирование углеродных нановолокон диспропорционированием СО, Химия тв. топлива, 2007, №4, с.66-70.