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PHYSICAL AND CHEMICAL PROPERTIES OF CARBON NANOTUBES

Synthesis of carbon nanotubes (CNT) results in formation of both multilayer and single-layer filamentary tubular structures about 0.8–5.0 nm in diameter and up to hundreds microns in length. The impurities of metals used as catalysts in the course of CNT synthesis as well as impurities in the form of amorphous carbon (carbon-black) and graphitized inclusions, fullerenes and other nanoparticles can be contained on the external and internal surfaces of the tubes.

The aim of the present work is the study of effect of different kinds of chemical treatment on physical and chemical properties of CNT produced by gas-phase catalytic deposition of hydrocarbons on the Ni–Mg catalyst (produced by Alit Co.). Chemical treatment is necessary to remove the residue of the catalyst and to oxidize amorphous carbon.

Physical and chemical properties of untreated and treated CNT have been studied by X-ray diffraction analysis, adsorption analysis, thermal desorption spectrometry, thermographic analysis, magnetic and electrochemical analysis.

It is ascertained that each kind of the applied acidizing of the untreated and treated CNT results in an increase in the specific surface, total porosity; adsorption activity correlated with the amount of active centers and thermal stability are also changed. Acidizing treatment of the initial CNT by HCl, HNO_3 and acid mixtures decreases Ni content in the material by 3 times, from 1.5 to 0.5%. But this treatment does not remove amorphous carbon. To remove amorphous carbon, extra treatment by mixtures of $H_2CrO_4 + H_2SO_4$ or $H_2SO_4 + HNO_3$ is especially effective.

As a result of the studies, principal distinctive characteristics of the quality of powder of multilayer carbon nanotubes (MCNT) have been defined, production technology of three grades of MCNT (MCNT-A, MCNT-B and MCNT-C) has been developed.

Keywords: carbon nanotubes, specific surface, porosity, adsorption activity, thermal stability

Fig. 1. SEM image of CNT sample

Fig. 2. Thermodesorption spectra of water vapour from CNT1 (curve *1*), CNT2 (*2*), CNT4 (*3*), CNT3 (*4*)