Obtaining of Carbon Nanotubes in Reactor with Fluidized Bed of Catalyst

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The researching activity related to CNTs has grown most significantly over the past 10 years. Since 2006, world capacities of production of CNTs have increased 10-fold. The annual number of scientific publications on CNT and issued patents continues to grow [1]. Carbon nanotubes are used in many areas, such as energy, biotechnology, microelectronics, textiles, etc. [2]. There are many methods for producing carbon nanotubes, such as electric arc synthesis, CVD, flame synthesis [3], etc. Today CVD (chemical vapour deposition) is a recognized leader in the field of carbon nanotubes synthesis.

Studies on the synthesis of carbon nanotubes in a reactor with a fluidized bed of catalyst have been carried out. A laboratory vertical CVD-installation for the carbon nanotubes synthesis with a fluidized bed of catalyst was prepared. The structure of this installation is similar to the structure of horizontal CVD reactor. The quartz tube (working chamber) is equipped with a porous ceramic septum which fixes the fluidized area of the moving layer. The CVD reactor consists of a vertical furnace and a quartz tube. Nitrogen and acetylene were used as the initial gases. The following types of catalysts were used in this work:

- Silica gel spheres impregnated with a solution of $Fe(C_5H_5)_2$;
- Al_2O_3 microparticles (80-160 μm) impregnated with a solution of $Fe(C_5H_5)_2$;
- Al_2O_3 (spheres) impregnated with a solution of $Fe(C_5H_5)_2$.

Scanning electron microscopy and Raman spectroscopy were used to determine the morphology and structure of carbon nanotubes. The results showed that Al_2O_3 spheres impregnated with a $Fe(C_5H_5)_2$ have the best catalytic properties in the synthesis of carbon nanotubes. In this case, synthesized CNTs with an insignificant content of amorphous carbon had diameters from 88 to 122 nm.

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