Short Communication _____ *Thematic Section:* Research of the New Technologies.
Reference Object Identifier – ROI: jbc-02/15-44-12-196 *Subsection:* Inorganic Chemistry.
Publication is available for discussion in the framework of the on-line Internet conference "*Butlerov readings*".
http://butlerov.com/readings/
Contributed: November 11, 2015.

Effect of synthesis condition on the morphology of obtained carbon materials

© **Evgeny S. Vavilov**,[+] and **Igor N. Kovalev***
Department of Solid State Chemistry and Nanoprocesses. Chelyabinsk State University.
Molodogvardeytsev St., 70-B. Chelyabinsk, 454021. Chelyabinsk Region. Russia.
Phone: +7 (351) 799-70-63. E-mail: chem_faculty@csu.ru.

*Supervising author; [+]Corresponding author
Keywords: carbon nanomaterials, pyrolysis, carbon nanotubes, scanning electron microscope, radiography.

Abstract

The synthesis of the carbon nanomaterials was carried out in an installation, which was a ceramic tube, through which the inert gas current was passed. The tube was equipped with independent furnaces providing heating of two zones: a reaction zone and a preheating zone. Carbon materials were received by two different methods: catalytic pyrolysis of hydrocarbons and the interaction of carbon dioxide with magnesium. In the first case, a catalyst was placed in the reaction zone, a toluene boat was placed in the preheating zone. The fusion temperature was 750 °C, fusion time 60-90 minutes. The reaction was carried out with different values of the excessive pressure of argon in the system. The pressure was varied from 0.1 to 0.5 atm. When the second method was implemented, magnesium powder was placed in the reaction zone, and a mixture of argon and carbon dioxide gas was put into the system. The pressure of argon was 0.5 atm, carbon dioxide pressure was 0.2 atm. The reaction zone was heated to 800 °C. The synthesis was cariing out for 1.5 hours.

The synthesized products were explored using such methods, as raster electron microscopy and X-ray analysis. Via raster electron microscopy method it was shown that at toluene pyrolysis carbon nanotubes were formed, the quality of which was heavily dependent on the excessive pressure of argon in the system. Nanotubes obtained under pressure of 0.1 atm were characterized by a small length and a large diameter (up to 150 nm). Conversely, at a pressure of 0.5 atm nanotubes with the length to 2 μm and a diameter of about 70 nm were formed.

The material obtained by the carbon dioxide interaction with magnesium was the wrong form particles, which didn't belong to the nanotubes class. Studies of the desiccant properties of this material by the benzene adsorption method had shown that its adsorption capacity was five times higher than carbon nanotubes and 2.5 times higher than that of activated coal.

The radiographs of all received materials contain wide reflexes, which are typical for badly ordered forms of carbon.

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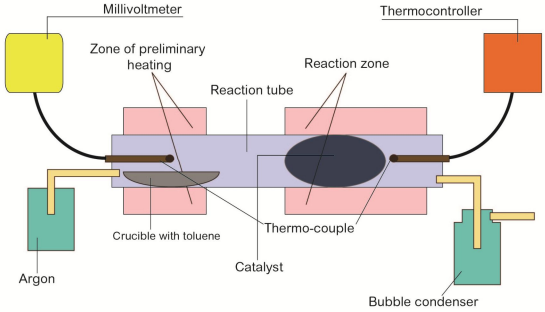

Fig. 1. Scheme of the reactor to obtain CNT *via* hydrocarbon pyrolysis method