SYNTHESIS OF CARBON NANOTUBES BY ELECTRIC DISCHARGE PLASMA

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Nowadays, synthesis of carbon materials is one of the most perspective nanotechnology areas [1]. Among these materials, carbon nanotubes (CNTs) occupy a special place. Carbon nanotubes shows a unique properties, such as high electrical conductivity, chemical and thermal stability, ability to accumulate gases, as well as greater durability and high values of elastic deformation.

There are several methods of CNTs synthesis. For example, laser ablation [2], chemical vapor deposition [3] and electric arc discharge [4-5]. Last 20 years, much attention has been paid to synthesis of carbon nanotubes by an electric arc discharge method, because this method is promising, simple and cost effective. Typically, such synthesis processes are implemented using electric arc reactors separately, combined or separately-combined types [6].

This paper addresses the issue of the CNTs synthesis in W-C system by electric discharge plasma in the open air without using any vacuum equipment. At the first stage, series of experiments on synthesis of carbon nanostructures was carried out using a vacuum-free electric arc reactor. At the next stage, XRD and TEM analysis of obtained ultradispersed powder product were carried out.

According to X-ray diffraction data, the synthesized product contains several crystalline phases. Three is graphite C, carbon nanotubes C, tungsten W, tungsten carbides WC and W_2C. The addition of tungsten to the synthesis process contributes to the formation of carbon nanotubes [7].

The results of HRTEM analysis is shown in Figure 1. These results confirm the presence of carbon nanotubes in the synthesized material. The CNT diameter is in the range of 80-100 nm, and the length of carbon nanotubes averages up to about 1 micron.

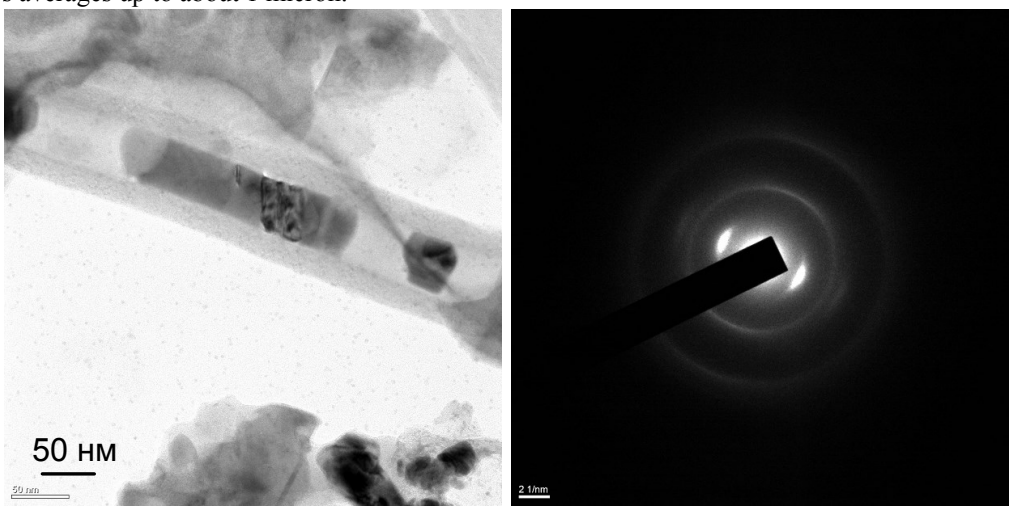

Fig.1. HRTEM image and typical electron diffraction pattern

According to the calculations performed on the electron diffraction pattern, the interplananar distances correspond to the reference values of multilayer carbon nanotubes according to the PDF4 + program data within the limits of the permissible error.

Thus, in this paper, the synthesis of carbon nanotubes in the W-C system by electric discharge plasma in the open air without the use of any vacuum equipment and systems for the generation of protective gaseous media is considered.

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