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The impact of catalyst surface on morphology of the obtained carbon nanomaterials

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Abstract

Various carbon nanomaterials (CNM), including carbon nanotubes (CNT), were synthesized via method of toluene catalytic pyrolysis under argon current at a nickel catalyst. For the synthesis there were used catalysts with different surface structure and obtained via different methods. Synthetized carbon materials morphology and morphology of used catalysts' surface were investigated with the use of the scanning electron microscope method.

It was determined that the catalyst's surface structure had a strong impact on the form of the synthetized carbon nanomaterials. Under these circumstances, presence of nickel nanoparticles on the catalyst's surface is the key to shaping a specific type of carbon phase. It is expected that these nanoparticles are active centers in forming carbon nanotubes.

By reason of the absence of such centers, forming of CNT was not observed when there was used a catalyst with surface composed of flat regions with a diameter from 5 to 10 mcm without additional inclusions. The material, obtained in this case, was homogeneous formless carbon layer that uniformly covered the catalyst's surface. The use as a catalyst of the material on the surface of which nickel nanoparticles were present allowed to obtain carbon nanotubes of different quality.

It was shown that the qualitative CNT might be synthetized with the use of a compositional catalyst on the inert ceramic surface of which nickel nanoparticles with a diameter from 200 to 500 nm were distributed. Distance between such nanoparticles is much larger than their size. Advantage of this type of catalyst is explained by the fact that active centers are disposed at a great distance from each other, thus ensuring unhampered growth of carbon nanotubes. CNT obtained via this method have smoother surface and larger sizes, than CNT synthetized with the use of catalysts with closely spaced active centers. In the latter case, interaction between growing nanotubes frequently leads to their contortion, jointing, forming twisted agglomerate.

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