STRUCTURAL TRANSFORMATION OF METALLIC CATALYST NANOPARTICLES OF IN DIFFERENT PROCESSES OF CARBON NANOTUBES FORMATION

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Introduction

There are a few main methods of carbon nanotube and nanofiber synthesis. The most commonly used amongst them are sublimation of graphite with subsequent desublimation and pyrolysis of hydrocarbons. In all the cases the carbon nanomaterial is formed in the presence of catalysts – Fe, Co, Ni or alloys of these metals.

Results and discussion

The structural transformations of iron-containing metal catalyst particles during the different basic processes of carbon nanotubes synthesis have been investigated by means of Mossbauer spectroscopy, high resolution electronic microscopy, Raman spectroscopy, X-Ray diffraction and termogravimetry.

The changes in structural and chemical state of Fe:Ni powder catalysts particles in the arc discharge synthesis [1], Fe-MgO fine grade powder catalyst [2] and ferrocen-toluol gas mixture [3] in different pyrolized synthesis were examined.

Conclusions

It was found that formation of iron-metal-graphite complex on the catalyst particles take place in all above-mentioned synthesis of carbon nanotubes. The complex is a germ of carbon nanotube's growth which coordinates this growth from amorphous carbon, according to our previous results [1]. It's quantitative content is pro rata to the outcome of nanotubes in all investigated processes.

It was shown in the paper that gamma–Fe particles (with a large quantity of carbon dissolved in) being generated in the synthesis process don't appear to be catalytic ones and their fast formation along with a-Fe catalytic particles puts obstacles in the way of nanotubes growth.

References

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