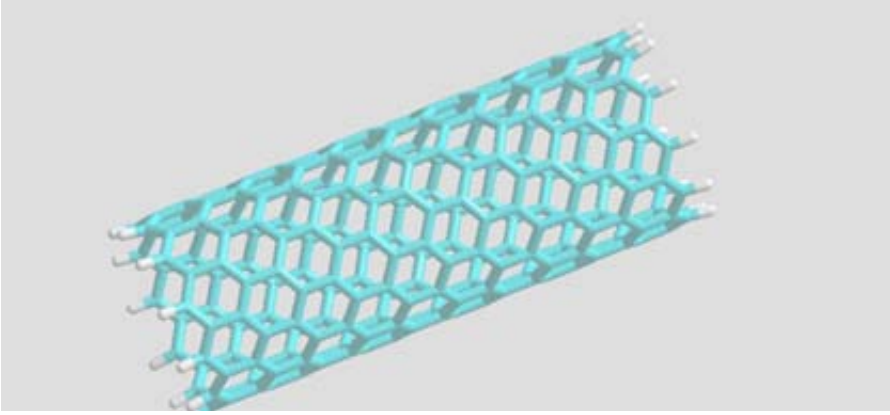
NATIONAL METALLURGICAL ACADEMY OF UKRAINE

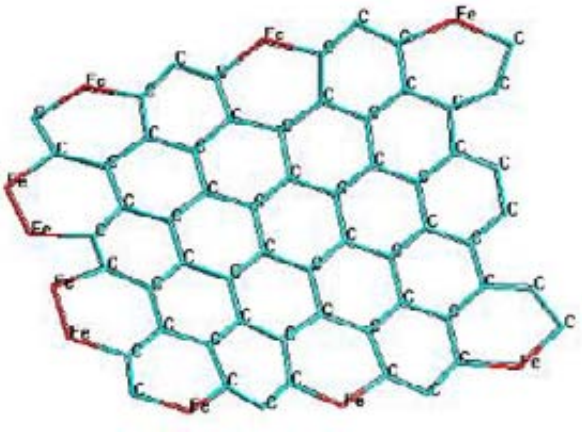
DESIGNING AND MANUFACTURE OF NANOCOMPOSITE MATERIALS FROM CARBON NANOTUBES (CNT)



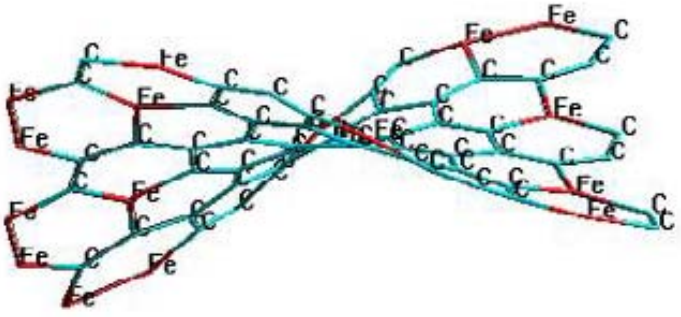
Carbon nanotubes with excellent properties are promising materials for a wide range of applications.

Mechanism of CNT growth was proposed by using semi-empirical method. In this model interaction of catalytic atoms, like iron, with carbon atoms of a graphene sheet was studied.

First more active carbon atoms of graphene sheet which have more tendencies to form carbides with iron atoms were determined. In the next step formation of metastable carbides on the boundaries of graphene sheet with determined active carbon atoms was simulated. In this step folding of graphene sheet was observed. Repeating first and second step leads to fold the graphene sheet more and form a shape like nanotube:



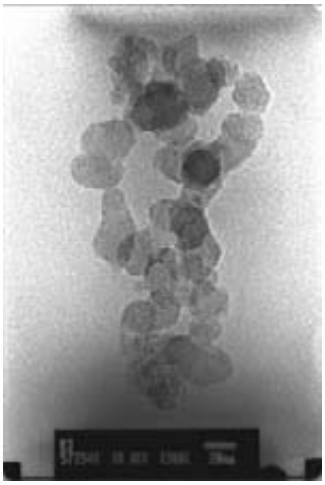
Graphene sheet with placed iron atoms in first step of modeling



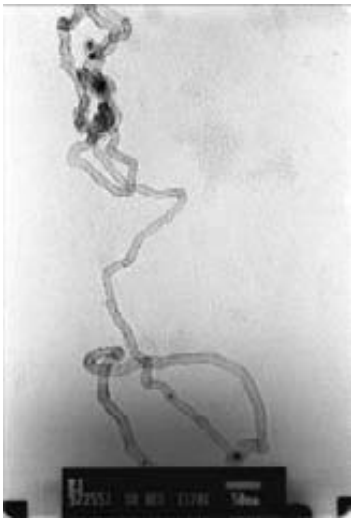
Effect of catalyst particle on folding the graphene sheet in second step

Carbon nanotubes were synthesed by a catalytic disproportion of carbon monoxide. The synthesized products are studied by TEM and HRTEM microscopy. MWNT

and onion-like carbon nanomaterials were the main morphological shape of products.



TEM image of onion-like carbon nanoparticles produced with CO disproportion catalyzed by Fe_2O_3



TEM image of produced MWNT catalyzed by Co_2O_3

In the purpose to improve mechanical properties of metals the idea to design of these materials from the liquid or powder metal systems with carbon nanotubes as reinforcements was proposed.

The main idea of creation of ferrous – carbon nanocomposite arises from a two known reasons: first one - hardness and strength rises from steel to iron with increasing of carbon content; second one – plasticity changes vice versa. There is a long existent dream to design Fe-C materials with plastic matrix and reinforced particles having uniform distribution into metal.

At previous techniques this was not possible because the input of carbon foresees its dissolution in the melt and then main phase formation at solidification and phase transformation.

Qualitative placing of the nanotubes into stable disperse suspension (including high temperature media) is the first factor of success in composite formation. Therefore nanofilm coated on surface of CNT may help to improve wettability of CNT in liquid alloys and the other side to the protect CNT from interaction with liquid ferrous metal.

Nanometer-scale coatings of another material or ferrous metal contenting components on the surface of CNT improve the properties of carbon nanotubes and will make it possible to use CNT in different media.