MULTICHANNELS OF SYNTHESIS OF CARBON NANOSTRUCTURES IN LOW-TEMPERATURE PLASMA [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2021.48.1.132

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Carbon nanotubes are stretched structures with a diameter of one to several tens of nanometers and a length of several microns. They combine the properties of molecules of molecules and of solid matter and might be considered as an intermediate state of the matter. These tubes contain one or several hexagonal graphite layers bended into cylinder [1, 2]. In addition to cylindrical geometry the graphite layer might form a two-dimensional crystal – graphene. Unique physical and mechanical properties of carbon nanotubes and graphene and their high specific surface make them applicable for the development of new electronic devices, ultra resistant and light materials, advanced power sources (hydrogen storage, supercapacitors, fuel cells, photovoltaic convertors), efficient filters, biocompatible materials and so on [3,4].

Wide spectrum of carbon nanostructures was synthesized by means of simple plasma chemistry using DC plasma torch: carbon nanotubes, nanowalls, graphene, hydrogenated graphene and a mixture of nanotubes with graphene. The synthesis was performed in the plasma-chemical reactor under the pressure varying in the close range 350-710 Torr with different types of hydrocarbon as an admixture to the helium plasma. Aliphatics (propane, butane methane and acetylene) were used providing a variation of C:H ratio. The plasma-chemical pyrolysis of hydrocarbons in the temperature range 1000-8000 K was analyzed using the thermodynamic and gas dynamic characteristics of the plasma flow by assuming local thermodynamic equilibrium [5]. It is determined that the main contribution to the formation of predecessors of condensed carbon makes the equilibrium composition of plasma jet in the temperature range 2500-3500 K. In this range the interrelation between atomic hydrogen H and hydrocarbon molecules CH varies dramatically, and the mole fraction of solid carbon Cgr goes upward. It is shown that the C: H ratio in the initial carbon source affects the plasma-chemical system, which leads to different ways of nanostructure formation.

The work is supported by the Russian Foundation for Basic Research, grant nos. № 19-08-00081.

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Pt/ru/GB-Shavelkina.docx) [↑](#footnote-ref-1)