Nanocomposites and nanomaterials

CNTs synthesis on the catalytic substrate

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Despite the apparent simplicity of the organization of CVD methods of carbon nanotubes (CNTs) synthesis, they require a careful approach to the selection of control parameters, the study and optimization of kinetic characteristics of the process. The majority of scientific and patent literature concerning CNTs and nanofibers synthesis is devoted to periodic processes. They are usually implemented in tubular reactors with a low productivity.

In recent years in the Gas Institute of NASU new approaches have been explored and developed, which would enable nanotubes continuously production of uniform quality. We studied the CNTs growth process with the aim of intensification and optimization of the mode of their production, increase reliability and durability of the device in which synthesis occurs [1,2].

We have developed proposals that relate to methods and devices for carbon nanomaterials production in the products of hydrocarbon gases conversion in the presence of catalysts, preferably based on iron or its alloys. They can also be used in the production of composite materials, sorbents, catalysts, etc. The task to improve the method of CNTs producing on the catalytic substrate was successfully solved. The intensification of the process of CNTs growing and optimization of the mode of their synthesis are provided as a result of a preliminary heating of the catalytic substrate in an oxidizing atmosphere followed by it processing by an inert gas, hydrogen and supplying into the reaction zone with carbon-contained gas.

We developed some decisions to improve the aggregate for CNTs synthesis. It's proposed to apply consistently the lock (sluice) chambers in different zones of the reactor. Distinctive feature of the device – supporting of different gas atmospheres in the heating, reaction and cooling chambers due to gas-tight gates between them.

Proposed technological solutions allow to increase the yield of CNTs per volume unit of carbonaceous atmosphere. The best result of CNTs yield in the carbon material was approximately 90%.

1. A. Nebesnyi, V. Kotov, A. Sviatenko, D. Filonenko, A. Khovavko, B. Bondarenko. Carbon nanomaterial Formation on Fresh Reduced Iron by Converted Natural Gas // Nanoscale Research Letters (2017) 12:107 DOI 10.1186/s11671-017-1882-6.

2. Bondarenko B, Sviatenko O, Kotov V, Khovavko A, Filonenko D, Nebesniy A, Vishnevsky A (2013) Research of the technology of carbon nanotubes production in gas mixtures contained CO // International Journal of Energy for a Clean Environment 14(2–3):177–182. doi:10.1615/ InterJEnerCleanEnv2014006802.