SYNTHESIS OF CARBON NANOSTRUCTURES BY PLASMA CHEMICAL METHOD

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Annotation

In the work, an installation based on a carbon plasma jet in a helium stream was developed and manufactured. The modernized installation scheme is a compact stand with conveniently located systems for monitoring vacuum, gas and water pressure, and electrode movement devices. An advantage of the installation is also the fact that it does not require reduced pressure for synthesis, which greatly simplifies the production process itself. The content of the obtained fullerene mixture in soot completely depends on the helium flow and power input and ranges from 4% to 20%. The synthesis in our installation is characterized by the high yield of C_{60} and C_{70} - The relative content of the extracted fullerene mixture is 7:3.

Keywords. Carbon nanostructures, fullerenes, Raman spectroscopy, optical microscopy, arc synthesis.

Introduction

Recently, a lot of work in the field of nanotechnology has been held at the development of new materials based on carbon, which have unique properties. Nanotechnology has a broad concept, including the creation, processing, diagnostics and use of materials, devices and systems with the range of size within 0.1-100 nm, which demonstrate new or substantially enhanced physical, chemical and biological properties, functions, phenomena and processes due to their nanoscale features [1]. In the second half of the 80s, a new form of carbon was discovered - fullerene. It turned out that carbon at its option forms the spherical molecules. To create such an object, it is necessary to obtain ionized vapor from carbon atoms and then condense it in the helium atmosphere [2].

The massive use of fullerenes and their derivatives is constrained by the imperfection of synthesis methods. Nowadays, almost all existing fullerenes are synthesized by the thermal evaporation of graphite. The method of thermal evaporation of graphite is based on the formation of fullerenes during thermal spraying of a graphite electrode in an arc discharge plasma burning in a helium atmosphere. This method allows to obtain fullerenes in an amount sufficient for a detailed study of their physical and chemical properties. Fullerenes can be obtained from extended fragments of graphite, which are then purified.

Experiment

The synthesis of fullerenes by the plasma-chemical method proceeded at a higher pressure. Then the pressure used in conventional installations (100-200 torr), which leads to a higher probability of particle collisions, i.e. contributes to increased installation efficiency. The results were analyzed with the use of both Raman spectroscopy, and optical microscopy, which showed the presence of fullerenes. Thus, the results gave a reason to conclude that the plasma-chemical reactor, which can be used for the synthesis of various fullerenes, has rather wider possibilities than it was considered before.

REFERENCES

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