INFLUENCE OF GAS TEMPERATURE ON NUCLEATION AND GROWTH OF DUST NANOPARTICLES IN HIGH-FREQUENCY PLASMA

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The trend of development of nanomaterials already allows us to clearly see that one of the most promising areas in nanotechnology is the synthesis of carbon nanomaterials. In turn, nanoparticles are isolated solid-phase objects, the sizes of which in all three dimensions are from 1 to 100 nm. To date, many interesting discoveries related to the physicochemical characteristics of a carbon nanomaterial (CNM) are being studied. This reveals great potential for the application of UNM in various fields not only of science, but also in construction, energy, electronics, and so on. In this paper, the method of chemical deposition from gas phase with plasma enhancement (PECVD) was used to obtain carbon nanomaterials. The production of carbon nanoparticles is carried out in a high-frequency discharge plasma of 13.56 MHz, a matching device of type L. This installation consists of a vacuum chamber in which a system of cylindrical tubes with electrodes is integrated. The electrodes are made in the form of plane-parallel disks located at a distance of 20 mm. The temperature in the vacuum chamber is regulated by a cooling and heating system using liquid nitrogen and a heater. Thus, the temperature of the plasma-forming medium can be varied in the range from -20 to 1000C. On the active electrodes in the capacitive discharge, a constant current is induced, the self-bias voltage of which directly affects the concentration of the electron flow in the plasma. To study plasmochemical synthesis and the formation of nanoparticles, a method based on measuring the self-bias voltage VDC is used. The resulting nanoparticles are analyzed using an electronic scanning microscope Quanta 3D, micrographs are taken. In this research paper, carbon nanoparticles were synthesized by the PECVD method and it was found that various parameters, such as the temperature in the working chamber, the self-bias voltage, the gas pressure, etc., directly affect their formation. For example, it became known that in the case of increasing the temperature from room to 1000 C, the time of formation of carbon nanoparticles increases by 4 times.

References

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