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ANM Abstracts

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Synthesis of carbon nano- and microparticles by RFCD discharge

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INTRODUCTION

In this work carbonous nano- and microparticles were obtained by the plasma chemical vapor deposition method in RF discharge. The size and structure of obtained particles in dependence on the discharge parameters were researched. Their sizes and structure depending on the discharge parameters were investigated. Samples of synthesized carbonous nano- and microparticles in RF discharge plasma were obtained. Morphology and chemical composition of obtained samples are investigated by scanning electron microscopy (SEM) and Raman spectroscopy. Analyses of obtained results indicate that synthesis and deposition processes depend on plasma parameters. The optimal conditions of nano- and microparticles synthesis were determined.

EXPERIMENT

The experiments were carried out in the plasma of radiofrequency capacitive discharge [1,3]. The experimental setup consists of the following devices: the gas-discharge chamber, matching device, high frequency generator and module for defining the self-bias voltage. The main part of the experimental setup is the electrodes system, where a high-frequency gas discharge is formed. The stainless steel electrodes with diameter 10 cm are located parallel to each other in a horizontal position at a distance 2 cm. The top electrode is grounded. The lower electrode is connected to the RF generator with a frequency $f=13.56$ MHz. For the forming of plasma the mixture of argon and methane gases is used. The pressure of gases varied in a region of 0.1-2.0 Torr and the discharge power - a region of 1 – 50 Watt. The working chamber has lateral windows to observe the processes in the plasma of RF discharge.

RESULTS AND DISCUSSION

Thus, the carbon nano- and microparticles were synthesized by plasma chemical vapor deposition method in the plasma of radio-frequency discharge. The samples of the carbon nano- and microparticles were studied by a Quanta 3D 200i scanning electron microscope (Figure 1).

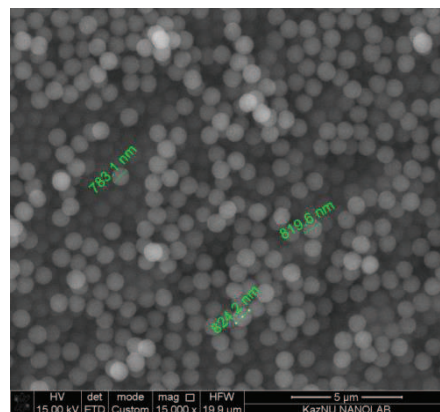


Figure 1– SEM picture of the synthesized carbonous nanoparticles ($P=30$ W, $p=0.6$ Torr)

CONCLUSION

In this work carbon nano and microparticles were obtained by the plasma chemical vapor deposition method in RF discharge and their size depending on the discharge parameters were investigated. Samples of synthesized carbon nano- and microparticles in the plasma of RF discharge were obtained. Morphology and chemical composition of obtained samples were investigated by scanning electron microscopy. Analysis of obtained results indicates that synthesis and deposition processes depend on plasma parameters. The optimal conditions of nanoparticle synthesis were determined. Synthesized nano- and microparticles have diameter from 200 nm up to several microns. Hence, the rapid growth of nano- and microparticles depends on the discharge power whereas the growth deceleration depends on the gas concentration.

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