THE INFLUENCE OF GAS TEMPERATURE ON FORMATION AND GROWTH OF THE DUST NANOPARTICLES IN COMPLEX PLASMA

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The nanoparticles and nanostructured materials became the basis of medicine and pharmaceutics, energy, electronics, automotive industry, etc. So studying the influence of plasma and gas parameters on the formation and growth of nanoparticles is very important. The works [1, 2] shows how the synthesis of nanoparticles affects on the intensity of the plasma emission. A better comprehension of particle formation may help us to understand the plasma basic problems. On the other hand, it is interesting to be able to control the production of particles. The influence of gas temperature on the formation and growth of particles in the plasma of gas mixture of argon and silane has been studied in many works [3, 4]. As shown experimentally, small deviations of parameters of plasma and gas (pressure, power and electron density) can completely change the law of clusters' growth, the formation of particles and their behavior [5].

In this work, the influence of gas temperature on the size and structure of the dust nanoparticles was studied. The gas temperature ranged from 100°C to -30°C. Plasma-chemical method of synthesis of nanoparticles from gas phase was used. All experiments were conducted at constant plasma parameters as gas pressure and discharge power. On the basis of mathematical and graphical calculations dependencies of self-bias voltage and electron density on the gas temperature were obtained. Graphs of the time of nanoparticle nucleation depending on the gas temperature at different plasma parameters, and diameter distribution and concentration of nanoparticles depending on the synthesis time in Ar/CH_4 plasma were obtained. It was determined that the time of formation and growth of the nanoparticles increases when plasma forming gas is heated and decreases at lower temperature.

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