DUST FORMATION IN REACTIVE PLASMAS

Johannes Berndt, Eva Kovacevic, Laïfa Boufendi

GREMI Université d'Orléans, France

(*) **johannes.berndt@univ-orleans.fr**

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The unique chemical and physical properties of nanoparticles make them interesting for the rapidly growing field of nanotechnology. Nanoparticles are used as buliding units for nanoassemblies [1] and novel nanocomposite materials [2] and they possess a great potential for biomedical applications [3].

The common request for these technological applications is the synthesis of nanoparticles with adjustable characteristics. The non-equilibrium character of low temperature plasmas provides an excellent tool for both a tailored production of nanoparticles and a controlled surface modification or surface functionalization of nanoparticles. Particle properties as size, shape, chemical composition and morphology can be effectively controlled by the plasma parameters and by the choice of the precursor material. However the formation of particles in a low temperature plasma is a rather complex process involving a great variety of different species. Various kinds of positive and negative ions as well as several neutral species can contribute to this process. Moreover the formation of particles and their charging has a severe impact on the plasma itself: the basic plasma parameters as electron temperature and electron density are changing as well as the density of excited states, the spatial profiles of these values, the chemical composition of the plasma, the heating mechanism, the sheath properties, or the plasma impedance [4-7]. An essential requirement for a tailored production of dust particles is therefore the understanding and control of the mechanisms that are involved in their formation and growth. constitution of plasma synthesised nanoparticles.

This contribution focuses on the formation of nanoparticles in various hydrocarbon and silane gas mixtures. The influence of gas composition, pulse frequency and duty cycle (in the case of pulsed discharges), discharge geometry and wall conditioning on the formation of nanoparticles is studied both theoretically and experimentally.

Reference

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