Charging of small particulates in plasma: study by computer simulations

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Computer simulations are in recent years a powerfull and frequently used tool in science and industry. With the increasing of the computer performance they can be used also for the study of dusty plasma behaviour, that is a complex problem involving many physical phenomena. The complexity of these models necessitates the usage of effective numerical methods.

Our contribution is aimed on the theoretical aspects of electrical charging of small particulates immersed into plasma. When a dust particulate is immersed into plasma, it charges electrically due to different velocities of different kinds of charged species contained in plasma. In laboratory facilities the light electrons are usually much faster than much heavier ions, and, therefore, the particulate charges negatively. This behaviour can be well used for plasma diagnostics and in many technical applications.

In the presented computer model the plasma is considered to be a fluid of electrons, positively charged ions and neutral particles. Plasma is described by continuity equations for charged particles and the Poisson's equation. The particle flux is expressed by the drift-diffusion approximation, the convective term in the equation of motion is neglected. Reaction rates are determined by the non self-consistent particle model. The surface charge is determined by the integration of total particle flux over the given boundary. Computer models are conceived as time-dependent problems.

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