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MICROPARTICLES IN A RF PLASMA UNDER HYPER GRAVITY CONDITIONS

J. Beckers, W. W. Stoffels
Eindhoven University of Technology,
Department of Applied Physics
5600 MB, Eindhoven, the Netherlands

T. Ockenga, M. Wolter, H. Kersten
Christian-Albrechts-Universität zu Kiel,
AG Plasmatechnologie
D-24098 *Kiel, Germany*

For diagnostic purposes micrometer-sized particles can be used as floating electrostatic probes. Once injected into a complex rf plasma, these particles will become negatively charged and can be trapped in the plasma sheath due to an equilibrium of several forces working on them, e.g. the electrostatic force, gravity, drag forces and thermophoresis. Measuring for example the position of the particles in the plasma sheath and the interparticle distance while varying plasma parameters (power, pressure, temperature, gas etc.) gives important information about plasma properties like the ion flux and the sheath potential.

We experimentally investigated the behavior of micrometer sized particles inserted and trapped in a rf plasma under varying gravity conditions in a centrifuge. Here we present first results of those measurements. The experiments were carried out in a Perspex box containing a parallel plate capacitively coupled rf argon plasma at pressures between 20 and 115 Pa. The typical forward power applied to the bottom electrode was ~10 Watt. The squared electrodes are separated 5 cm from each other and both contain centered holes in order to trap the particles in the created potential well. This also gains possibilities to observe particle behavior from below. The monodisperse particles which are made of melamineformaldehyde and have sizes ranging from 5 up to 12 μm are illuminated by an expanded 532 nm laser beam. The height of the particles on which the forces are in equilibrium is measured from pictures collected with an onboard CCD camera. This whole setup is mounted on a centrifuge originally developed to study high pressure metal halide lamps under hyper gravity conditions [1].

Results show that under these condition particles can be trapped in the plasma sheath when the gravitational force is 2.6g or less. When larger acceleration forces are applied the particles are lost from the discharge. Due to the increased apparent gravity of the particles in the centrifuge the height of the cloud above the powered bottom electrode decrease with ~2 mm when the acceleration force is increased from 1g up to 2.6g.

1. A J Flikweert, T Nimalasuriya, G M W Kroesen, W W Stof fels, Plasma Sources Sci. Technol. **16** (2007) 606-613.