Electron Temperature Control in the Zyflex Chamber

C. A. Knapek[1], D. P. Mohr[1], P. Huber[1], U. Konopka[2], H. M. Thomas[1]
[1]DLR German Aerospace Center, Research Group Complex Plasmas, Wessling, Germany
[2]Auburn University, Auburn, AL, USA
christina.knapek@dlr.de

In a complex plasma, the electron temperature T_e of the surrounding plasma is an important factor in defining the particle charge and interaction. T_e in a capacitively driven rf-discharge is mainly given by ohmic heating in the plasma bulk and stochastic heating due to reflection of the electrons at the sheath edge. By inserting a grid between the rf-electrode and the rest of the plasma chamber, the latter is separated from the region of plasma production (Fig. 1). The grid represents a barrier for slow electrons if it is grounded or negatively biased, but fast electrons can pass through the grid and create a low temperature electron population by ionizing neutral gas atoms on the other side. There are no further heating mechanisms for these electrons, and T_e can be controlled by e.g. varying the dc bias of the grid, thus selecting the electron energies allowed to pass [1].

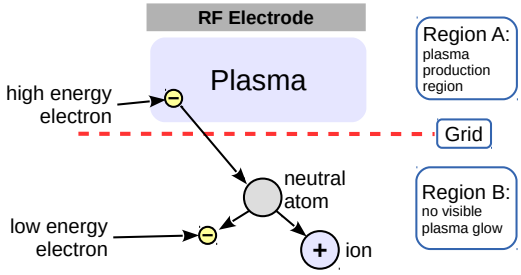

Figure 1: Plasma is generated between an rf electrode and a grid (Region A). Fast electrons pass through the grid and ionize neutral gas atoms on the other side, generating a low temperature electron population (Region B).

First results of experiments are presented where particles were inserted into Region B (Fig. 1) of the discharge chamber, and the influence of changing the dc bias of the grid, thus controlling T_e, on the particle behavior was studied. The experiments were conducted in the "Zyflex" chamber – a large, cylindrical plasma chamber with parallel, rf-driven electrodes. The chamber is currently being developed as part of the PlasmaLab project, an experimental setup for complex plasma research on board of the International Space Station (ISS) to study fundamental properties of complex plasmas in large 3D systems in microgravity.

This work and some of the authors are funded by DLR/BMWi (FKZ 50WM1441).

References

[1] K. Kato, S. Iizuka and N. Sato, Appl. Phys. Lett. **65 (7)**, 816 (1994)