PO4089

Analysis of the sheath behavior of an analytic model for a capacitive discharge

Laura Kroll, Dennis Engel, Ralf Peter Brinkmann

Theoretische Elektrotechnik, Bochum, Germany

laura.kroll@rub.de

Global models are particularly suitable for incorporating the most relevant plasma characteristics. In comparison to spatially resolved simulations, e.g. PIC simulations, they are computational less demanding. They also need low computing times whereby results can be achieved faster. In this work the numerical modeling of a capacitively coupled discharge is shown. For this purpose, an existing global model [1] is extended by a sheath in front of the grounded electrode in order to be able to investigate the boundary sheath behavior in front of the driven and the grounded electrode. Particular emphasis is put for a variation of the area ratio of the driven to the grounded electrode. The obtained results allow conclusions about the effects of the nonlinearities as well as for the effect of the plasma series resonance. In addition, it can be said that the assumption of the DC-floating potential is suitable for large area ratios (AG ≥ 30•AE).
A first approach for the sheath model uses a constant ion density profile, which is called matrix sheath model. Additionally an experimentally determined ion density profile is used in the model and suitable parameter variations allow a comparison of the results using the two different density profiles.
As an outlook, a further improvement of the boundary sheath behavior can be achieved by incorporating thermal and dynamic effects. Moreover the ambipolar field which is particularly important for the ion dynamics is considered. This can be accomplished by using an improved sheath model.

[1] Mussenbrock T., Brinkmann R. P., Liebermann M. A., Lichtenberg A. J., and Kawamura E. 2008 Phys. Rev. Lett. 101 08500

Keywords
Global model
Sheath model
Area ratio