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Modeling and control of ion energy distribution functions at the electrodes of multi-frequency capacitively coupled plasmas EDMUND SCHÜNGEL, West Virginia University, ZOLTÁN DONKÓ, IHOR KOROLOV, ARANKA DERZSI, Wigner Research Centre for Physics, Hungarian Academy of Sciences, JULIAN SCHULZE, West Virginia University — The energy of ions flowing onto boundary surfaces in technological plasmas is of crucial importance for applications. In particular, the shape of the ion energy distribution function (IEDF) determines the surface processes. This is why capacitive radio-frequency (RF) plasmas are widely used. It has been found that the mean energy and flux of ions can be controlled separately in dual-frequency discharges. However, advanced methods should allow for a control of not only the mean ion energy, but also of the shape of the IEDF. Here, we present such an approach based on voltage waveform tailoring. A RF voltage consisting of up to 5 harmonics is applied to one electrode. The outcome of PIC/MCC simulations is compared to an analytical model, which tracks the motion of ions in the electric field of the RF sheath and takes charge exchange collisions into account. The IEDF width, i.e. the maximum and mean ion energy, is controlled by tuning the applied harmonics' phases according to the Electrical Asymmetry Effect. Based on a fundamental understanding of the ion dynamics, the IEDF can be customized and specific features of the distribution – such as peaks at intermediate energies – can be generated and shifted along the energy axis by adjusting the shape of the driving voltage waveform.

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