Abstract Submitted
for the GEC13 Meeting of
The American Physical Society

Electron heating and control of ion properties in capacitive discharges driven by customized voltage waveforms JULIAN SCHULZE, Ruhr-University Bochum, ARANKA DERZSI, IHOR KOROLOV, Hungarian Academy of Sciences, EDMUND SCHUENGEL, Ruhr-University Bochum, ZOLTAN DONKO, Hungarian Academy of Sciences — We investigate the electron heating dynamics in capacitive radio frequency plasmas driven by customized voltage waveforms and study the effects of modifying this waveform on the DC self-bias, η, the ion flux, Γ_i, and the mean ion energy, E_i, at the electrodes by PIC simulations. The driving voltage waveform is customized by adding N consecutive harmonics ($N \leq 4$) of 13.56 MHz with specific harmonics' amplitudes and phases. In an argon plasma, we find η to be generated via the Electrical Asymmetry Effect for $N \geq 2$. η can be controlled by adjusting the harmonics' phases and is enhanced by adding more consecutive harmonics. At 3 Pa, the discharge is operated in the α-mode and E_i can be controlled by adjusting the phases at constant Γ_i. The ion flux can be increased by adding more harmonics due to the enhanced electron sheath heating. However, we find E_i not to remain constant as a function of N at both electrodes due to a change of η as a function of N. At 100 Pa and using a high secondary electron emission coefficient of $\gamma = 0.4$, the discharge is operated in the γ-mode. Due to this mode transition and the specific ionization dynamics in the γ-mode, Γ_i is no longer constant as a function of the harmonics' phases and decreases with increasing N.

Julian Schulze
Ruhr-University Bochum

Date submitted: 10 Jun 2013 Electronic form version 1.4