Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Control of electron heating dynamics and DC self bias in electronegative capacitive CF_4 plasmas by voltage waveform tailoring JULIAN SCHULZE, West Virginia University, BASTIEN BRUNEAU, ERIK JOHNSON, JEAN-PAUL BOOTH, TREVOR LAFLEUR, Ecole Polytechnique, IHOR KOROLOV, ARANKA DERZSI, ZOLTAN DONKO, Hungarian Academy of Sciences, STEVEN BRANDT, EDMUND SCHUENGEL, West Virginia University, ARTHUR GREB, DEBORAH O'CONNELL, TIMO GANS, York Plasma Institute — The effect of tailoring the driving voltage waveform on the electron heating dynamics and the generation of a DC self bias in multi-frequency capacitive CF_4 plasmas is investigated by a combination of Phase Resolved Optical Emission Spectroscopy, voltage measurements, and kinetic PIC/MCC simulations. One electrode is driven by up to 5 consecutive harmonics of different fundamental frequencies (3 MHz - 13.56 MHz). By adjusting the harmonics' phases and amplitudes different waveforms (peaks, valleys, sawtooths) are realized and found to strongly affect the spatio-temporal excitation dynamics and the electrical generation of a DC self bias via the Electrical Asymmetry Effect. For a given waveform, increasing the pressure induces an electron heating mode transition from the α- to the Drift-Ambipolar mode due to an increase of the electronegativity. For sawtooth waveforms, the ionization induced asymmetry and the polarity of the DC self bias are found to be reversed at high pressures compared to electropositive gases. At high frequencies the simulations show that the discharge can be split into two halves of different electronegativity, which can be controlled by tailoring the driving voltage waveform.

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Date submitted: 11 Jun 2015 Electronic form version 1.4