Abstract Submitted
for the GEC06 Meeting of
The American Physical Society

Radio-frequency phase-modulation of spatial electron density in a two-frequency confined capacitive coupled discharge S.K. KARKARI, C. GAMAN, A.R. ELLINGBOE, Dublin City University, Ireland — The effects of oscillating sheath, hence the dynamics of electron flow in the bulk plasma can be of significant importance in modeling a two or multi frequency capacitive coupled system. Most of the modeling results deal with bounded plasma sheath boundary, defined by the point of separation of maximum electron displacement from the positive space charge sheath. However in practical applications, the discharge gap is narrow ($\sim$ 1 cm) as is the case in a standard plasma processing tool (Exelan^{TM}, Lam Research Inc.) routinely used in semi-conductor manufacturing industries. The rf-sheaths can be a substantial fraction of the separation between the electrodes, leading to significant amount of electric field perturbing the bulk plasma density. We report on an experimental investigation of space and phase-resolve electron density using a floating hairpin resonance probe in a modified plasma tool (Exelan); the discharge is powered with the sum of voltages at 27.12 MHz and 1.937 MHz drive frequencies in $Ar/O2/C_4F_8$ gas mixtures. The results show that the electron density is modulated in the bulk of the discharge at both driving frequencies (1.937 MHz + 27.12 MHz). At the centre of the discharge the modulation frequency is twice the low frequency cycle due to the exclusion of electrons from the opposite sheath at alternate phase of the low-frequency cycle.

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Date submitted: 16 Jun 2006 Electronic form version 1.4