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Effects of charged particle dynamics, process control, and surface characteristics on spatio-temporal behavior in capacitive RF plasmas[1] S. BRANDT, M. KOEPKE, West Virginia Univ, A. DERZSI, Z. DONKO, Wigner Research Centre for Physics, B. BERGER, J. SCHULZE, Ruhr-Univ Bochum, D. KEIL, Lam Research Corp — Our simulations and experimental studies have analyzed the spatio-temporal excitation, ionization, and power absorption dynamics in an electronegative CF_4 radio-frequency capacitively coupled discharge driven by various tailored-voltage waveforms using up to three harmonics of a fundamental frequency of 13.56 MHz. The influence of electronegativity on the discharge was observed through a variation of the mixture ratio of CF_4 and Ar gases. Phase-resolved optical emission spectroscopy (PROES) allowed tracing of the development of the electrical asymmetry effect. The dependence of the discharge dynamics on the secondary electron emission coefficient (SEEC) was investigated using PROES in an electropositive gas (Ar) for plasma-facing aluminum electrodes with variable surface roughness, with and without an aluminum oxide film deposited on the electrode. The alpha-to-gamma mode transition was found to be modified by the dependence of the SEEC on both surface roughness and film thickness. These results aid the understanding of the effects of an incident-energy-dependent SEEC for deposition and etching applications in plasma processing, where electronegative gas admixtures and substrate contamination are highly influential.

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