Post-deadline presentation

Thursday, October 4th, 12:00 Crystal Ballroom A

Secondary Electron Effects in a DC/RF Hybrid Capacitive Coupled Plasma Etcher by Lee Chen, Kazuki Denpoh, Peter Ventzek (Tokyo Electron Limited) and Alok Ranjan (University of Houston)

Abstract
DC/RF hybrid plasma sources are utilized in dual-frequency etch tools in order to achieve high etch rate and high selectivity. In this work, 2D test particle and 2D particle-in-cell (PIC) simulations have been used to describe the nature and role of "ballistic" electrons, which are originated as secondary electrons on the DC+RF biased upper electrode and then accelerated in the sheath toward the opposite lower electrode (wafer). For simplicity in the test particle model, the upper electrode's RF is not considered. The PIC simulations are self-consistent. The ballistic electron bunch results in a highly non-Maxwellian plasma. In addition, when the RF bias is applied on the wafer, ballistic electrons are confined in the potential well formed between electrodes and only thermalized with the central Maxwellian body very slowly. The collisionless nature of the ballistic electron can be seen in the phase-space plot. The detailed nature of the electron kinetics and trapping effects are described by the PIC model and are consistent with the test particle results. Simulations also capture the measured electron density trends with different source powers. Finally, ionization rate constant due to ballistic electrons can be fit with a simple formula as a function of the electric field in the DC sheath.