Abstract Submitted
for the GEC07 Meeting of
The American Physical Society

Capacitive Discharges Driven by Combined DC/RF Sources M.A. LIEBERMAN, EMI KAWAMURA, A.J. LICHTENBERG, UC Berkeley, E.A. HUDSON, Lam Research Corporation — The performance of low pressure rf capacitive discharge reactors can be modified by applying an auxiliary dc power source to a reactor electrode. The dc source induces a dc current flow through the plasma and alters the sheath voltages and widths. This can increase the plasma density and etch rate. These effects may be ascribed to an enhanced density of high energy secondary electrons in the discharge due to the alteration of the sheath voltages. We have obtained analytic expressions for the sheath voltages and sheath widths for both collisional and collisionless sheaths driven by a combination of dc and rf voltage sources. The analysis is done for both symmetric (equal area) and asymmetric diode discharges, as well as a triode configuration. The analytical results for the symmetric and asymmetric diode discharges are compared to the results of numerical simulations using plane-parallel and cylindrical 1d3v (one-dimensional displacement, three velocity components) particle-in-cell (PIC) codes over a wide range of pressures and rf frequencies, finding good agreement. Secondary electron dynamics and energy distributions are also examined; these yield increased discharge efficiency. The uniformity of the secondary electron and ion fluxes at the target electrode are also examined with a series of two-dimensional (2D3v) PIC simulations.

M.A. Lieberman
UC Berkeley

Date submitted: 05 Jun 2007 Electronic form version 1.4