Abstract Submitted
for the GEC10 Meeting of
The American Physical Society

Collisional sheaths and resulting ion energy distributions at rf biased electrodes[1] X. VICTOR QIN, A.E. WENDT, University of Wisconsin-Madison — In plasma processing of materials, ions are accelerated toward the substrate by a sheath electric field generated by an rf bias voltage applied to the substrate electrode. By tailoring the shape of the periodic voltage waveform, ion energy distributions (IEDs) dominated by a single peak at a specified energy can be created at low pressures. We use the capability to manipulate the substrate voltage waveform as a tool to systematically examine the effects of collisions within the sheath on the IED at a biased substrate. Single peaked IEDs were recorded with a retarding field energy analyzer (RFEA) for a range of argon pressures (10-80 mTorr), power input for plasma generation (300-900 W) and sheath voltages (20-300V). We characterize the collisionality of the resulting IEDs by the fraction of the ion flux in the narrow IED peak. This fraction is found to be a monotonically decreasing function of a collisionality parameter, defined as the ratio of sheath thickness to ion mean free path, over this range of parameters. Results will be compared with predictions based on a Fick's Law analysis, and implications for arbitrary shapes of bias voltage waveforms as well as processing applications will be discussed.

[1]Support from Lam Research is gratefully acknowledged.

Amy Wendt
University of Wisconsin - Madison

Date submitted: 14 Jun 2010 Electronic form version 1.4