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Manipulation of Bias Voltage Waveform to Control Bombarding Ion Energy Distribution[1] X. VICTOR QIN, YUK-HONG TING, AMY WENDT, University of Wisconsin-Madison — In materials processing applications using low pressure plasmas, positive ions are accelerated by a sheath electric field toward the substrate, where they enhance surface reactions. The amplitude of a sinusoidal bias voltage waveform applied to the substrate electrode is often used to coarsely control the average energy of bombarding ions, but generally produces a broad bimodal ion energy distribution (IED). Manipulation of the bias voltage waveform shape to produce IEDs with one or two peaks at selected energies has been previously utilized to highlight the significant role of the IED in plasma etching. Presented here are direct IED measurements made with a retarding field energy analyzer at the biased electrode. Measurements in a 10 mTorr helicon argon plasma in which ion flux and ion energy at the substrate are independently controlled clearly demonstrate the ability to predictably produce arbitrary IEDs at the substrate by tailoring the shape of the bias voltage waveform. Results for sinusoidal (500 kHz-10 MHz) and tailored (500 kHz) waveforms compare favorably with predictions based on computation of ion trajectories through the sheath electric field.

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