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Langmuir wave standing wave resonance in DC/RF plasma LEE CHEN, MERRITT FUNK, Tokyo Electron America — The electron energy distribution function (EEDf) of parallel-plate plasma with a high-negative DC electrode and an opposing RF electrode is far from Maxwellian [L. Chen *et al.*, Proc. on 31^{st} Dry Processing Symposium, 1–3 (2009) 7]. It has four distinct energy-groups, in descending order: DC-cathode injected ballistic electrons (BE), continuum, middle-energy peak, Maxwellian. The middle-energy peak has energy (E_M) in the range of $\sim$ 40eV$<E_M<$400eV depending on the glow discharge parameters. Injected BE excites high phase velocity Langmuir waves. Through electron decay instability, the initial Langmuir waves decay to a broad spectrum of lower phase velocity waves, sustaining the continuum through Landau damping. Reflection and bouncing of the Langmuir waves between the DC sheath-edge and the oscillating RF sheath-edge localize a preferred mode of wavelength $\lambda \sim 2S$ with S being the peak RF-sheath thickness. Standing wave resonance of the secondary Langmuir wave locks in a preferred phase velocity, sustaining the middle-energy peak electrons through Landau damping of the resonant mode. By the standing wave resonance model, the energy of the middle-energy peak is $E_M \propto V_0^{3/2} v_B^{-1}$ with V_0 being the RF peak-to-peak voltage and v_B being the ion Bohm velocity, and the curve fits the measured energies of various discharge parameters.

Lee Chen
Tokyo Electron America

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