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Controlling the Electron Energy Distribution Function Using a Biased Electrode[1] SCOTT BAALRUD, Univ of Iowa, BENJAMIN YEE, MATTHEW M. HOPKINS, EDWARD V. BARNAT, Sandia National Laboratory — Positively biased electrodes inserted into plasmas influence the EEDF by providing a sink for low energy electrons that would otherwise be trapped by ion sheaths at the chamber walls. In hot filament generated discharges, the EEDF is nominally characterized by a cool trapped population at energies below the sheath energy and a comparatively warm tail population associated with the filament primaries. Inserting a positively biased electrode has little influence if it is so small that it collects a negligible fraction of the total electron current exiting the plasma. However, as the electrode area approaches $\sqrt{2.3 m_e/m_i} A_w$, where A_w is the chamber wall area, it collects most of the electrons leaving the plasma. This drastically reduces the density of the otherwise trapped population, and causes the electron temperature to increase as the distribution approaches a temperature associated with the energetic filament primaries. A global model is developed based on current and power balance, which shows the interconnected nature of the electron temperature, density and the plasma potential. This model is compared with Langmuir probe measurements in a dc filament generated plasma [1], and with 2D PIC simulations.

[1] Barnat, Laity and Baalrud, Phys. Plasmas 21, 103512 (2014).

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