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End-boundary sheath potential, Langmuir waves, electron and ion energy distribution in the low pressure DC powered Non-ambipolar Electron Plasma LEE CHEN, ZHIYING CHEN, MERRITT FUNK, Tokyo Electron America, Inc., Austin, TX 78741 — The non-ambipolar electron plasma (NEP) is heated by electron beam extracted from the electron-source Ar plasma through a dielectric injector by an accelerator located inside NEP. NEP pressure is in the 1-3mTorr range of N_2 and its accelerator voltage varied from $V_A = +80$ to $V_A = +600$V. The non-ambipolar beam-current injected into NEP is in the range of 10s Acm^{-2} and it heats NEP through beam-plasma instabilities. Its EEDf has a Maxwellian bulk followed by a broad energy-continuum connecting to the most energetic group with energies above the beam-energy. The remnant of the injected electron-beam power terminates at the NEP end-boundary floating-surface setting up sheath potentials from V_S =80 to V_S =580V in response to the applied values of V_A. The floating-surface is bombarded by a space-charge neutral plasma-beam whose IEDf is near mono-energetic. When the injected electron-beam power is adequately damped by NEP, its end-boundary floating-surface V_S can be linearly controlled at almost 1:1 ratio by V_A. NEP does not have an electron-free sheath; its "sheath" is a widen presheath that consists of a thermal presheath followed by an "anisotropic" presheath, leading up to the end-boundary floating-surface. Its ion-current of the plasma-beam is much higher than what a conventional thermal presheath can supply. If the NEP parameters cannot damp the electron beam power sufficiently, V_S will collapse and becomes irresponsive to V_A.

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