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The effect of ambipolar electric fields on the electron heating in capacitive RF plasmas JULIAN SCHULZE, West Virginia University, ZOLTAN DONKO, ARANKA DERZSI, IHOR KOROLOV, Hungarian Academy of Sciences, EDMUND SCHUENGEL, West Virginia University — We investigate the electron heating dynamics in argon and helium capacitively coupled RF discharges driven at 13.56 MHz by Particle in Cell simulations and by an analytical model. Electrons are found to be heated by strong ambipolar electric fields outside the sheath during the phase of sheath expansion in addition to classical sheath expansion heating. Moreover, we find that electrons reflected multiple times from the expanding sheath edge within one RF period are the primary sources of ionization. In fact a synergistic combination of different heating events is required to sustain the plasma. The ambipolar electric field outside the sheath is found to be time modulated due to a time modulation of the electron mean energy caused by the presence of sheath expansion heating only during one half of the RF period at a given electrode. This time modulation results in more heating than cooling on time average. If an electric field reversal is present during sheath collapse, this time modulation will be enhanced. This ambipolar electron heating is found to represent an important heating mechanism, which should be included in models of capacitive RF plasmas.

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