Abstract Submitted
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Bulk heating of electrons in capacitive radio frequency atmospheric pressure microplasmas TORBEN HEMKE, DENIS EREMIN, THOMAS MUSSENBROCK, Ruhr-University Bochum, ARANKA DERZSI, ZOLTAN DONKO, Hungarian Academy of Sciences, KRISTIAN DITTMANN, JUERGEN MEICHSNER, University of Greifswald, JULIAN SCHULZE, Ruhr-University Bochum — Electron heating and ionization dynamics in capacitively coupled radio frequency atmospheric pressure microplasmas operated in helium are investigated by particle-in-cell simulations and semi-analytical modeling. A strong heating of electrons and ionization in the plasma bulk due to high bulk electric fields are observed at distinct times within the RF period. Based on the model the electric field is identified to be a drift field caused by a low electrical conductivity due to the high electron-neutral collision frequency at atmospheric pressure. Thus, the ionization is mainly caused by ohmic heating in this "Ω-mode." The phase of strongest bulk electric field and ionization is affected by the driving voltage amplitude, which determines the resistivity of the discharge via its effect on the plasma density. At high voltage amplitudes the ionization peaks at the sheath edges due to a decrease of the ion density towards the electrodes. Significant analogies to electronegative low-pressure macroscopic discharges operated in the drift-ambipolar mode are found, where similar mechanisms induced by a high electronegativity instead of a high collision frequency have been identified.

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