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Driving frequency effects on atmospheric-pressure RF helium microplasmas: plasma density, electron energy and plasma impedance[1]
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— The effects of the driving RF frequency on the properties of low temperature atmospheric pressure helium microplasmas are discussed in light of simulation results of a 500 micron discharge driven at constant input power with a 10MHz-2.45GHz voltage source. The electron density is found to be a non-monotonic function of the driving frequency and agrees with experimental observations made in different frequency bands with different devices. The physics underpinning this non-monotonic behaviour are investigated and the increasing penetration of the electric field as frequency increases is identified as a key factor. Additionally, the relation between the plasma impedance and the mean plasma density is investigated, and the validity and accuracy of equations commonly used to infer the plasma density from experimental impedance measurements discussed. While this method can provide quantitative estimations, the accuracy suffers when the discharge operates in the gamma mode and in low-density high-frequency discharges where the displacement current across the bulk plasma cannot be neglected.

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