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The utility of continuum simulations for direct current and microwave microplasmas VENKATTRAMAN AYYASWAMY, ARGHAVAN ALAMATSAZ, ABHISHEK KUMER VERMA, University of California Merced — State-of-the-art microplasma devices have contributed to several challenges that require a fundamental understanding of the various mechanisms involved in order to achieve optimal operation for a given application. In this context, the role of computations cannot be stressed enough. Historically, the computational techniques used for simulating plasmas belong to two categories continuum/fluid and kinetic methods. The primary goal of the current work is to perform an exhaustive comparison of continuum and kinetic simulations for a range of operating conditions. Kinetic simulations using the particle-in-cell with Monte Carlo collisions (PIC-MCC) method and continuum simulations using the full-momentum equation are performed at various operating conditions. It is shown that using the electron energy distribution function (EEDF) predicted by BOLSIG+ in continuum simulations of direct current microplasmas leads to a significant under-prediction of plasma densities. The discrepancy between kinetic and continuum simulations is attributed to the presence of hot electrons created as a result of secondary emission. On the other hand, continuum simulations performed for a microwave microplasma operating at 0.5 GHz showed excellent agreement with kinetic simulations.

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