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Self-consistent simulation of a microwave coaxial plasma waveguide ROCHAN UPADHYAY, Esgee Technologies Inc., LAXMINARAYAN RAJA, The University of Texas at Austin — Microwave discharges are typically useful for generating high density, non-equilibrium plasmas at relatively low electron temperature. Recently there has been much interest in Coaxial Plasma Waveguides (CPW) for large area deposition and etching. In a CPW, microwave propagates between a metallic or dielectric surface and a plasma that acts as an outer conductor. The plasma is sustained by surface wave heating due to the microwave propagating in the waveguide. Most studies of this phenomenon have focused on understanding of the electromagnetic surface wave, its dispersion characteristics and power deposition. The plasma is typically modelled as quasi-neutral and sheath effects are either neglected or represented using simplified analytical models. This approach usually precludes the analysis of important effects like self-bias, imposed DC or RF bias on the electrodes, electrostatic waves and the influence of sheath voltage on charged species transport and/or reaction rates. In this study we simulate a CPW using a fully self-consistent model. The model uses the electrostatic and magnetic vector potential equations that are fully coupled with the plasma governing equations to model the electromagnetic effects. This allows us to study sheath effects in conjunction with the surface wave phenomena at microwave frequencies. We compare results with a simplified model that assumes a quasi-neutral plasma that neglects the sheath. We also discuss the range of applicability of simplified models.

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