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Computational Modeling and Simulation of a Resonant Plasma Source ROCHAN UPADHYAY, Esgee Technologies Inc., PETER VENTZEK, Tokyo Electron America, LAXMINARAYAN RAJA, The University of Texas at Austin, ALOK RANJAN, Tokyo Electron Miyagi — Electrical resonance can be exploited to extend low temperature, unmagnetized plasma sources beyond their usual limits. Electrical resonance in a cavity can be achieved by different antenna configurations, one such is described by Niazi et. al. (Plasma Sources Sci. Technol.,3,1994), who use a coil wrapped around a tube. The resonator typically has a configuration dependent resonant frequency and a high quality factor that allows gas heating by strong electric fields producing a high density plasma suitable for material processing. Due to the dependence of the resonance on the precise geometrical and material properties of the chamber, a full three dimensional computational modeling of the plasma electromagnetic wave coupling is necessary. In this study we simulate the plasma in a resonant cavity using a quasi-neutral plasma model that is solved together with the Maxwell Equations in 3D. We distinguish the frequency response of the system with and without plasma. Simulations reveal spatial plasma distributions that are largely governed by electron heating by the electric field that in turn is determined by the structure of the coil. We present dependence of plasma on pressure and power. Comparisons with literature results, including those of Niazi et. al., are also presented.

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