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Fluid Modeling of a Very High Frequency Capacitively Coupled Reactor ROCHAN UPADHYAY, Esgee Technologies Inc., LAXMINARAYAN RAJA, The University of Texas at Austin, PETER VENTZEK, Tokyo Electron America, TOSHIHIKO IWAO, KIYOTAKA ISHIBASHI, Tokyo Electron Ltd., ESGEE TECHNOLOGIES INC. COLLABORATION, THE UNIVERSITY OF TEXAS AT AUSTIN COLLABORATION, TOKYO ELECTRON LTD. COLLABORATION — Very High Frequency Capacitively Coupled Plasma (VHF-CCP) discharges have been studied extensively for semiconductor manufacturing applications for well over a decade. Modeling of these discharges however poses significant challenges owing to complexity associated with simulation of multiple coupled phenomena (electro-static/magnetic fields and plasma physics) over different scales and the representation of these phenomena in a computational framework. We present 2D simulations of a self-consistent plasma with the electromagnetic field represented using vector and scalar potentials. For a range of operating conditions, the ratio of capacitive and inductive power, calculated using empirical correlations available in the literature, are matched by adjusting both the electrostatic and electromagnetic fields in a decoupled manner. We present results using this model that demonstrate most of the important VHF-CCP discharge phenomena reported in the literature, such as electromagnetic wave versus electrostatic heating and its impact on plasma non-uniformity, wave resonances, etc. while realizing a practically feasible computational model.

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