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Numerical simulation of electromagnetic effects in very high frequency capacitively coupled plasma[1] JIAN-KAI LIU, Dalian University of Technology, DE-QI WEN, Michigan State University, YU-RU ZHANG, YONG-XIN LIU, YOU-NIAN WANG, Dalian University of Technology, PSEG TEAM —
A two-dimensional (2D) fluid model, coupled with Maxwell equations and an equivalent circuit model, is developed to understand the electromagnetic (EM) effects in large-area capacitively coupled plasmas (CCP) driven at very high frequency (VHF). In our study, we discussed the effects of two distinct surface wave modes, namely the z-symmetric radially propagating standing wave mode and the z-antisymmetric mode, on these EM effects in asymmetric reactors. At low driving frequencies and low gas pressures, the$\mathbf{E}_r$of z-antisymmetric mode dominates the spatial distribution of the electron deposition power density, leading to an edge-high electron density profile, which is also called the telegraph effect in experiments. As the frequency increases at constant rf power and gas pressure, the$\mathbf{E}_z$of z-symmetric mode becomes increasingly significant on the electron deposition power density, and meanwhile the surface wave wavelength decreases. Therefore, the electron density peak shifts to the radial center, namely the standing wave effect. Furthermore, the influences of gas pressure and rf power on the EM effects are also investigated in this work.

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