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The effect of gas pressure on the nonlinear harmonic excitation in very high frequency asymmetric capacitive discharges[1] JIAN-KAI LIU, Dalian University of Technology; University of California, Berkeley, EMI KAWAMURA, MICHAEL LIEBERMAN, ALLAN LICHTENBERG, University of California, Berkeley, YOU-NIAN WANG, Dalian University of Technology — The standing wave effect, which may lead to center-high density profiles in high frequency capacitive discharges, can be enhanced by nonlinearly excited harmonics. In this work, a nonlinear transmission line model, which solves for electromagnetic fields in the time domain, is coupled to a 2D bulk plasma fluid model to study nonlinear effects in asymmetric cylindrical capacitive discharges. In this model, the bulk plasma fluid model is solved to obtain plasma density and electron temperature distributions. An analytical collisional or collisionless ion sheath model is used to determine the electron sheath heating and the nonlinear dependence of sheath voltage on sheath charge. We first compared the results for collisional and collisionless ion sheath models to address the influence of collisions. Then, the effect of pressure on nonlinear harmonic excitation was investigated. At low pressure, the nonlinear harmonics significantly enhance the standing wave effect and on-axis power deposition. But the nonlinear harmonics gradually damp out as pressure increases, leading to a transition from center-high to edge-high density profiles.

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