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E to H transition in very high frequency capacitive discharges. PIERRE LEVIF, PASCAL CHABERT, JEAN-LUC RAIMBAULT, JEAN-MARCEL RAX, LPTP, Ecole Polytechnique, France, MICHAEL A. LIEBERMAN, Department of Electrical Engineering and Computer Science, University of California, Berkeley, USA — Large area capacitive discharges driven at frequency higher than the usual industrial frequency of 13.56 MHz have attracted recent interest for materials etching and thin film deposition on large area substrates. However, electromagnetic effects, become significant if the excitation wavelength λ and the plasma skin depth δ are not infinite and can be important limitations for plasma processing uniformity. A self-consistent electromagnetic-transmission line model valid in the entire range of λ and δ of practical interest is solved. We find that the plasma may either be sustained by the usual capacitive (E) field or by an inductive (H) field, and that the discharge experiences E to H transitions as the voltage and frequency between the electrodes are raised. At low pressure, the transition is global whereas at high pressure the transition is local, the centre is in the E mode while the edges are in the H mode.

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