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Evaluation of RF Micro-Discharge Regimes in the Performance of Evanescent-Mode Cavity Resonators[1] ABBAS SEMNANI, DIMITRIOS PEROULIS, Purdue University — A number of different RF discharge mechanisms may be important in gas breakdown including ionization, secondary electron emission, and field emission.[2] However, the impact of each of these mechanisms is a strong function of frequency.[3] Consequently, estimating power handling in microwave devices needs to carefully consider the operating frequency. In this paper, we study the frequency-dependent impact of these mechanisms in two evanescent-mode cavity resonators[4] operating at 1 GHz and 50 GHz. The key characteristic of these resonators, unlike typical cavities, is that the resonant electric field is primarily concentrated in a relatively small volume. The smallest dimension of this volume is referred to as critical gap and typically is in the order of a few μm. The two resonators in this study have the same critical gap size of 19 μm which results in the same gas critical frequency of 6.3 GHz in atmospheric pressure. Plasma simulation results as well as the electromagnetic simulations considering plasma are presented and compared for both cases which operate in different discharge mechanisms.

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