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Fluid modeling of operating modes in a field emission driven alternating current (FEDAC) microdischarge AYYASWAMY VENKATTRAMAN, ARGHAVAN ALAMATSAZ, THERAZHUNDUR RAMESH SHIVAPRASAD, Univ of California - Merced — The recent interest in electrostatic microscale devices has lead to a great emphasis on electrical breakdown of gases in microgaps. The breakdown process has been shown to be significantly different from its counterpart in macrogaps with field emission of electrons from the cathode playing a major role. This work aims to build on prior work dealing with pre-breakdown and post-breakdown operating modes in direct current field emission driven (FED) microdischarges. Specifically, charged particle dynamics in microscale gaps that are driven by time-varying fields are studied using an in-house two-fluid code with appropriate cathode boundary conditions including field emission. The model includes continuity and energy equations for both electrons and ions to account for the significant non-equilibrium and is augmented by the Poisson's equation for electrostatic potential. The frequency dependence of breakdown behavior as well as pre-breakdown and post-breakdown current-voltage characteristics is determined for a wide range of frequencies from low radio frequency (RF) to microwave and contrasted with existing results for direct current FED microdischarges. The results are also used to explain trends recently observed in an evanescent-mode cavity resonator operating in the microwave regime.

Venkattraman Ayyaswamy
Univ of California - Merced

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