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Model for Triggered Vacuum Switches

Thursday 23 March 2017 14:00 (30 minutes)

Triggered vacuum spark gaps are useful as fast, high current switches in a variety of pulsed power applications. We will present a 3D PIC-DSMC model of a triggered vacuum switch in which the arc is triggered by running a current through a semi-conductive film adjacent to the cathode surface. Joule heating of the film results in both electron and material emission and the gap ultimately breaks down with significant current flow through the system. As plasma forms near the cathode, a parallel path for the trigger current forms resulting in reduced joule heating and potentially starving the developing plasma of material and delaying breakdown. The model currently includes these effects by separately solving for the film current given a total trigger current that passes through an assumed temporally varying parallel film and plasma resistances. The film current is then used to determine the electron emission and film material sublimation boundary conditions due to Joule heating. We then iterate the PIC-DSMC breakdown simulations and the solution of the film current/material supply until reasonable convergence is reached. We will show breakdown behavior such as delay time and starvation across a range of film resistances.

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Modelling and Simulations

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