Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Low-voltage operating mode of a high-current magnetized cold-cathode plasma[1] TIMOTHY SOMMERER, STEVEN ACETO, DAVID SMITH, General Electric Research, NICHOLAS HITCHON, JAMES LAWLER, University of Wisconsin — A series of approximations and simple models is used to estimate the properties of a cold-cathode plasma in a high-voltage, high-power gas switch for use in grid-scale electric power conversion. The active plasma volume is a plane-parallel gap ≈1 cm filled with helium at a pressure on order 0.1 torr. A magnetic field in the region adjacent to the cathode is used to increase the current density to practical levels >1 A/cm^2. The plasma can operate in a "low voltage mode" (≈80 V) that has the appearance of a constricted attachment at the cathode surface and a more diffuse region toward the anode. Cathode material is absent from the plasma emission spectrum. Various attempts to model the spot indicate that the plasma in the constriction is near full ionization, and that there is a dynamic balance of neutral gas atoms between the constriction, the cathode surface, and the neighboring diffuse plasma. The electron emission mechanism is assumed to be conventional, by ion impact, but field emission may contribute.

[1]The information, data, or work presented herein was funded in part by the Advanced Research Projects Agency-Energy (ARPA-E), U.S. Department of Energy, under Award Number DE-AR0000298.

Timothy Sommerer
General Electric Research

Date submitted: 18 Jun 2015 Electronic form version 1.4