Operation of a high-voltage, high-power gaseous electronics switch for electric grid power conversion\textsuperscript{1} TIMOTHY SOMMERER, SERGEY ZALUBOVSKY, General Electric Research, Niskayuna, NY — 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 volume is a plane-parallel gap \( \sim 1 \text{ cm} \) filled with hydrogen at a pressure \( \sim 0.3 \text{ torr} \). A magnetic field in the region adjacent to the cathode is used to increase the current density to practical levels \( \sim 1 \text{ A/cm}^2 \). The estimated bulk plasma density is mid-\(10^{12} \text{ cm}^{-3} \) and the electron temperature is \( \sim 3 \text{ eV}, \) to offset volume recombination. The magnetic field enhances ionization near the cathode and also impedes electron diffusion away from the region, sometimes resulting in a peak of plasma density in an extended presheath region. The switch is opened by applying a positive potential to a grid between the cathode and anode, leading to the formation of an ion matrix sheath around the grid, and an ion-acoustic wave that sweeps out the conducting plasma between the grid and the anode in about 1 \( \mu \text{s} \).

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