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# Switching Characterization of Multi-gap and Multi-aperture High Power Pseudospark Switch (PSS)

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There is still an ongoing interest and need for high power (30-70kV/5-10kA) gas-filled switches in high energy accelerator facilities and pulsed power applications. Principally low-pressure, one-gap cold cathode pseudospark switches (PSS) have demonstrated to be an alternative to thyratrons for hold-off voltages up to 30kV. In present and future high energy accelerator facilities, the design of power modulators mainly depends on the availability of fast, reliable, durable, and commercially available high voltage switches. Multi-gap thyratrons momentarily are unique for that. Former basic studies have shown that in similar way two- or three-gap PSS are a promising alternative. In this paper the design, development and switching characterization of a coaxial three-gap PSS prototype are presented. A high dielectric ferroelectric trigger unit is incorporated in the cathode region for breakdown initiation in the first gap and subsequent synchronous breakdown of the next gaps. To guarantee long lifetime with high currents, high hold-off voltages and optimized plasma coupling, kidney shaped ring slot electrodes with baffles are used. Each of the gaps is designed for voltage hold-off up to 30kV with a total voltage hold-off for the three-gap PSS of approximately 70kV. Studies of switching behavior have been carried out at different operating conditions, such as varying gas type (hydrogen/helium/argon/nitrogen) and gas pressure (10-80Pa), hold-off voltages (5-60kV), use of various trigger configurations, and change of circuit parameters. The short-time scale analysis of the voltage waveform manifest steps in the voltage fall at low gas pressure and low hold-off voltages, which indicate a time delay in plasma coupling by the drift region. This effect was not observed at higher voltages (≥15kV) and gas pressure (≥ 20Pa). The overall performance of the three-gap prototype PSS has been analyzed in terms of hold-off voltage, fall time, current rise time, peak current, delay time, jitter, and related parameters.

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