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2P54 - Polarity Effect of Repetitive Corona Stabilization Breakdown

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Gas-discharge closing switches have poor repetition performance, which is due to the gaseous insulation will decrease for a short time after the last breakdown , and therefore the gas switch will usually close at a much lower voltage than the initial breakdown voltage. The corona-stabilized switch is based on corona stabilization phenomenon that a space charge develops around the highly stressed electrode and prevents premature breakdown to take place. This means the switch can readily operate with high repetition rates at high operating voltages.
Polarity effect in highly non-uniform electric field is a well-documented discharge feature. The electrode arrangement of the corona-stabilized switch results in a typical highly non-uniform electric field. In this electrode gap, ionization always begins from the rod electrode. But the drifts of space charge under positive and negative impulses have significant difference, which leads to different corona stabilization effects. And the difference is supposed to have a noticeable impact on corona stabilization breakdown. In this paper, polarity effect of repetitive corona stabilization breakdown is investigated. Double-pulse method is employed to investigate the insulation recovery rate between single rod and plane electrode. Recovery rate curves for hold-off voltage are obtained under both positive and negative pulses. Indexes for Repetition performance of corona stabilization breakdown, such as divergence of breakdown voltage, failure rate and cumulative effect, under different external impulse polarity are also investigated by a repetition rate pulse generator. Kinematic law of space charge in corona stabilization breakdown process is studied. The physical model of corona stabilization breakdown in gas switch is established under both positive and negative pulses.

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