

Further statistical studies of ionization growth and breakdown formation mechanisms in the final breakdown phase of a transient hollow cathode discharge

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Abstract:

A transient hollow cathode discharge (THCD) is a high-voltage low-pressure discharge, which is characterized by an axial hollow in the cathode electrode. The temporal sequence of the different parts of ionization growth in breakdown formation, which take place just before electric breakdown, are statistically studied. The von Lane formalism has been used to characterize in detail the statistical time distribution of the different processes required for electric breakdown to occur. The experiments have been performed in Hydrogen at pressure between 13.3 and 53.2 Pa, with different sizes of the cathode aperture. It has been found that the different processes of ionization growth and breakdown formation mechanisms involved in the sequence leading to breakdown are not associated with a single characteristic time. Time-shifted Gaussian distribution functions have been identified which, when added together, reproduce the cumulative time distribution for each observed event, especially at low pressure and smaller cathode aperture, where the hollow cathode effect is less effective.