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About positive streamer corona inception near a curved electrode

SERGEY PANCHESHNYI, LAPLACE-CNRS — Inception of first discharge is often a key question for pulsed discharge applications rapidly developing last time. Fine control of a short (for example, nanosecond) discharge requires detailed understanding of inception phenomena. It is known that ignition voltage of a DC or low-frequency AC corona in air is well described by Peek's law that assumes single-avalanche triggering. This inception voltage doesn't depend on polarity and secondary emission processes. In contrast, pulsed corona inception conditions differ significantly for both polarities that means a completely different mechanism of inception. In this case, a multi avalanche mechanism is typically responsible for streamer inception. In the present paper, a detailed model of first positive corona inception near a curved electrode is presented. Collisional detachment of electrons from negative ions in electric field, avalanche development and drift of ions of both polarities are the main processes taken into consideration. The entire frequency range (from DC to sub-nanosecond voltage pulses) is analyzed and compared with available experimental results. Inception probability as a function of voltage amplitude and voltage duration is calculated for various levels of background negative ion densities. The presented results were obtained in simple rod-plain gas discharge geometry but this model is applicable for other geometries as well.

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