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Capacitor barrier discharges in air at atmospheric pressure

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Atmospheric plasma sources are attractive because of their advantages such as low cost, simplicity, ease of operation, etc. At atmospheric pressure, plasma discharge is an avalanche breakdown that, without quenching, easily develops into electric arc. In order to produce stable plasma at high pressure, the discharge current must be limited properly. Most of the plasmas used in industrial applications are realized by means of dielectric barrier discharges (DBDs) under ac voltages. In DBDs, at least one side of the discharge gap is insulated from the electrodes by a dielectric layer.Discharge is triggered when the electric field in the gap reaches the threshold value. Chargesgeneratedare deposited onto the dielectrics. The trapped charges induce an internal electric field which extinguishes the discharge in the very half cycle and facilitates the discharge in the following half cycle.
Charge trapping and de-trapping of dielectrics are quite complex processes that are strongly dependent on the materials and their history. Consequently, the behavior of DBD plasmas is often complicated due to the charging of dielectrics.One way around the complication is an arrangement with the dielectrics outside of the discharge gap. Here, this is achieved by connecting a capacitor in series to the discharge gap which consists of two parallel common plate electrodes. Charges generated during the discharge cannot flow through the capacitor. Rather, they accumulate on it. The voltageacross the gap is compensated, as the capacitor is charged up, and the discharge extinguishes when the voltage drop fallsbelowthe threshold.i.e., the capacitor quenches the discharge in asimilar wayas the barrier dielectricsin DBDs- Thus, direct exposure of the dielectrics to the plasma is avoided. In this contribution, the discharge mechanism of such capacitor barrier discharges (CBDs) and the influence of circuit parameters on their discharge behavior are studied.

Keywords
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