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Experimental and modeling results on the axial and radial breakdown dynamics in dielectric barrier discharges HANS HÖFT, MARKUS M. BECKER, DETLEF LOFFHAGEN, MANFRED KETTLITZ, INP Greifswald, Felix-Hausdorff-Str. 2, 17489 Greifswald, Germany — The breakdown of dielectric barrier discharges (DBDs) was investigated with respect to its axial and radial development. For this purpose, a pulsed-driven, single-filament DBD at atmospheric pressure (0.1 vol% O_2 in N_2) with 1 mm gap was used. The experimental diagnostics consisted of an iCCD and a streak camera system (50 ps temporal and 10 μs spatial resolution) combined with fast electrical probes. Additionally, time-dependent, spatially 2D fluid model calculations were performed. A correlation of the axial (cathode-directed) streamer propagation and the streamer diameter was found, i.e. this diameter increases with the axial propagation velocities. Furthermore, the radial expansion velocities ($\sim 10^5$ m/s) during the streamer breakdown phase also increase with the axial propagation velocities ($\sim 10^6$ m/s). The analysis of the radial dynamics allows the separation of the streamer propagation and the transient glow phase during the channel formation, i.e. the discharge channel widens, when the cathode-directed streamer hits the cathode surface. By means of synchronized measurements of the electrical current and the emission intensity, the temporally resolved current density could be determined in reasonable agreement with the modelling results.

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