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3D Kinetic Modeling and Quantification of Cathode Directed Streamer Evolution in an Azimuthally Swept Pin-to-Plane Wedge Geometry.[1] ASHISH JINDAL, CHRIS MOORE, ANDREW FIERRO, MATTHEW HOPKINS, Sandia National Laboratories — Positive streamer evolution in 600 Torr air is modeled in pin-to-plane wedge geometries using a 3D kinetic particle-in-cell (PIC) code that simulates particle-particle collisions via the direct simulation Monte Carlo (DSMC) method. 3D wedges of 5, 15, 30, and 45 degrees are used to keep the problem space tractable. 6kV DC is applied to a 100 μm hemispherical anode seeded with a 1 eV-10^{18} m^{-3} spherical plasma of 100 μm radius at its tip, generating a 4 MV/m overvolted field across a 1.5 mm gap terminated by a planar grounded cathode. The air chemistry model includes Townsend breakdown (electron-neutral elastic, excitation, ionization, attachment, and detachment collisions and secondary electron emission) and streamer (photoionization and ion-neutral collisions) mechanisms via tracking excited state neutrals that can either quench via collisions or spontaneously emit a photon based on specific Einstein-A coefficients. Electrons are tracked with picosecond temporal resolution, spatially binned, and averaged over 6 randomly seeded simulations. Streamer dynamics are quantified for each wedge angle in terms of electron velocity and density. Results indicate solution convergence in terms of these parameters is achievable.

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