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Electrosprays: cone-jet breakup in the presence of DC electric fields[1] OMAR MATAR, DEVIN CONROY, RICHARD CRASTER, DEMETRIOS PAPAGEORGIOU, Imperial College London, HSUEH-CHIA CHANG, Notre Dame University — The breakup of an electrified jet in a gas with an axially applied electric field is investigated theoretically. The jet fluid is taken to be a symmetric electrolyte and modelling of the cationic and anionic species is carried out by considering the Nernst-Planck equations in order to find the volume charge density that influences the electric field in the jet. At high flow rates, the governing equations are investigated asymptotically in the long-wave limit and the one-dimensional model is solved numerically for a wide range of hydrodynamic, electrostatic, and electrokinetic parameters. For low flow rates, a boundary integral method is used to solve for the electrostatic potential surrounding the interface, which assumes a cone-like shape from which a thin jet emanates. In both cases, the electric field causes the jet to stretch and thin to a point where ion repulsion forces the jet to undergo Rayleigh fission. We measure the axial distance at which this point occurs by comparing the jet radius to the distance at which ion repulsion is important.

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