Abstract Submitted
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A numerical study on charging mechanism in leaky dielectric liquids inside the electrostatic atomizers[1] BABAK KASHIR[2], ANTHONY PERRI[3], ALEXANDER L. YARIN[4], FARZAD MASHAYEK[5], University of Illinois at Chicago — The charging of leaky dielectric liquids inside an electrostatic atomizer is studied numerically by developed codes based on OpenFOAM platform. Faradaic reactions are taken into account as the electrification mechanism. The impact of ionic finite size (steric terms) in high voltages is also investigated. The fundamental electrohydrodynamic understanding of the charging mechanism is aimed in the present work where the creation of polarized near-electrode layer and the movement of charges due to hydrodynamic flow are studied in conjunction with the solution of the Navier-Stokes equations. The case of a micro channel electrohydrodynamic flow subjected to two electrodes of the opposite polarity is considered as an example, with the goal to predict the resulting net charge at the exit. Even though the electrodes constitute a small portion of the channel wall, otherwise insulated, it is indicated that the channel length plays a dominant role in the discharging net charge. The ionic fluxes at the electrode surfaces are accounted through the Frumkin-Butler-Volmer relation found from the concurrent in-house experimental investigations.

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