Abstract Submitted
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On The Relationship Between Internal Flow and Jet Dynamics in a Charge Injection Atomizer[1] WILLIAM DOAK, PAUL CHIAROT, State University of New York at Binghamton, MICROFLUIDICS AND MULTIPHASE FLOW LABORATORY TEAM — Atomization of a dielectric micro-jet is achieved using an electrohydrodynamic (EHD) charge injection process. The atomizer is comprised of a grounded nozzle plate and an internal high voltage probe, with electric potentials up to 20 kV, concentric with the emitting orifice. Dielectric fluid flows through the cavity between the electrodes, impeding electron transport from the probe to ground and imparting charge to the fluid. When the jet is uncharged, it breaks up via an axisymmetric (Rayleigh-Plateau) instability. Once charged, a non-axisymmetric (bending) instability, in addition to the axisymmetric instability, is observed in the jet. Both instabilities modes grow with increasing jet charge density: the intact jet length shortens and the bending amplitude increases. We have found that changes in the jet instability modes are related to the EHD flow induced inside the nozzle. A transparent nozzle was built and the flow was seeded with micro-spheres to study this phenomenon. High speed microcopy and digital image correlation was used to measure the EHD flow at different jet stability conditions. We found that transitions in the internal flow are associated with changes in the jet stability regimes.

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