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Interface-tracking electro-hydrodynamic model for droplet coalescence LINDSAY CROWL ERICKSON, DAVID NOBLE, Sandia National Laboratories — Many fluid-based technologies rely on electrical fields to control the motion of droplets, e.g. micro-fluidic devices for high-speed droplet sorting, solution separation for chemical detectors, and purification of biodiesel fuel. Precise control over droplets is crucial to these applications. However, electric fields can induce complex and unpredictable fluid dynamics. Recent experiments (Ristenpart et al. 2009) have demonstrated that oppositely charged droplets bounce rather than coalesce in the presence of strong electric fields. Analytic hydrodynamic approximations for interfaces become invalid near coalescence, and therefore detailed numerical simulations are necessary. We present a conformal decomposition finite element (CDFEM) interface-tracking method for two-phase flow to demonstrate electro-coalescence. CDFEM is a sharp interface method that decomposes elements along fluid-fluid boundaries and uses a level set function to represent the interface. The electro-hydrodynamic equations solved allow for convection of charge and charge accumulation at the interface, both of which may be important factors for the pinch-off dynamics in this parameter regime.

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