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Vortex-driven charge transfer between partially coalescing droplets WILLIAM RISTENPART, J.C. CREASEY, B.S. HAMLIN, University of California at Davis — Oppositely charged drops fail to coalesce above a critical field strength, despite the attractive force between the opposite charges. Here we report the existence of a critical ionic conductivity below which oppositely charged drops only partially coalesce. The degree of coalescence of water drops in oil can be tuned from complete coalescence at low field strengths to complete non-coalescence at high field strengths, thus providing external control over the size of the resulting daughter droplet. Strikingly, in this regime the size and charge of the daughter droplet are both independent of the conductivity. We present evidence suggesting the charge transfer is instead dominated by convection associated with the capillary-driven penetration of a vortex into the larger drop, and we demonstrate that the size of the daughter droplet is consistent with a scaling model based on a balance between capillary-driven inertia and electrostatic repulsion.

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