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Multi - directional Electrophoretic Positioning of Charged Drops B.S. HAMLIN, I.K. EMERSON, J.W. GAGE, W.D. RISTENPART, Univ. Calif. at Davis — We demonstrate a multi-directional electrophoretic technique to provide precise control over the position, trajectory and velocity of a charged object. Two or more pairs of electrodes, oriented along different directions, are periodically activated and deactivated to move the charged object along a desired trajectory. Two perpendicular sets of electrodes, for example, can induce the charged object to take a series of sudden 90° turns. We derive scaling expressions for the rates of acceleration and deceleration as the electric field direction is switched, and we corroborate the expressions experimentally for water droplets in oil. Surprisingly, we observe that the electrode geometry significantly alters the trajectory of charged drops, even in the absence of an applied electric field. The results have broad implications for any system that requires dynamic three-dimensional positioning, including lab-on-a-chip devices and electrophoretic displays.

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