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Dynamic behaviors of oppositely charged emulsion droplets ZHOU LIU, The University of Hong Kong, HANS M. WYSS, Eindhoven University of Technology, ALBERTO FERNANDEZ-NIEVES, Georgia Institute of Technology, HO CHEUNG SHUM, The University of Hong Kong — In this work, we investigate the dynamic behaviors of two oppositely charged emulsion droplets. Using an electrocapillary number and separation distance between droplets, we have characterized three types of droplet behaviors in electric field. Besides the common seen coalescence, two qualitatively different dynamic behaviors are identified: fuse-and-split and periodic non-coalescence. In fuse-and-split regime, the droplets fuse into a jet, which subsequently breaks up into two droplets. In periodic non-coalescence regime, the droplets contact and bounce away periodically without coalescence. Further analysis indicates that the applied voltage always decreases dramatically upon droplets' contact due to spikes of discharging current. Thus, the electric field strength drops and surface tension quickly dominates over electric stress upon droplet's contact. By analyzing capillary instability, all the observed dynamic states can be attributed to the different initial shapes of dumbbell-like jet formed upon droplets' contact. By controlling the initial separation distance between droplets, the shapes of the jet and thus the resultant dynamics can be precisely manipulated.

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