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Interaction of droplets in recirculation regions within microfluidic systems NASTARAN GHAZI, Columbia University, ASHKAN HOSSEINI, SHAHAB SHOJAEI-ZADEH, Rutgers, The State University of New Jersey — We investigate the interaction of oil droplets in continuous water phase as they travel across the streamlines of a recirculation region using microfluidic devices. Oil droplets are first generated using hydrodynamic focusing and then enter a recirculation region. The droplets then keep recirculating until they are pushed out by the incoming ones. We show that the frequency of droplet generation, viscosity contrast (oil to water), and geometry determine which droplets to stay in the recirculation region and which one to leave. Using flow field simulations, we investigate the migration of droplets and their trajectories based on the geometry of the recirculation region, the bubble size, and fluid properties. Under favorable conditions, when droplets interact within the recirculation region for long enough time, the film thickness that separates the two interfaces reduces and droplets will coalesce. The proposed design thus provides a suitable platform to study droplet coalescence within microfluidic devices.

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