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Synchronized Reinjection and Coalescence of Droplets in Microfluidics MANHEE LEE, Department of Physics, Harvard University, JESSE COLLINS, DONALD AUBRECHT, SHINHYUN KIM, TINA LIN, ASSAF ROTEM, School of Engineering and Applied Sciences, Harvard University, LAURA SOLOMON, College of Engineering, Temple University, DAVID WEITZ, School of Engineering and Applied Sciences, Harvard University, VINOTHAN MANOHARAN, Department of Physics & School of Engineering and Applied Sciences, Harvard University, DAVID A. WEITZ COLLABORATION — In droplet-based microfluidics, one of the essential techniques is controlled addition of desired materials into the droplets. This is best achieved through the coalescence of pairs of droplets, and therefore various methods of coalescence have been developed over the last decade. However, the coalescence of two different droplets made independently in different devices still remains a challenging problem, primarily because it is difficult to synchronize the reinjection of the different droplets before their coalescence. In addition, typical coalescers require some specific conditions such as uniform droplet-droplet distances and constant flow rate, which hinders the flexible use of coalescers in practical applications. Here we present a straightforward method for synchronizing reinjection of two kinds of droplets and coalescing them. We employ a home-made emulsion collector operated by hydrostatic pressure to reinject droplets into a device, where two kinds of droplets are driven into two opposing T-junction alternatively and then pairs of droplets are merged at the new coalescer proposed here. We use the technique to create droplets with a controlled number of colloidal particles inside, so that we can observe their self-assembly into a cluster.

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