

Interfacial controlled fusion of individual femtoliter droplets on demand

Disclosure Number

201002471

Technology Summary

This disclosure describes a passive method for on-demand control of femtoliter-volume droplet formation and fusion, based on interfacial-induced forces that act on droplets due to an abrupt change in channel height at water/oil channel junctions. We show that chemical reactions due to droplet fusion could be triggered at sub-millisecond time scales. Mixing triggered by a fusion event is more rapid than can be explained assuming only diffusive contributions, and must also include convection from inertial effects occurring during droplet collisions. We also demonstrate with this method a reversible chemical toggle switch based on alternating fusion of droplets containing acidic or basic solution, monitored with the pH-dependent emission of fluorescein. This lays the groundwork for exploring more complex chemical and biochemical reaction sequences triggered and monitored in real time in discrete ultrasmall water-in-oil droplet reactors.

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