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Enhancing Liquid Micro-volume Mixing with Wettability-Patterned Surfaces JARED MORRISSETTE, PALLAB SINHA MAHAPATRAA, University of Illinois at Chicago, RANJAN GANGULY, Jadavpur University, CONSTANTINE MEGARIDIS, University of Illinois at Chicago, UIC - MNFTL TEAM — Self-driven surface micromixers (SDSM) based on patterned wettability technology provide an elegant solution for low-cost point-of-care (POC) devices and lab-on-a-chip (LOC) applications. Our SDSMs are fabricated by strategically patterning three wettable wedge-shaped tracks onto a non-wettable surface. Current state-of-the-art micromixers require energy, however, our SDSMs utilize the inherent surface energy of liquids, coupled with wettability contrast to efficiently mix small amounts of liquids (e.g. droplets). Transport and mixing of the SDSMs is accomplished by means of Laplace pressure-driven flow and several mixing approaches, such as splitting-recombining, stretching-folding, and transversal vortices. Mixing is initiated when separate liquid micro-volumes are transported along respective, juxtaposed wettable tracks. As the liquid micro-volumes coalesce, subsequent mixing occurs during transport of the combined volume over a third separate wettable track that also features a non-wettable "island." The two-dimensional island disrupts the flow of liquids, in a similar manner a three-dimensional obstacle would, thus generating the aforementioned mixing enhancement. Several SDSMs, each having different island geometries, were investigated, giving rise to a greater understanding of efficient mixing on surfaces. The study offers a design basis for developing a low-cost surface microfluidic mixing device on various substrates.

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