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Pumpless Transport of Low Surface Tension Liquids in Surface Tension Confined (STC) Tracks CONSTANTINE MEGARIDIS, THOMAS SCHUTZIUS, MOHAMED ELSHARKAWY, University of Illinois at Chicago, MANISH TIWARI, Swiss Federal Institute of Technology, ETH-Zurich — Surfaces with patterned wettability have potential applications in microfluidics, fog capture, pool boiling, etc. With recent fabrication advancements, surfaces with adjacent superhydrophobic and superhydrophilic regions are feasible at a reasonable cost; with properly designed patterns, one can produce microfluidic paths (a.k.a. surface tension confined or STC tracks) where a liquid is confined and transported by surface tension alone. The surface tension of water is relatively high (72 mN/m), as compared with oils ($\sim$25 mN/m) and organic solvents ($\sim$20 mN/m). This makes the design of STC channels for oils and organic solvents far more difficult. In this study, open STC tracks for pumpless transport of low-surface tension liquids (acetone, ethanol, and hexadecane) on microfluidic chips are fabricated using a large-area, wet-processing technique. Wettable, wax-based, submillimeter-wide tracks are applied by a fountain-pen procedure on superoleophobic, fluoroacrylic carbon nanofiber (CNF) composite coatings. The fabricated anisotropic wetting patterns confine the low-surface tension liquids onto the flow tracks, driving them with meniscus velocities exceeding 3 cm/s. Scaling arguments and Washburn's equation provide estimates of the liquid velocities measured in these tracks, which also act as rails for directional sliding control of mm-sized water droplets. The present facile patterned wettability approach can be extended to deposit micrometer-wide tracks.

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