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# Water droplets on liquid crystal-infused porous surfaces

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The design of open surface microfluidics that enables orthogonal control of liquid mobility and chemical composition is crucial for devising the next generation of microfluidic platforms that will find use in applications across chemical, environmental, and biomedical fields. To achieve these functionalities, extensive studies have demonstrated stimuli-responsive liquid mobility on open platforms based on either micro/nanoscale topographical surfaces or water-immiscible liquid-coated surfaces. However, methods of manipulating droplets' chemical compositions tend to rely upon chemical adsorption directly from the underlying surface, which has been shown to subsequently pin droplets to the surface and render them immobile.

We report the design of a liquid crystal (LC)-based open surface microfluidic platform that enables the independent manipulation of the mobility and chemical compositions of droplets. Specifically, we use porous LC polymeric networks to stabilize thermotropic LC mesogens to overcome the issue of water-induced LC dewetting. We find that the mobility of water droplets on LC-based surfaces depends on the positional order of the LC. Moreover, we experimentally demonstrate that the mesogenic orientational order of the LC surface plays a pivotal role in the release of chemicals from the LC surface to droplets. Finally, we investigate the effect of water droplet impact behaviors (bouncing, spreading, retraction, wetting) on such surfaces. We primarily focus on the deposition regime where surface chemistry, roughness, and wettability of the LC mesophase play an important role in the early stage of the post-impact dynamics.

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