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Directional wicking on topographic micropatterns

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Directional spreading and wicking of liquid drops on topographic micropatterns are studied on regular arrays of triangular posts breaking the reflection symmetry of the lattice. To test for directional wicking on this class of patterns, we employ heptane drops forming a material contact angle of 50° on Teflon coated samples fabricated using standard photolithography processes. Depending on the density and aspect ratio of the triangular posts, we observe either selective wicking into certain directions, spherical-cap shaped drops with a mobile three-phase contact line, or the formation of drops with a circular or angular pinned three-phase contact line. Drops of the latter class eventually evolve into “sunny-side-up droplets”consisting of a liquid film extending to the initial footprint of the drop immediately after deposition and coexisting with a shrinking cap-shaped drop sitting on the film. The observed directional wicking phenomena can be explained in terms of capillary instabilities at the film edge that govern its mobility at different orientations relative to the micropattern.

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