Understanding the wetting of micro-textured surfaces can help give them new functionalities

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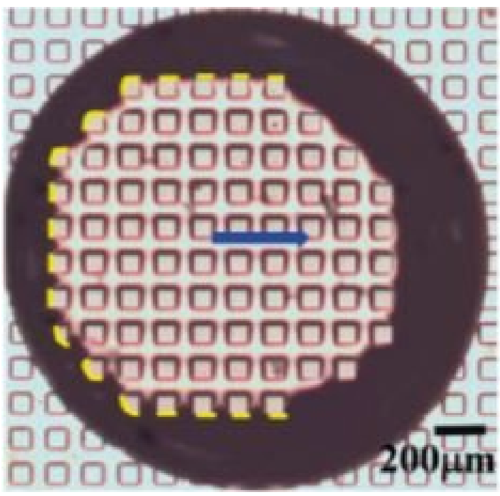

Snapshots of contact line configurations when water droplets slide on surfaces with micro-pillars. Credit: S. Qiao, Q. Li and X. Q. Feng (2018), Sliding friction and contact angle hysteresis of droplets on micro-hole-structured surfaces, *Eur. Phys. Jour. E* 41:25, DOI 10.1140/epje/i2018-11631-x

The wetting and adhesion characteristics of solid surfaces critically depend on their fine structures. However, until now, our understanding of exactly how the sliding behaviour of liquid droplets depends on surface microstructures has been limited. Now, physicists Shasha Qiao, Qunyang Li and Xi-Qiao Feng from Tsinghua University in Beijing, China have conducted experimental and theoretical studies on the friction of liquid droplets on micro-structured surfaces.

In a paper published in *EPJ E*, the authors found that under the same solid fraction, friction on surfaces with a structure made up of micro-holes is much higher than that on surfaces patterned with an array of pillars. Such micro-structured surfaces have helped design new surfaces that mimic surfaces found in nature, such as self-cleaning surfaces, reduced-drag surfaces, surfaces capable of transporting liquids in microfluidic systems, variants with anti-icing or heat transfer properties, and even surfaces that facilitate oil-water separation.

In this study, the authors focus on the sliding behaviour of a droplet on micro-hole-structured surfaces. Recently, the same group of physicists showed that the percentage of space occupied by solids for a unit-area surface can indeed significantly affect liquid droplets' sliding behaviour on surfaces with micro-pillar structures.

In this study, the authors demonstrate that the continuity of the surface micro-structures can also alter droplets' sliding behaviour considerably. They show that the sliding friction increased with increasing solid area fraction. This conclusion was experimentally validated by actively sliding a water droplet on solid surfaces with micro-holes and micro-pillars of various sizes while simultaneously measuring the resultant sliding friction forces.

The authors then explain the contrast in friction between micro-hole and micro-pillar surfaces qualitatively by developing an improved theoretical model, which extends the classic wetting mechanics model by considering a finite effective width of the solid-liquid-gas contact line.

More information: Shasha Qiao et al, Sliding friction and contact angle hysteresis of droplets on microhole-structured surfaces, *The European Physical Journal E* (2018). DOI: 10.1140/epje/i2018-11631-x

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