Drop Mobility on Microtextured Surfaces with Wettability Contrasts

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Abstract

Drop transport on solid surfaces has been a rising issue for the recent ten years due to its importance for the development of microfluidics, self-cleaning surfaces, better heat transfer surfaces e.g. dropwise condensation enhancement, to name a few. Although various techniques for drop manipulation based on chemical, thermal and electrical principles were reported, they might cause undesired problems in applications, such as chemical compatibility, temperature change, and electrical interference. In the present report, we demonstrate high drop mobility by applying wettability gradients/contrasts on superhydrophobic surfaces. Employing well-defined micro textured surfaces allow us to easily control and parameterise the wettability by changing their morphology and dimensions (Figure 1 (a), (b)). In our experiment, a millimetre-sized drop of pure water was gently placed, using a KRÜSS DSA100 (Figure 1 (c)), onto an interface of two surfaces with different textures, which result in wettability contrast. Right after the deposition, the drop quickly moved/ jumped toward the surface with lower hydrophobicity. A visual CCD camera and subsequent image analysis allowed to trace the motion of the drop (Figure 1 (d)). The mechanisms driving the drop motion have been discussed and modelled.

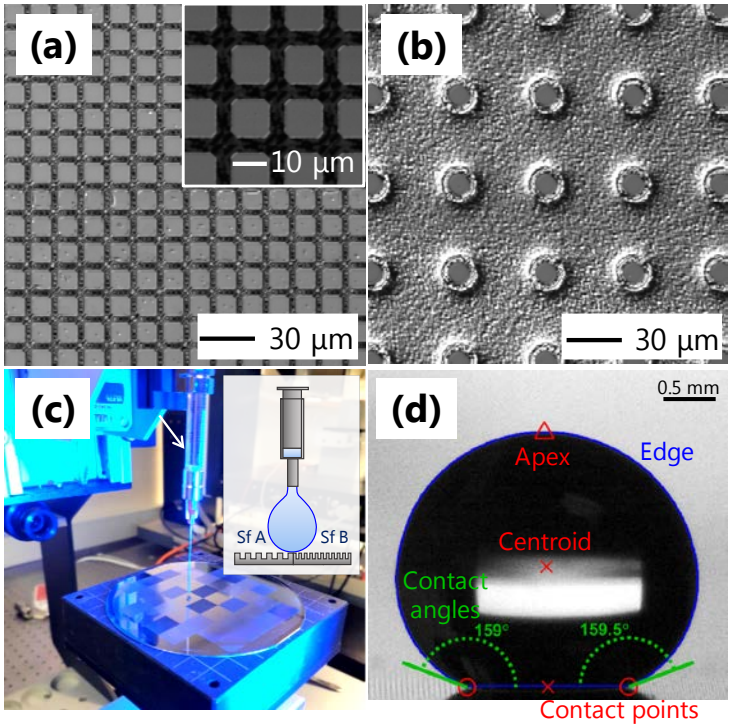

Figure 1 (a) and (b) Exemplary microscopic images of surfaces with square and circular pillars, respectively. (c) Picture of the drop dosing equipment (KRÜSS DSA100). (d) Image processing to extract position of drops and contact angles.