ADVANCED MATERIALS

Supportting information for the article:

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Complex droplets on chemically modified silicon nanograss

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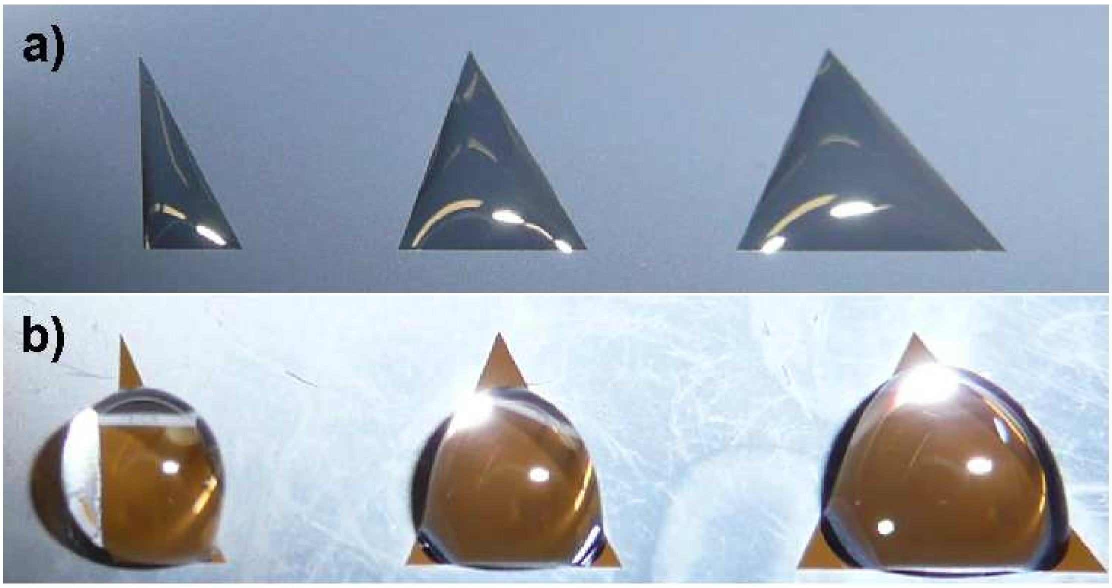
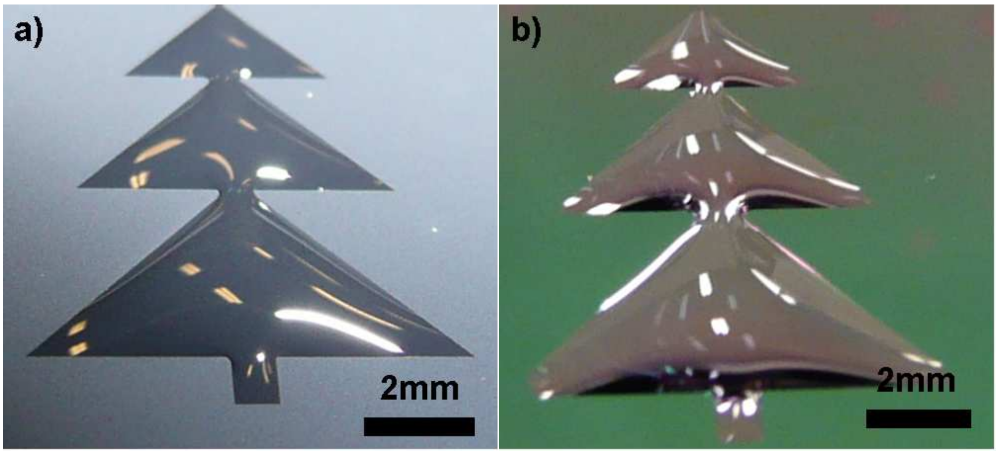
Supporting Figures

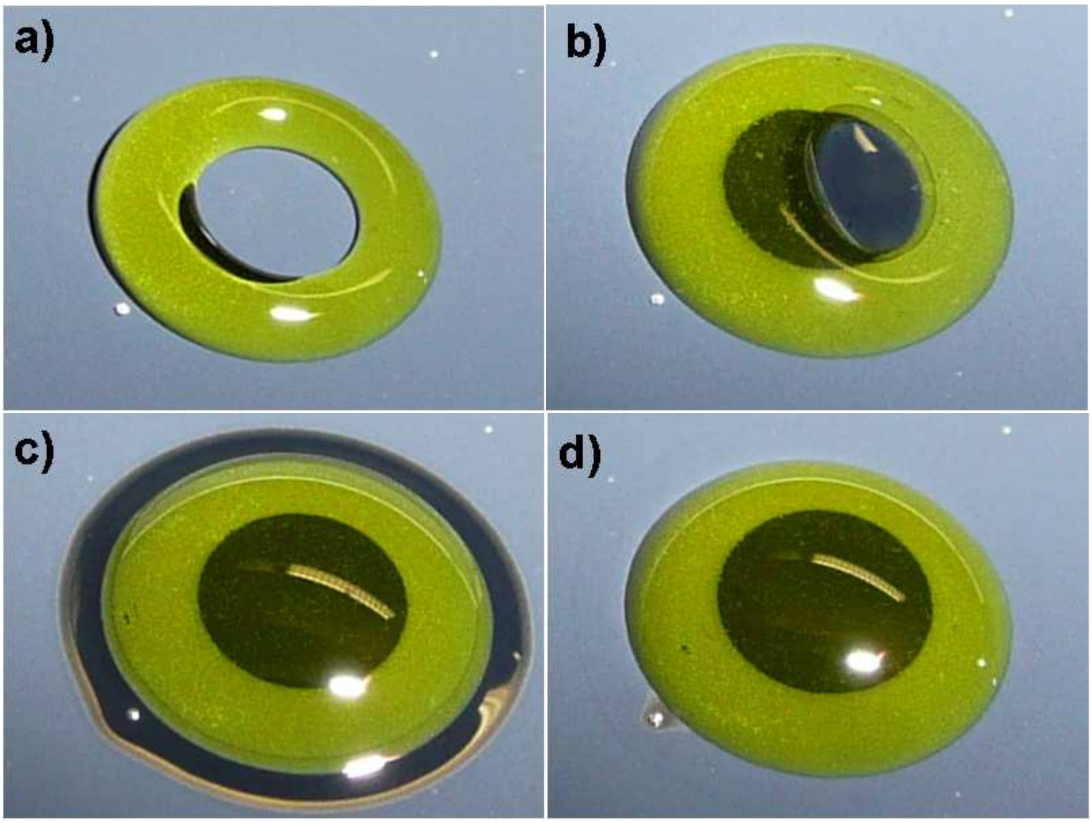


Supporting Figure 1. Two different surfaces were fabricated to demonstrate the importance of hydrophilicity of droplet areas. a) Triangle areas are completely wetting oxidized silicon nanograss ($\theta = 0°$) and surrounding areas ultrahydrophobic fluoropolymer coated silicon nanograss. b) Bare smooth silicon ($\theta \approx 60°$) triangles are surrounded by similar fluoropolymer coated silicon nanograss. If the areas where droplets are applied are not completely wetting, it is impossible to create complex droplet shapes.



Supporting Figure 2. Acute and obtuse angles in droplets on two different surfaces, showing the importance of hydrophobicity of the outlying areas. In both cases the droplet area is completely wetting and the volume of the liquid is 10µl. a) Ultrahydrophobic outlying areas allow for sharp obtuse angles. b) In this case the outlying areas are a planar layer of fluoropolymer (θ ≈ 105°) and the droplet areas are planar silica (θ ≈ 0°). The roundedness of obtuse angles can be clearly seen.

Supporting Figure 3. A cap morphology on a surface consisting of planar silica (θ ≈ 0°) and planar fluoropolymer (θ ≈ 105°) surfaces. No air bubble gets trapped inside the droplet.



Supporting Figure 4. Lens droplet composed of two different immiscible liquids. a) A dyed, ring shaped water droplet is created on chemically modified silicon nanograss. b) Cyclohexane droplet is pipetted inside the water ring, which constrains the non-polar cyclohexane to stay inside the water ring. Increasing the water volume forces the water droplet to bulge morphology. c) Further increase in water volume leads to formation of a lens. Some of the cyclohexane does not fit inside the lens as pushed outside, while the rest gets enclosed between the lens and the silicon surface. d) Cyclohexane evaporates rapidly when in contact with air, but the water lens protects the enclosed cyclohexane from evaporation.

Supporting video legends

Supporting video 1. Morphology evolution. The droplet is initially in a symmetrical ring morphology. At a certain volume, the droplet undergoes a transition to a morphology that contains a single bulge. Further increase in droplet size increases the size of the bulge until the droplet undergoes a second transition to a lens morphology.

Supporting video 2. Concentric splitter. Water is pipetted one microliter at a time to a circular source, which eventually causes the droplet to advance on the ultrahydrophobic barrier. When the liquid makes contact with a ring shaped target, the droplet splits into two separate droplets, of which one sits on top of the source and one on top of the target.

Supporting video 3. Concentric splitter 2. The surfaces in this video are ultrahydrophobic silicon nanograss and slightly hydrophilic planar silicon ($\theta \approx 60°$) and the geometry is the same as in supplementary video 2. Water is pipetted to the circular source, but when it reaches the target, the surface energy gradient is not sufficient to split the droplet.

Supporting video 4. Square splitter. Water is pipetted to a square shaped source. Once it reaches the square shaped target, it successfully splits into two droplets.

Supporting video 5. Wedge splitter. Water is pipetted to a circular source. Once it reaches a triangle shaped target, it splits. The bulk of the droplet also repositions itself on top of the broader part of the triangle, demonstrating the concept of transfer lines.