Slippery Liquid Infused Porous Surfaces: Fabrication, Characterisation and Applications

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Abstract: Evaporating droplets and accurate droplet control are both vital in applications such as heat and mass transfer, inkjet printing and microfluidics. Usually evaporation occurs as a random "stick-slip" motion or by holding a constant contact angle (CCA) at the surface. Stick-slip motion most commonly occurs on surfaces or coatings where macro/microscopic roughness creates droplet pinning, prohibiting smooth droplet mvement. Slippery Liquid Infused Porous Surfaces (SLIPS) provide the lowest hysteresis solution to droplet pinning. The ability to coat any surface, including topologically pattered surfaces, allows new insights into droplet dynamics during evaporation.

We produce a unique surface coating consisting of a flat, porous network of chemically hydrophobised nanoparticles. This surface provides the hydrophobicity needed to repel water and the structure required for oil to imbibe into the surface. The surfaces are characterised with three methods to ensure the surface exhibits the lowest sliding angles ($<1^\circ$) and contact angle hysteresis achievable. Here we present an experimental application of CCA and droplet control by applying the SLIPS coating to an egg box shaped macro topography. During evaporation the droplet undergoes a series of predictable and reproducible shape changes, bringing back droplet positioning control to a pinning free surface.