# Amphiphobic nanoimprinted surfaces showing reversible contact angle modification in electrowetting

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Numerous studies have demonstrated super-hydrophobic surfaces with water contact angles greater than 150° and low contact angle hysteresis[1,2]. However, engineered surfaces, that show low affinity with most of the low surface tension liquids like oils, are not easy to make unless re-entrant or overhang structures in addition to surface roughness and low surface energy materials are provided. A liquid cannot enter a pattern with an overhang structure because of the resisting capillary force at the solid/liquid interface near the structure. As a result, the liquid cannot touch the bottom of the pattern and a layer with trapped air is formed on the surface[3,4].

We report a novel fabrication method to realize overhanging structures by means of ultraviolet nanoimprint lithography (UV-NIL). Combining UV photolithography and a one-step electrodeposition process we produced our master molds containing Nickel mushroom-like structures (Fig. 1). Subsequently, a negative soft PDMS stamp was copied from the nickel master molds and successfully replicated in a hybrid resist material namely Ormocomp. Full characterization of our produced surfaces by means of water or oil contact angle and electrowetting measurements demonstrate the ability to generate surfaces with amphiphobic properties based on the overhanging nature of our produced structures. Our topographical morphology was sufficient to generate a super-hydrophobic state of water due to the fact that the overhang structures promoted air trapping creating a composite interface. Moreover, testing various low surface tension oils, we demonstrate that our engineered surfaces show enhanced repellency towards these liquids as well as small hysteresis angles. Interestingly enough our surfaces were tested in electrowetting experiments[5], demonstrating an increased range of reversibility in the contact angle modification. We systematically study the effect of various surface geometry parameters as well of the dielectric thickness on the reversibility range, suggesting rules for the design of surfaces with optimum electrowetting reversibility[6].

Acknowledgments: The ICN2 is funded by the CERCA programme / Generalitat de Catalunya. The ICN2 is supported by the Severo Ochoa programme of the Spanish Ministry of Economy, Industry and Competitiveness (MINECO, grant no. SEV-2013-0295) and the EU H2020 project NMBP-PILOT-2016-721062 (FLEXPOL).

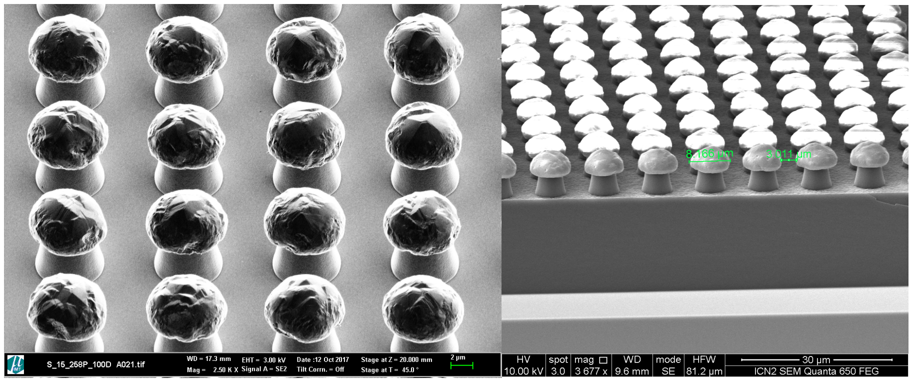


*Figure 1: (Left) Scanning electron microscope (SEM) image showing our Nickel master mold containing mushroom-like structures, (right) UVNIL replicated mushroom structures in Ormocomp material.*

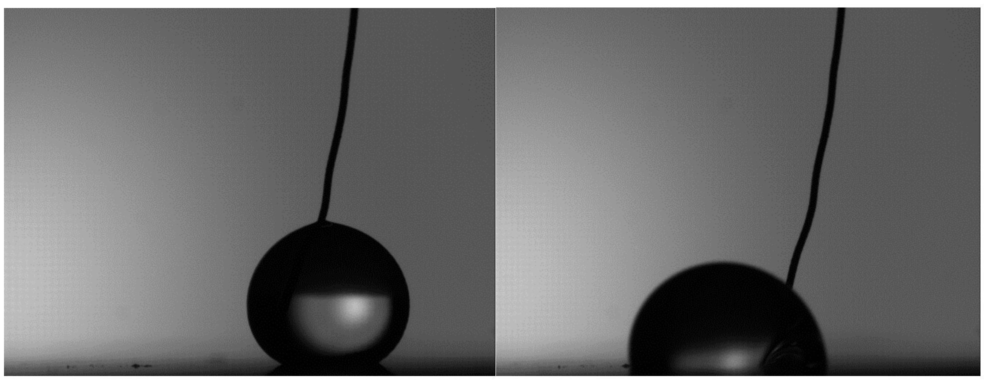

*Figure 2: Side view of a droplet in an electrowetting experiment: (a)Applied Voltage, V=0 Volt., (b) V= 503 Volt.*

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