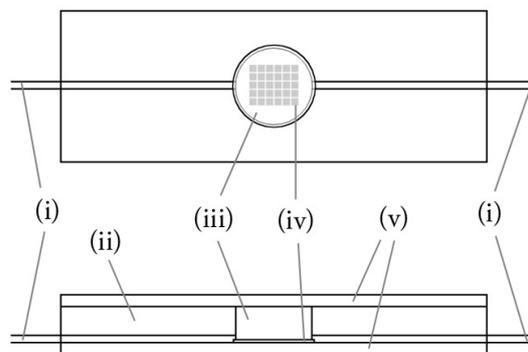


**Figure 1.** SEM micrograph of pillar structure in PE with the corner of the structured area visible. On hexagonal array samples, partial pillars were set into the edge of the area to avoid larger open areas where collapse might occur at a lower pressure.



**Figure 2.** Schematic top and side views of the measurement set-up. (i) Silicone tubing, (ii) PDMS, (iii) chamber, (iv) sample, (v) glass slides.

#### Supporting information for:

### Cassie-Wenzel and Wenzel-Cassie transitions on immersed superhydrophobic surfaces under hydrostatic pressure

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#### Sample preparation

A 10  $\mu\text{m}$  thick layer of AZ9260 (AZ Electronic Materials) photoresist was applied to a 6" silicon wafer by spincoating for 30 s at 2400 rpm. After baking it was exposed to UV light, at 12 mW/cm<sup>2</sup> for 27 s, using a chromium mask (with the desired pattern) in a mask aligner (Karl Süss MA6/BA6). The wafer was then developed for 9 minutes in 400K developer (AZ Electronic Materials) mixed 1:4 with water. A thin layer of nickel was sputtered onto the structured photoresist and a thicker nickel layer (~100  $\mu\text{m}$ ) was then deposited through electroplating. The nickel shim was peeled off from the silicon wafer and leftover photoresist was washed away with acetone. 30 nm of chromium and 100 nm of gold were sputtered onto the nickel master and the surface was treated in 1-octadecanethiol (Aldrich) in isopropanol. A thiol layer helps minimise stretching and breaking of the PE structures when separating the plastic film from the master after imprinting (due to lower adhesion between the thiol treated Ni-shim and the PE foil). A nanoimprint system (Obducat Eitre 6) was used for the imprinting, which was carried out with 0.2 mm thick PE film at 50 bar and 104° C for 90 s, release temperature was 70° C.

Fluoropolymer deposition was carried out in a Plasmatherm SLR ICP reactor with the following parameters: C4F8 flow 70 sccm; Ar flow 30 sccm; pressure 22 mTorr; ICP power 825 W; process time 30 s. The deposition rate was measured on silicon by stylus profilometer to 60 nm/min.

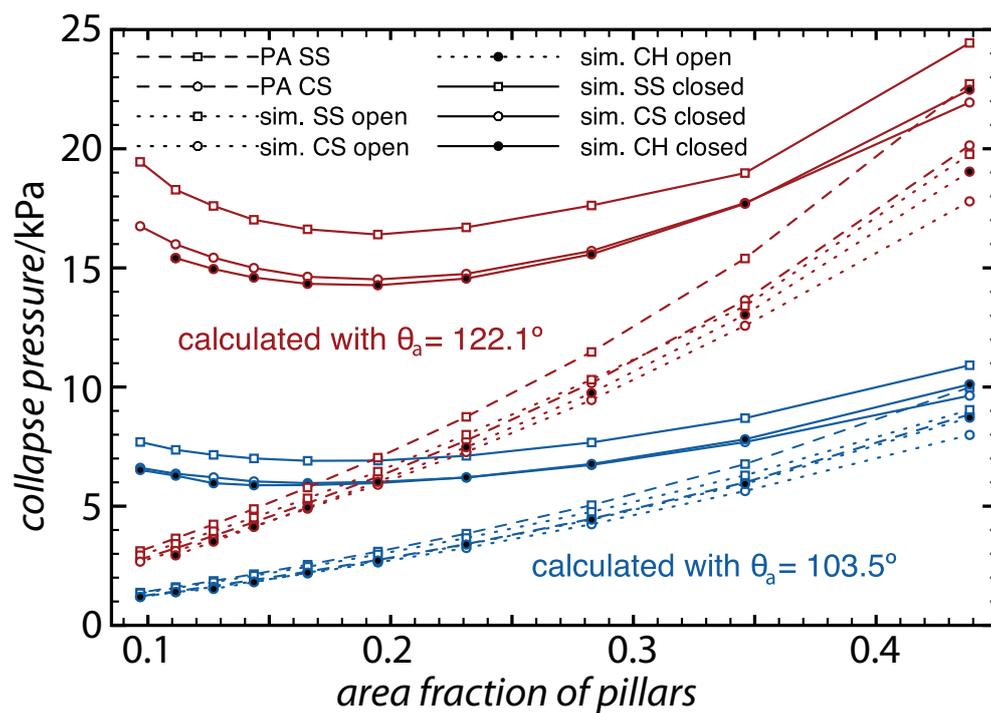
The various patterns were placed randomly in the array to avoid potential systematic errors due to placement relative to chamber walls and inlet and outlet. Several random configurations were used. Care was taken to ensure that the distance between

the pillars and the side wall of each structured area was never greater than the distance between pillars (fig. 1). Otherwise the collapse might occur at a lower pressure along the edge of the pattern.

Small pressure chambers (fig. 2) were constructed from polydimethylsiloxane (PDMS), glass slides and silicone tubing. Tubing with an inner diameter of 1 mm and outer diameter of 2 mm was placed along the bottom of a plastic box with a smooth bottom and PDMS (Wacker Elastosil RT 601, base and curing agent mixed 10:1) was poured over it to a depth of about 4 mm. The box was placed in a refrigerator for one hour to remove bubbles and then baked for one hour at 70° C. A 12 mm circular hole was cut out, across the tubing, and removed to form the chamber. The PE sample was cut into a circle, slightly larger than the chamber, with the structured part of the sample in the center. Both sides of the PDMS was oxidized under a corona discharge generator and a glass slide was clamped on each side with the sample inside the chamber and held against one of the slides by the PDMS (fig. 2). To complete the bonding the chamber with the sample inside was baked at 65° C for one hour.

#### Reversibility of the Cassie-Wenzel transition

In the movie file *reversible\_wetting.avi* it can be clearly seen that the Cassie state can be recovered after collapse on some surfaces by lowering the water pressure. In it the pressure is repeatedly raised and lowered. Of the six differently structured areas seen, the upper left and lower left show a full recovery of the Cassie state. On the lower right a small partial recovery can be seen. The other three (less densely pillared) areas only show a bubble forming and disappearing on top of the pillars.



**Figure 3.** Results of the analytical model and simulation for all three surface geometries in the experimental study.