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Fabrication of a Waterborne Durable Superhydrophobic  
Material Functioning in Air and under Oil

*Avijit Baidya, Sarit Kumar Das, Robin H. A. Ras, and  
Thalappil Pradeep\**

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## Supporting Information

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*Avijit Baidya,<sup>a,b,c</sup> Sarit Kumar Das,<sup>c</sup> Robin H. A. Ras,<sup>b,d</sup> and Thalappil Pradeep<sup>\*a</sup>*

<sup>a</sup>DST Unit of Nanoscience, Thematic Unit of Excellence, Department of Chemistry, Indian Institute of Technology Madras, Chennai, India

<sup>b</sup>Department of Applied Physics, Aalto University School of Science, Puumiehenkuja 2, 02150 Espoo, Finland

<sup>c</sup>Department of Mechanical Engineering, Indian Institute of Technology Madras, Chennai 600036, India

<sup>d</sup>Department of Bioproducts and Biosystems, Aalto University School of Chemical Engineering, Kemistintie 1, 02150 Espoo, Finland

E-mail: [pradeep@iitm.ac.in](mailto:pradeep@iitm.ac.in)

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### Instrumentation

AFM imaging was done with Witec alpha300 S confocal Raman spectrometer with an AFM attachment (Zeiss 20x objective). AFM imaging was carried out in non-contact mode with a cantilever with the following parameters: thickness 4  $\mu\text{m}$ , length 125  $\mu\text{m}$ , width 30  $\mu\text{m}$ , resonance frequency 320 kHz and force constant 42 N/m.

Electron microscopy imaging was done using a FEI Quanta 200 environmental scanning electron microscope (ESEM) with EDAX EDS system, to study the surface morphology of the coated substrate in different magnifications.

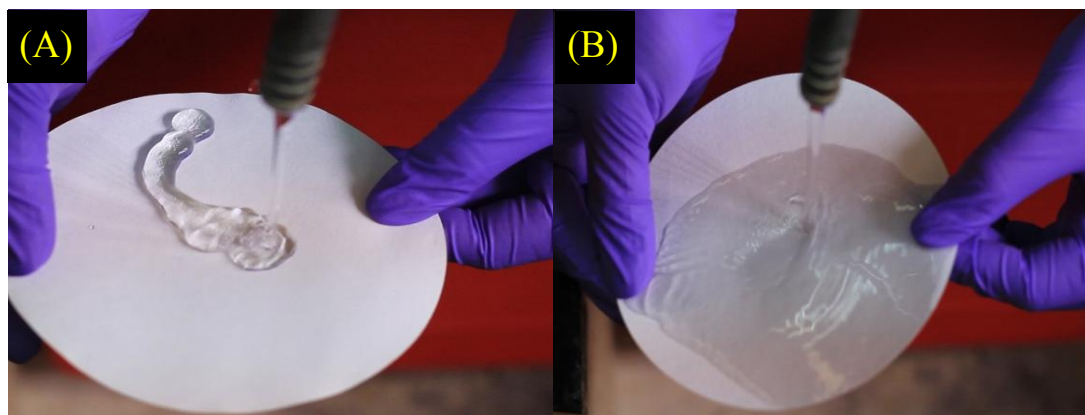
IR spectrum was collected using a PerkinElmer SpectrumOne FT-IR spectrometer.

X-Ray photoelectron spectroscopy (XPS) measurements were carried out using an Omicron ESCA Probe spectrometer with polychromatic Mg K $\alpha$  X-rays (1253.6 eV). The X-ray power applied was 300 W. The pass energy was 50 eV for survey scans and 20 eV for specific regions. Sample solution was spotted on stainless steel (SS) XPS sample plates and dried in vacuum. The base pressure of the instrument was  $5.0 \times 10^{-10}$  mbar. The binding energy was calibrated with respect to adventitious C1s feature at 285 eV.

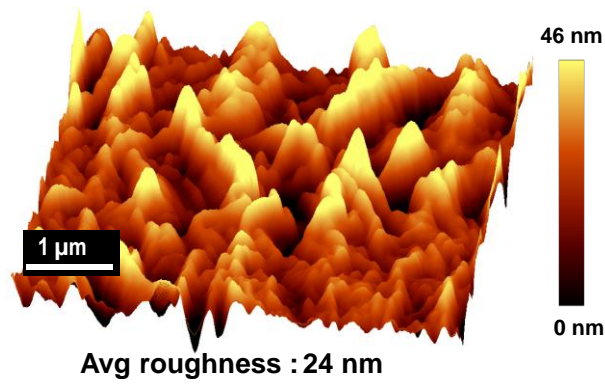
Contact angle and contact angle hysteresis (CAH) of water droplet on the different coated substrates were measured using a Holmarc contact angle meter.

Nikon D5100 camera was used to capture all the pictures and videos.

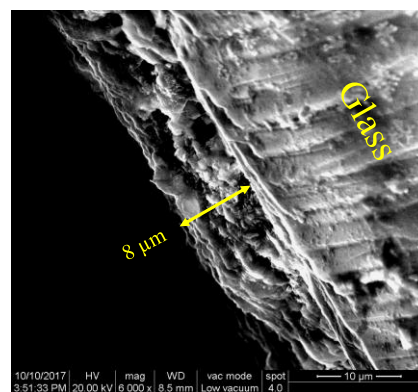
Spray of the water dispersed material was performed with Badger Air-Brush Co 360-9, Universal Airbrush.



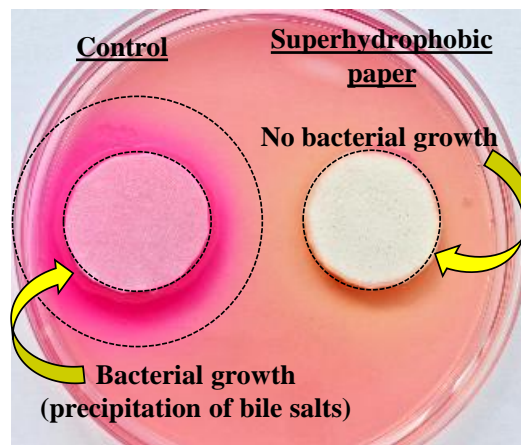
**Figure S1.** Water flows on A) superhydrophobic material coated filter paper (Lotus leaf effect) and B) normal filter paper. Water moves in a frictionless fashion on the coated surface whereas it wets the normal filter paper.



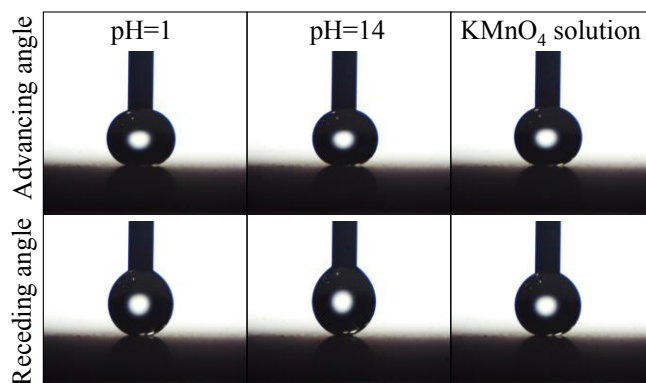
**Figure S2.** AFM image of unmodified clay, spray coated on glass substrate.



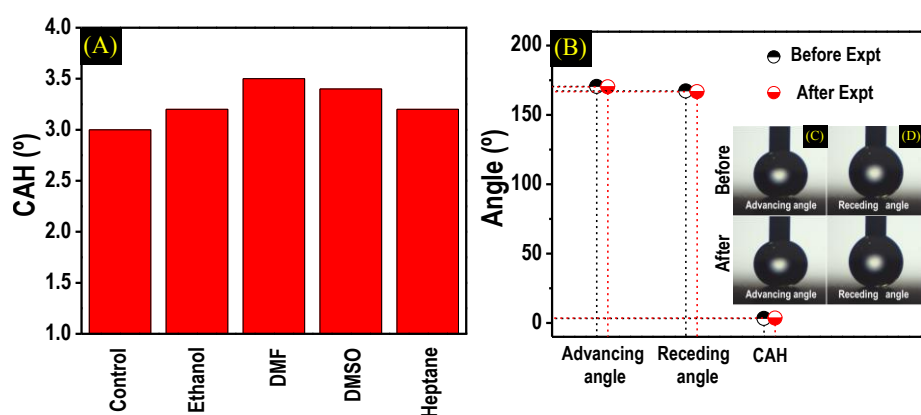
**Figure S3.** Cross-sectional SEM image. Thickness of the coating is shown.



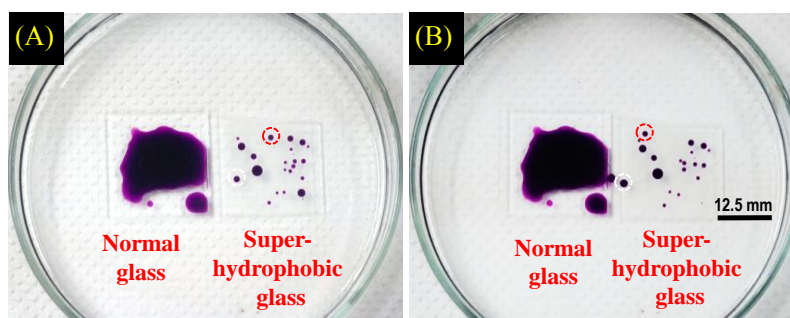
**Figure S4.** Demonstration of bacterial resistance property of superhydrophobic paper. This was compared with uncoated paper.



**Figure S5.** A) Contact angle hysteresis (CAH) of water droplets (pH=1, 14 and  $\text{KMnO}_4$  solution) over the coated glass substrates.

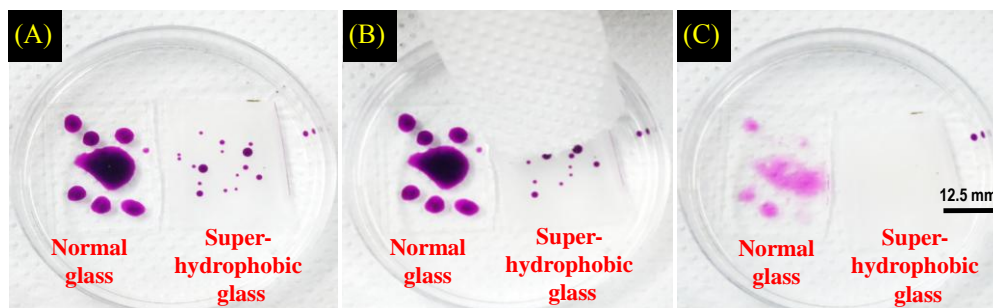


**Figure S6.** A) Contact angle hysteresis (CAH) values of water droplet over 170 h chemically (different organic solvent) treated surface. B) Graphical and pictorial representations of advancing angle, receding angle and CAH of water droplet over 170 h tetrahydrofuran (THF) treated surface (before and after). Images of C) advancing angle and D) receding angle (before and after). Experiments were done in air-water-solid interface.

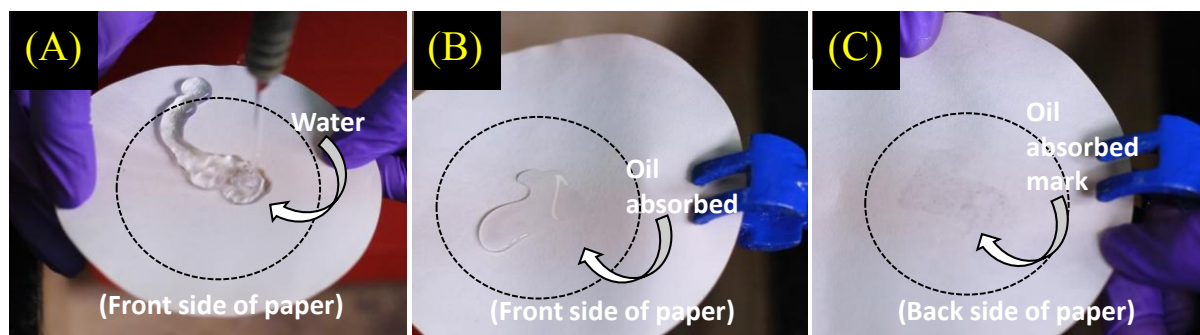


**Figure S7.** Mobility of water droplets on oil immersed coated surface upon mild shaking with hand. Droplets were kept inside oil on the surface for an hour before the experiment.  $\text{KMnO}_4$

solution was used here for the visual effect. Colored water droplet moved by vibration with hand (initial (A) and final (B) positions are marked for two individual droplets with red and white circles, respectively).



**Figure S8.** Cleaning of water droplets from oil immersed coated surface; normal glass as a reference.  $\text{KMnO}_4$  solution was used here for the visual effect. Colored water droplets were wiped off completely from the superhydrophobic surface with tissue paper. A) Before wiping, initial condition, B) during wiping and C) after wiping, final condition.



**Figure S9.** Demonstration of the superhydrophobic but oleophilic nature of flexible waterproof paper. (A) Unstable water drops on coated filter paper (lotus effect). (B-C) Paraffin oil on coated filter paper, part of which is absorbed by the paper (front side, B) and back side (C) of the same filter paper (with absorbed oil).

Videos are presented separately.