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Supporting Information

3D Printing of Mechanically Durable SuperhydrophobicPorous Membrane for Oil-Water Separation

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Preparation of superhydrophobic mesh. PDMS (part A), curing agent (part B), and inhibitor (3-Butyn-1-ol) were pre-mixed at a mass ratio of 10: 1: 0.1 and subsequently were diluted by cyclohexane to form a homogenous solution. After that, silica nanoparticles were dispersed into the resultant solution by a mechanical agitation of 900 rpm for 4 h and formed a homogeneous suspension. The total mass loading of PDMS and silica in the composite suspension vary from 5.7 wt% to 8.7 wt%. The mass ratios of PDMS/silica were adjusted to optimize the superhydrophobic properties of the composite coating. Then, the composite suspension was sprayed onto a clean steel mesh

(0.45 mm in pore size) using airbrush equipment at a nitrogen pressure of around 0.25 MPa. The solvent quickly evaporated during the flight of spraying droplets toward the mesh substrate. The thickness of the composite coating is controlled by adjusting spraying time (the optimized thickness is about 8-10 μm). Finally, the PDMS/silica composite coated mesh was heated at 120 ^{o}C for 1 hour to trigger the cross-linking reaction of PDMS/silica composite coating on the mesh.

Intrusion pressure tests. In the experiment, the printed membrane was fixed between two cylindrical plastic tubes with a diameter of 15 mm. The water was poured into the upper tube and then the maximum height of water that the membranes can support was recorded. The intrusion pressure of water can be calculated by following equation

$$P = \rho\ g\ h_{max}$$

Here, ρ is the density of water, g is the acceleration of gravity, and h_{max} is the maximum height of water that the membrane can support.

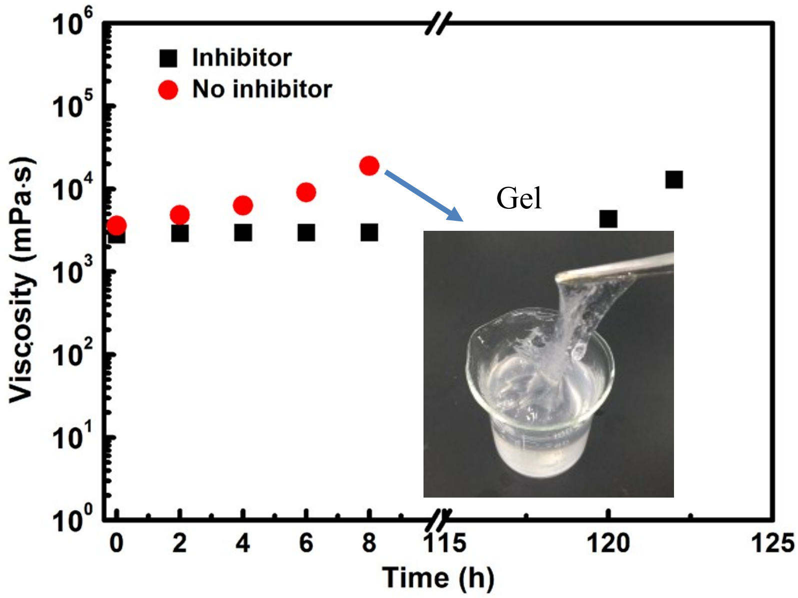

Fig. S1 Viscosities of PDMS inks with and without inhibitor as a function of storage time at room temperature.

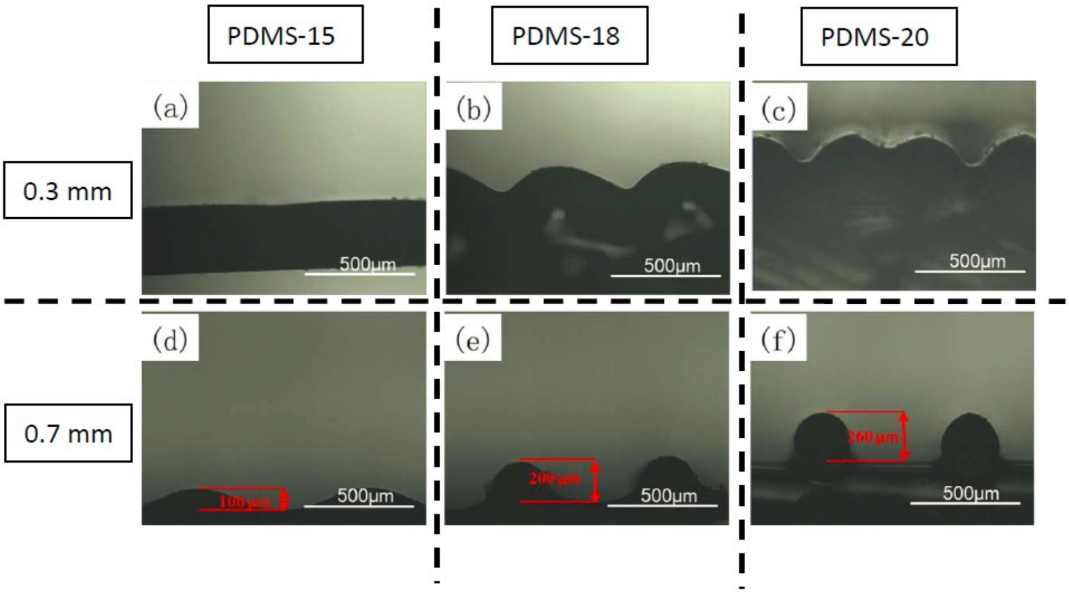

Fig. S2 Optical cross-sectional images of (a, d) PDMS-15, (b, e) PDMS-18, (c,f) PDMS-20 membranes when the filament spacings are set to 0.3 and 0.7 mm, respectively.

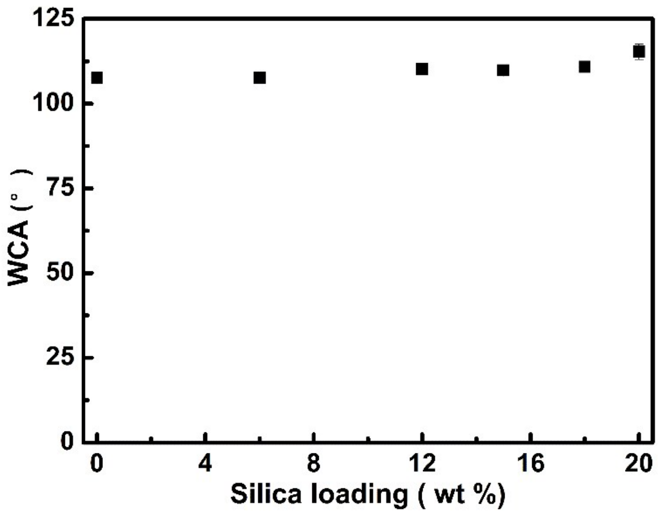

Fig. S3 WCAs of the cured PDMS inks (films) with different silica loadings. The inks with various silica loadings (0, 6, 12, 15, 18, and 20 wt%) were casted into flat films followed by thermal curing. Then, the WCAs of the flat films with various silica loadings were measured by a WCA goniometer.

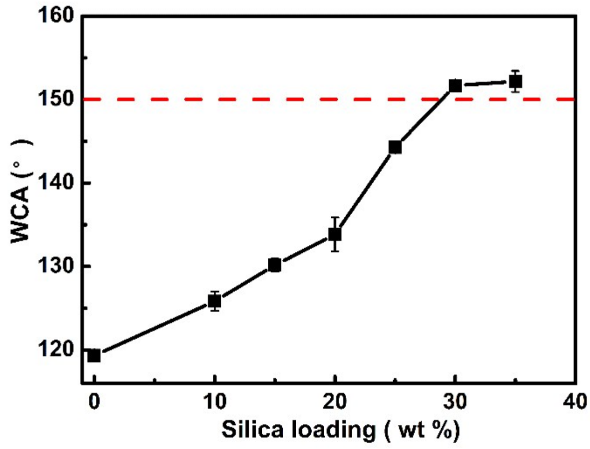

Fig. S4 WCAs of PDMS/silica composite coating on mesh as a function of silica loading.

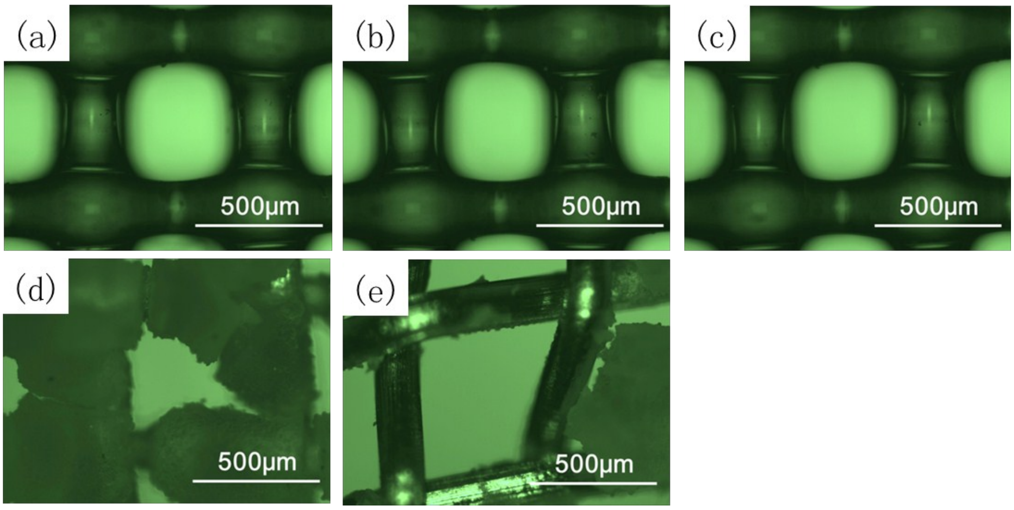

Fig. S5 Optical images showing the morphology changes of both printed membranes and mesh with superhydrophobic coating after mechanical damages. Printed membranes before (a) and after 1000-cycle bending (b) and 1000-cycle stretching (c) treatments. Meshes with superhydrophobic coating before (d) and (e) after 5-cycle bending treatment. After bending, irreversible deformation occurs in steel mesh accompanying the exfoliation of superhydrophobic coating.

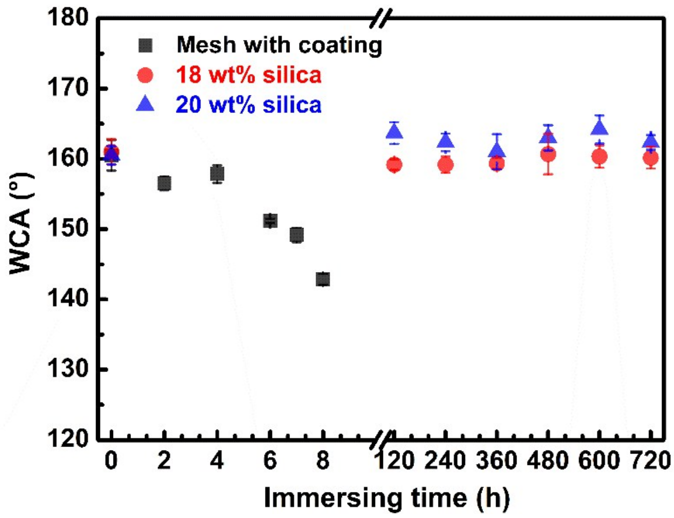

Fig. S6 WCAs of both the printed superhydrophobic membranes (filled with 18 and 20 wt% silica, respectively) and the superhydrophobic coating coated mesh after immersing in water (pH=7) with different time.

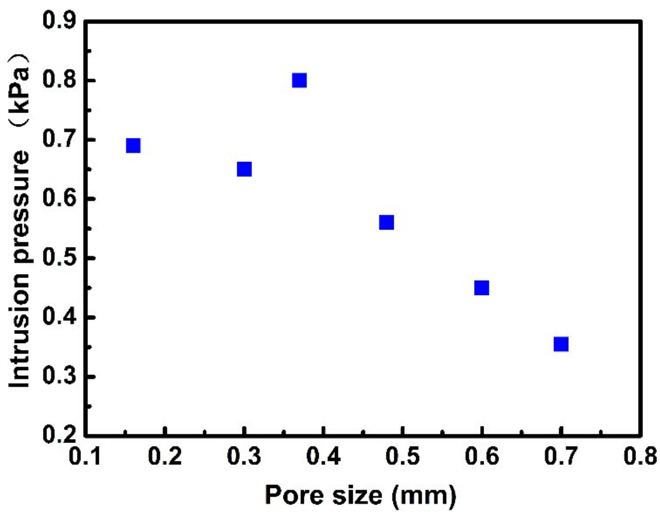

Fig. S7 Intrusion pressures of the printed membranes for water as a function of pore size.

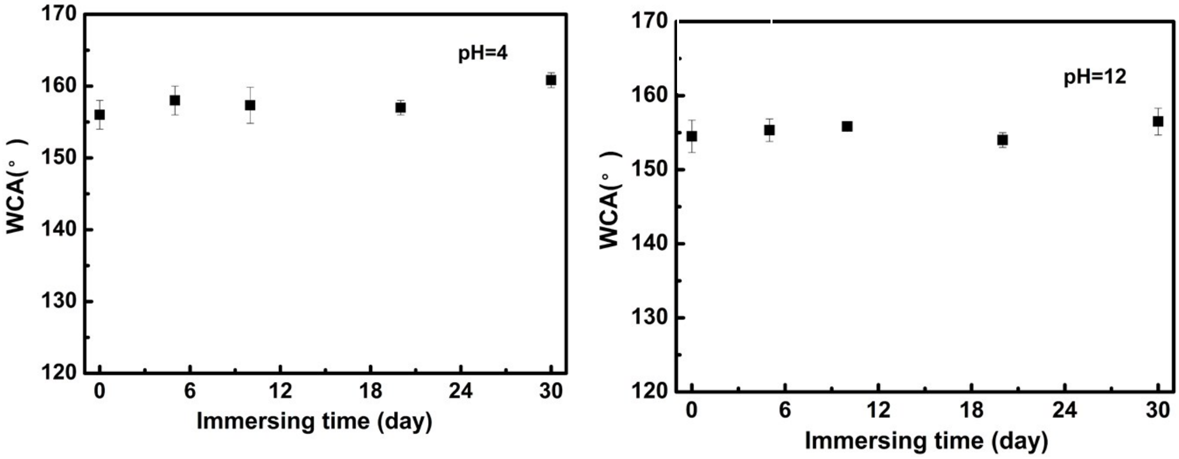

Fig. S8 WCA changes of the superhydrophobic PDMS membranes after serving in acidic (pH=4) or alkaline (pH=12) aqueous solution for different time.

Video. S1 3D printing process of superhydrophobic porous membrane.