Fabrication of Porous Polymer Coating Layers with Selective Wettability on Filter Papers via Breath Figure Method and Their Applications in Oil/Water Separation

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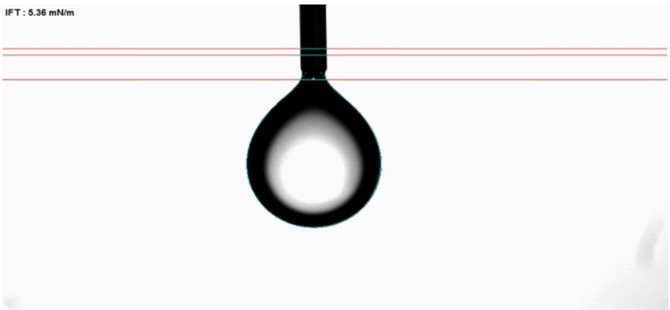

Figure 1. The polymer solution droplets profile in the measurement of liquid interfacial tension between the PBTF-30 dichloromethane solution and water by hanging drop method.

The result was calculated by digital image processing with OWRK method, and the interfacial tension between the PBTF-30 DCM solution and water is measured as 5.36 $mN \cdot m^{-1}$.

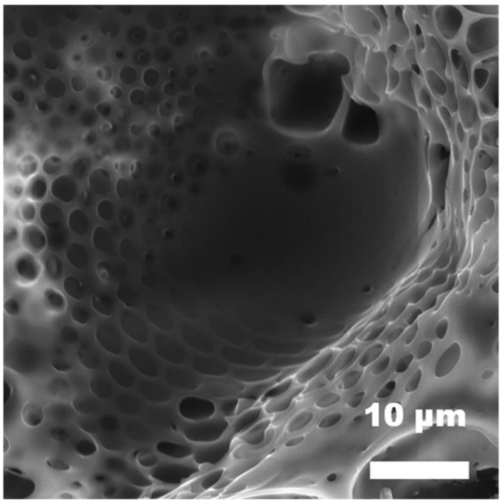

Figure 2. SEM image of deep furrow covered by honeycomb coating layers of PBTF- 30 (15 mg/mL).

The interfacial energy balance z_0 is defined as:

$$z_0 = z/R = (\gamma_w - \gamma_{w/s})/\gamma_s \qquad \text{Equation S1}$$

Where z is the distance between the droplet center and the air/solution interface; R is the droplet radius; $\gamma_{w/s}$ is the interfacial tension between water and solution; γ_w and γ_s are the surface tension of the water and the solution, respectively. When $-1 < z_0 < 1$, one layer of droplets stayed between the air and solution interface, forming monolayer ordered structures. When $z_0 > 1$, the droplets immerge into the solution, forming multilayer films. When $z_0 < -1$, water droplets could not remain at the interface or in the solution, so no ordered structure could be obtained.

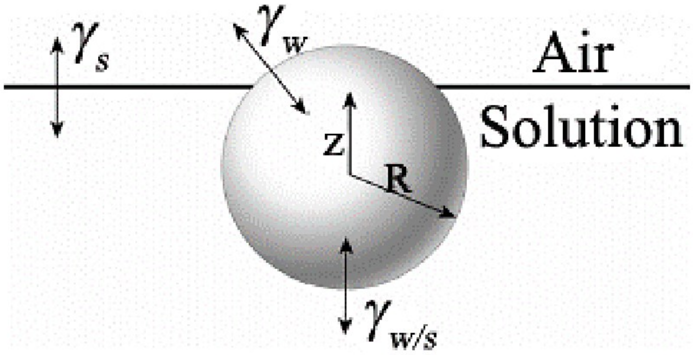

Figure S3. Schematic view of a spherical water droplet at the air/solution interface, with copyright permission from references [36]. γ_s and γ_w, the surface tension of solution and water, respectively; $\gamma_{w/s}$, the interfacial tension between water and the solution; z, the distance between the water droplet center and surface; R, the radius of the spherical water droplet.

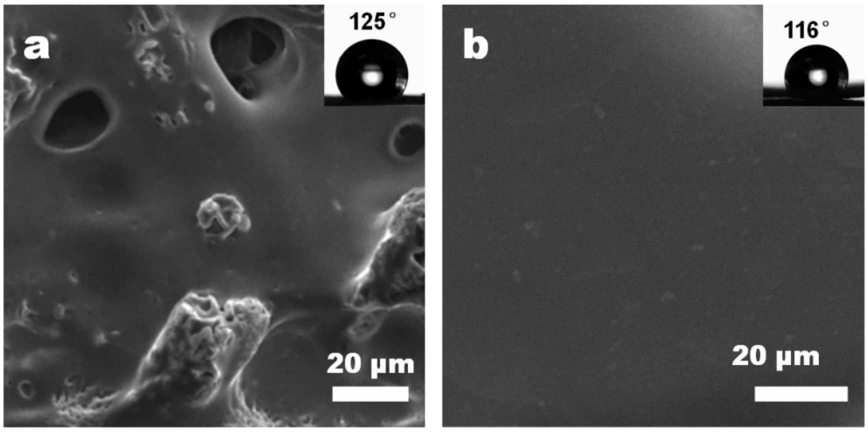

Figure S4. SEM images of the coating layers formed by PBTP-30 by spin coating method on (a) filter paper; (b) planar glass slide in the concentrations of 15 mg/mL.

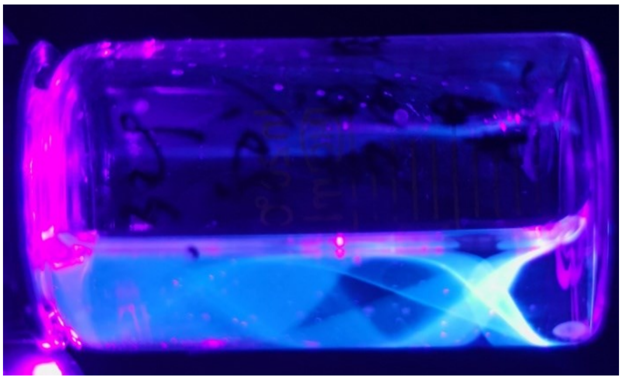

Figure S5. The strong Tyndall effect displayed by N-50 under the 405 nm ultraviolet light.

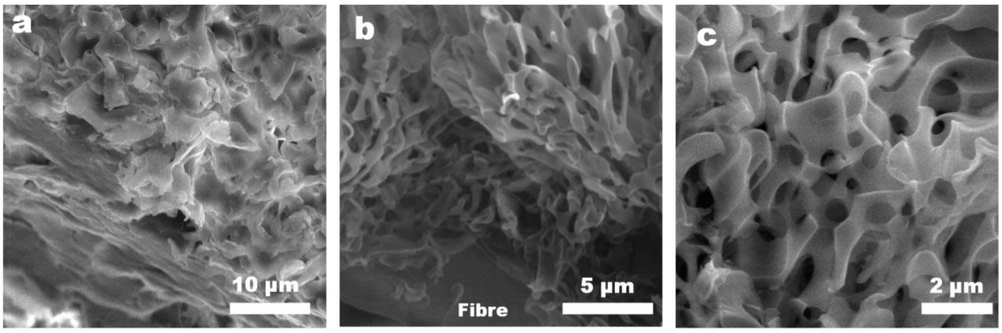

Figure S6. SEM images of the coating layers by N-50 (5 mL, 10 mg/mL) with 2 μL water (a) shear damaged polymeric coating layer; (b) coating layers in situ formed on fiber;(c) High magnification SEM image of the communicating pores.

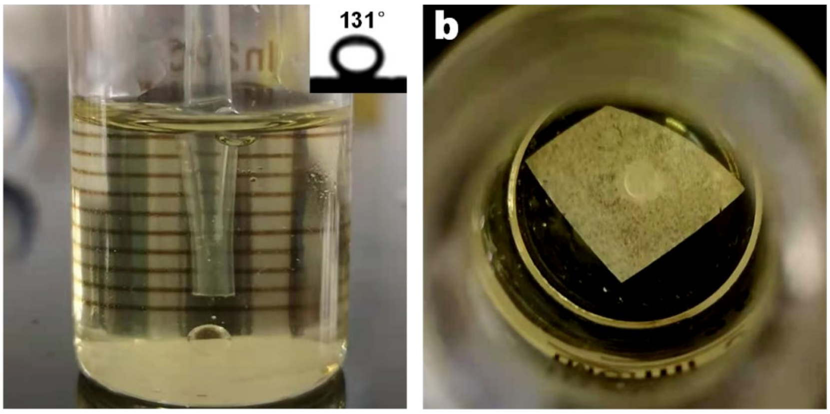

Figure S7. Water droplet contact statue under the oil phase of the N-50 coated filter paper (petroleum ether was employed as oil phase and was dyed into yellow), digital photographs of (a) the side view;(b) the top view.

The Flux (*F*) of petrol ether /water mixture was assessed by measuring the time spent in collecting the permeated oil, and calculated by Equation 2.

$$F = \frac{V}{St}$$ Equation (2).

Where *V* is the volume of the petrol ether, *S* represents the effective surface area of superhydrophobic composite, and *t* is the time, which is 60s (The video of the filtration process can be found in supporting information Video 2). The effective surface area *S* is in dynamic changing as the filtration proceeding. The initial *S* is 2.49cm^2 and the final *S* is 0 cm^2 since the *F* is a constant, the value of S is averaging as 1.2445 cm^2 and applied in *F* calculate. The value of *F* as calculated is 2989.15Lm^{-2} h^{-1}.