Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Supporting information

Bio-inspired Isotropic and Anisotropic Wettability on a Janus Free-Standing Polypyrrole Film By Interfacial Electro-polymerization

Jian Song,[a] Huan Liu, *[a] Meixiang Wan,[b] and Lei Jiang,[a,b] Ying Zhu,*[a]

[a] *Key Laboratory of Bio-inspired Smart Interfacial Science and Technology of Ministry of Education, School of Chemistry and Environment, BeiHang University, Beijing, 100191 P. R. China. E-mail:zhuying@buaa.edu.cn , Liuh@buaa.edu.cn*
[b] *Beijing National Laboratory for Molecular Sciences, Institute of Chemistry, Chinese Academy of Sciences*

1. SEM imags of free-standing PPy films fabricated at the different concentration of HCl

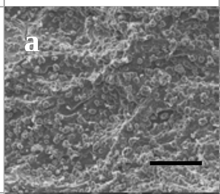
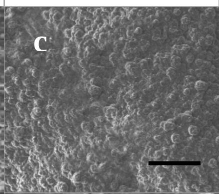
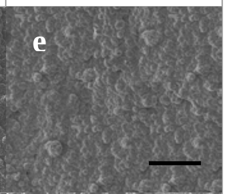
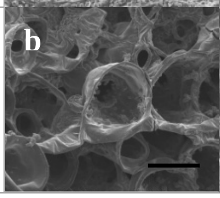
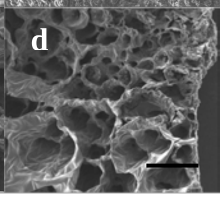
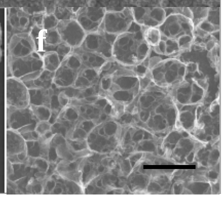
Concentration of HCl (mol·L^{-1})	0.01	0.03	0.05
PPy-A			
PPy-O			

Fig. S1. SEM imags of free-standing PPy films fabricated at the different concentration of HCl, (a, b) 0.01 mol·L^{-1}, (c, d) 0.03 mol·L^{-1}, (e, f) 0.05 mol·L^{-1}. Scale bars represent 100 μm.

One can see that the no significant changes were observed on the surface morphology of the PPy film toward aqueous phase (PPy-A) both in size and uniformity (Fig. S1a, c, and e), when the hydrochloric acid concentration is varied from 0.01 to 0.05 mol·L^{-1} and pyrrole monomer concentration is 0.2 mol·L^{-1}, As shown in Fig S1 b, d, and f, the the porous depths and diameters of the surface of PPy film toward organic pahse (PPy-O) are affected by the concentration of dopants used in the polymerization. The average diameter of porous produced in HCl of 0.01 mol·L^{-1} is about 200 μm (Fig. S1b), those made in HCl of 0.03 mol·L^{-1} approach 90 μm (Fig. S1d), and those synthesized in HCl of 0.05 mol·L^{-1} are centered around 72 μm (Fig. S1f). Fowever, the oriented porous microstructures facing organic phase have not been obversed at the low HCl concentration.

2. SEM imags of free-standing PPy films fabricated at different organic phases

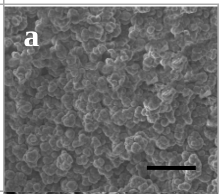
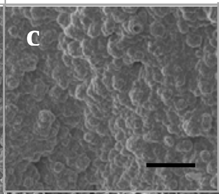
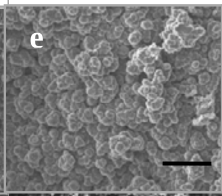
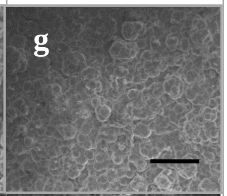
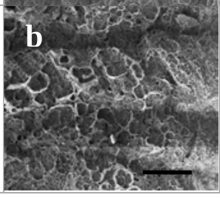
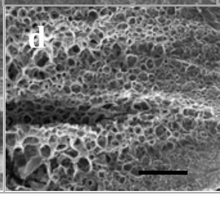
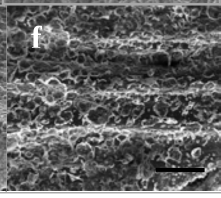
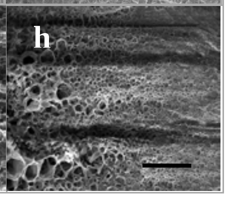
Organic solvent	Benzene	Toluene	Hexane	Chloroform
PPy-A				
PPy-O				

Fig. S2. SEM images of free-standing PPy films fabricated at different organic phases, (a, b) benzene, (c, d) toluene, (e, f) hexane, (g, h) chloroform. Scale bars represent 100 μm.

When the aqueous phase contains hydrochloric acid (0.08 mol·L^{-1}) as the dopant and electrolyte; and pyrrole monomer (0.2 mol·L^{-1}) is dissolved in different organic phase, such as, benzene, toluene, hexane, chloroform, as shown in Fig. S2. It is clear that PPy-A surfaces show also a typical hierarchical micro/nano-structures at different organic phases (Fig. S2a, c, e and g), and the PPy-O surfaces are wrinkling, thus also leading to the formation of the parallel ridges that is similar with the PPy-O surface formed in dichloromethane (Fig. S2b, d, f and h). The diameters of the porous range from 20 to 50 μm, and the average distance between ridges range from 50 to 200 μm.

Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

3. Static contact angles (CA) and sliding angle (SA) of water droplet on the wings of the butterfly

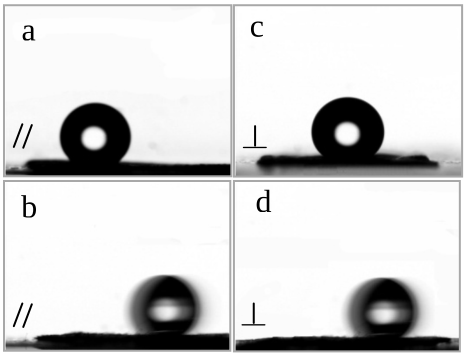


Fig. S3. (a, b) Static CA and SA of water droplet on the wings of the butterfly seen from direction parallel to the ridge; (c, d) Static CA and SA of water droplet on the wings of butterfly seen from the direction perpendicular to the ridge.

As show in Fig. S3, the water contact angle (CA) measured at a solid-air interface in the direction parallel to the ridge is 137.3 ± 1.7º (Fig. S3a), and that in the perpendicular direction is 142.1 ± 1.5º (Fig. S3c). As can be seen from Fig S3b, the droplet starts to roll off the surface in the direction parallel to the ridge when the wing is slightly tilted upward at an angle of 13.3 ± 2.4º. However, the droplet doesn't roll off the surface in the direction perpendicular to the ridge, when the wing is tilted gradually upward, until at an angle of 19.1 ± 2.9º (Fig. S3d).

4. Water CA of droplet on the PPy-A and PPy-O surfaces of a free-standing Janus PPy film measured at a solid-air interface

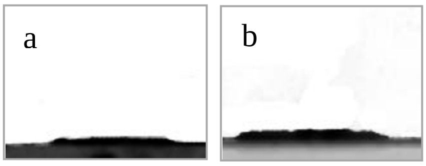


Fig. S4. (a) Water CA of droplet on the PPy-A suefaces, (b) Water CA of droplet PPy-O suefaces.

From this figure, we can observe that water CAs on the both surfaces of PPy film are 0º, exhibiting superhydrophilicity in air.