A novel bird-nest-like air superoleophobic/superhydrophilic $Cu(OH)_2$-based composite coating for efficient oil–water separation

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Supplementary materials

Synthesis of CMCH

The synthetic procedure of CMCH was based on the oxidation method, in which there is a reaction shown by Eq. (S1):

$$Cu + K_2S_2O_8 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4 + K_2SO_4 \quad \text{(S1)}$$

Synthesis of the CM@PDF coating

Firstly, the CM was immersed with 10 $g \cdot L^{-1}$ PDDA solutions. Secondly, 2.5 $g \cdot L^{-1}$ fumed silica, 15 $g \cdot L^{-1}$ FS-50 were dispersed in ethanol for 30 min under stirring, obtaining a suspension. Lastly, the suspension liquid was sprayed on the CM soaked with PDDA solutions using a spray gun, and the distance between the spray gun and it was kept at 300 mm and dried at 60 °C. The sample was marked as CM@PDF.

Synthesis of the CMCH@PVF coating

Firstly, the CMCH was immersed with 10 $g \cdot L^{-1}$ PVA solutions. Secondly, 2.5 $g \cdot L^{-1}$ fumed silica, 15 $g \cdot L^{-1}$ FS-50 were dispersed in ethanol for 30 min under stirring, obtaining a suspension. Lastly, the suspension liquid was sprayed on the CMCH soaked with PVA solutions using a spray gun, and the distance between the spray gun and it was kept at 300 mm and dried at 60 °C. The sample was designed as CMCH@PVF.

Fig. S1 The oil–water separation experimental device.

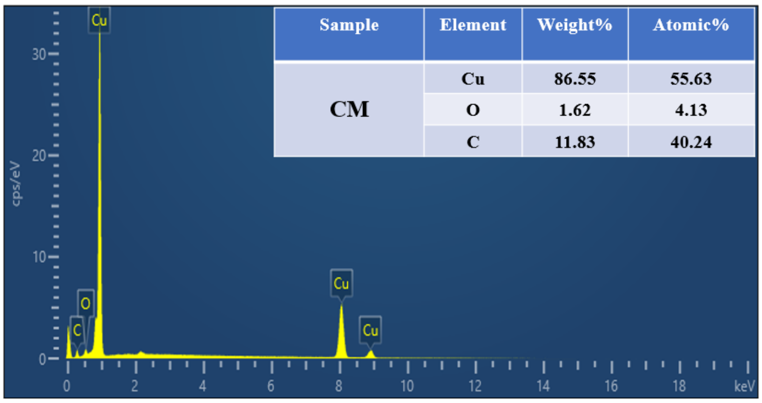

Fig. S2 The EDS result of copper mesh.

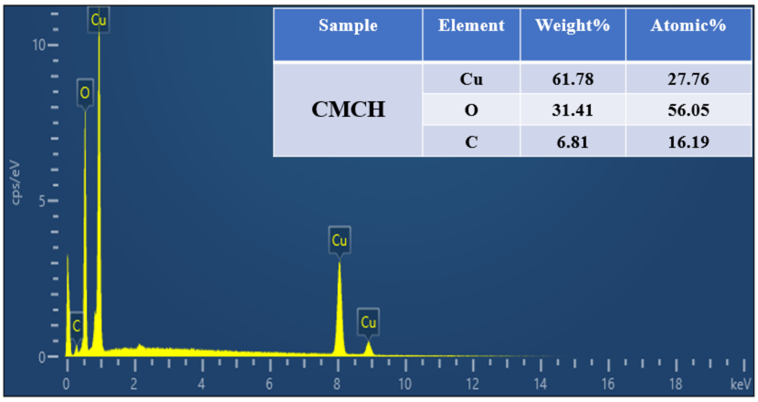

Fig. S3 The EDS result of CMCH.

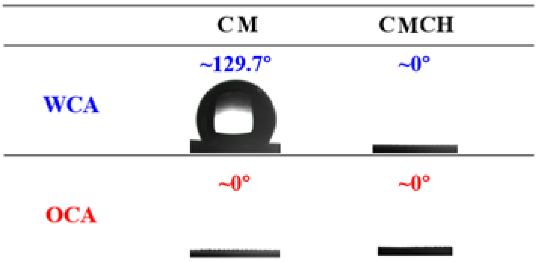

Fig. S4 Contact angles of water droplets and oil droplets in air on Cu and CMCH, respectively.

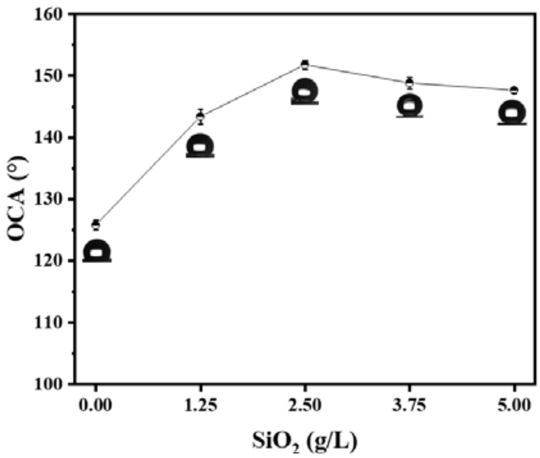

Fig. S5 Effect of SiO_2 content on oil contact angle in air.

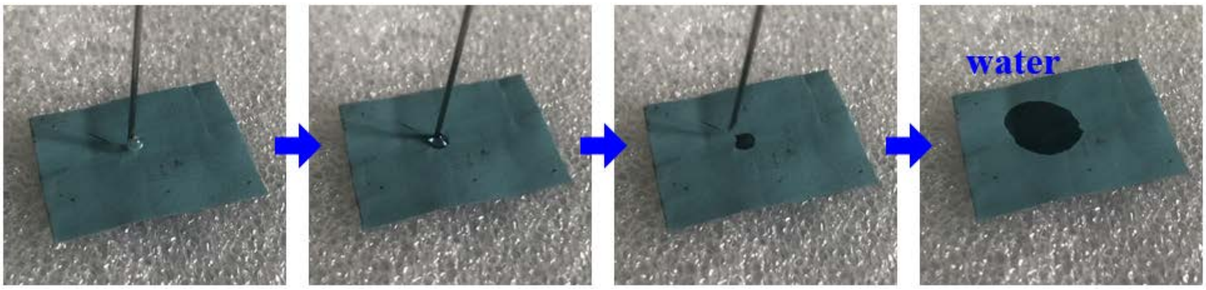

Fig. S6 The real state of the hydrophilic process on the surface of CMCH@PDF.

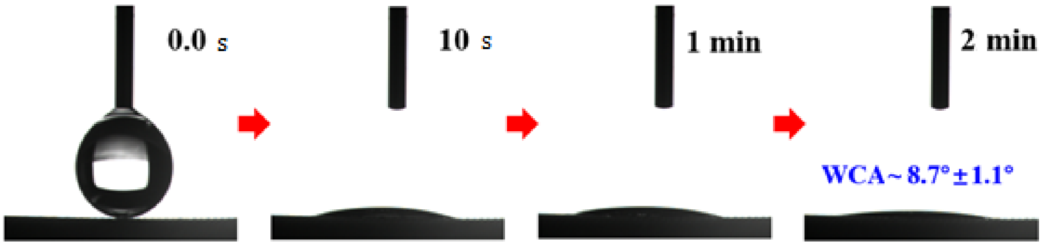

Fig. S7 The dynamic water contact angle of CM@PDF.

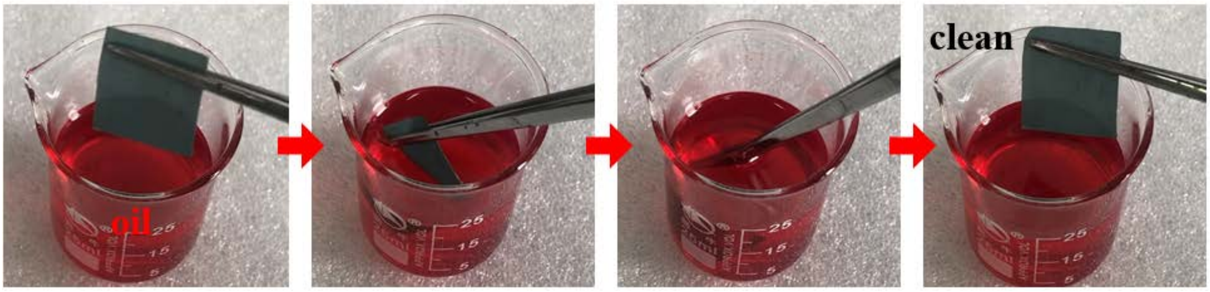

Fig. S8 The anti-oil performance testing process of CMCH@PDF.

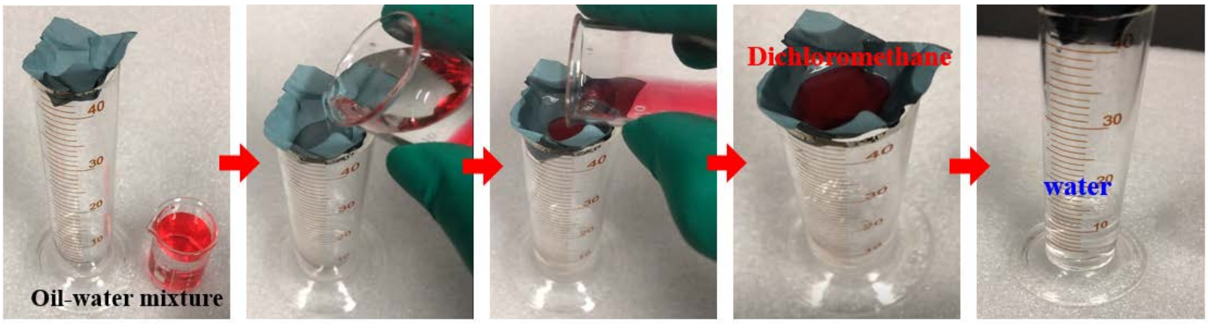

Fig. S9 Photos of the dichloromethane/water separation process.

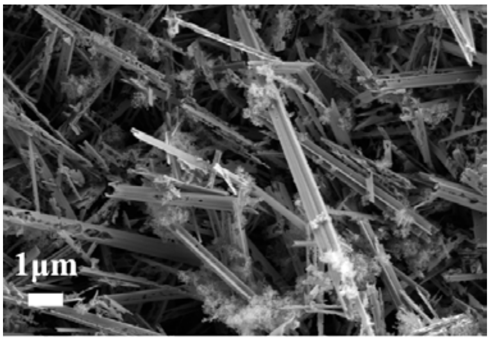

Fig. S10 SEM image of CMCH@PDF after immersion in pH = 1 solution for 24 h.

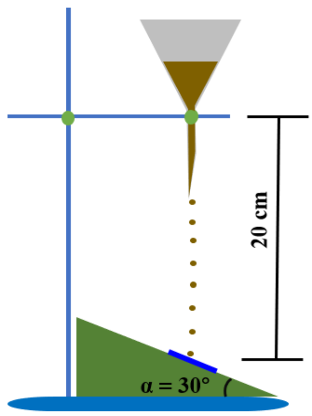

Fig. S11 The diagram of falling sand.

Table S1 Parameters of different kinds of oil droplets

Oil droplet	Parameters		
	Surface tension/(mN·m^{-1})	Density/(g·mL^{-1})	Viscosity/(mPa·s)
Diesel	28.3	0.82–0.87	4.33
Toluene	28.8	0.87	0.59
Edible oil	34.5	0.86–0.93	39.6
Peanut oil	35.0	0.87	–
Paraffin	–	0.86–0.91	–

Table S2 Comparison between the results from this work and published articles

Coating	Separation efficiency/%	Flux/(L·m^{-2}·h^{-1})	Ref.
PFOA/HACC/SiO_2	96.8	14100	[S1]
PFOA/SiO_2/PDMS-NH_2	96±1	–	[S2]
F-PETMP	99	699	[S3]
FS/AP/SiO_2	99	5000	[S4]
PFO/ZnO	99	458	[S5]
FS/SiO_2/PDDA	98.72	25185	this work

Table S3 Parameters of heavy oil and its oil–water separation efficiency

Oil	Parameters			
	Surface tension/(mN·m^{-1})	Density /(g·mL^{-1})	Viscosity /(mPa·s)	Oil–water separation efficiency
Dichloromethane	28.2	1.33	0.43	98.2%
Chloroform	27.1	1.48	0.56	98.6%

References

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