Supporting information

A photocatalytically active superhydrophilic/superoleophobic coating

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Contact angle and sliding angle analysis

Contact angles (CAS) and sliding angles (SAS) were measured by the sessile drop method using a Krüss DSA 100 (Krüss Company, Ltd., Germany) apparatus at ambient temperature. Liquid droplets were dropped carefully onto the surface. The volume of the individual droplet used for the CAs and SAs measurements was 5 μL. The average CA and SA value was determined by measuring the same sample at five different positions.

Table S1. Values of contact angle (CA), advancing contact angle (ACA), receding contact angle (RCA), and sliding angle (SA) for the probing liquids with different surface tensions.

| Probe liquids | Surface tension (mN/m) | CA (degree) | ACA (degree) | RCA (degree) | SA (degree) |
|---------------|-------------------------|-------------|--------------|--------------|-------------|
| Water         | 72.1                    | 0           | 0            | 0            | /           |
| Dichloromethane | 46                      | 160 ± 1.5   | 162 ± 2      | 157 ± 1      | 3.5 ± 1     |
| Rapeseed oil  | 35.7                    | 159 ± 0.5   | 161 ± 1      | 156 ± 2      | 4 ± 0.5     |
| Toluene       | 28.8                    | 157 ± 1     | 158.5 ± 2    | 152 ± 1      | 5.5 ± 1     |
| Hexadecane    | 27.5                    | 153 ± 0.5   | 154.5 ± 1    | 146.5 ± 2    | 6 ± 1.5     |

Table S1. Values of contact angle (CA), advancing contact angle (ACA), receding contact angle (RCA), and sliding angle (SA) for the probing liquids with different surface tensions.
The resulting coating displayed superoleophobic property with all oil contact angle values bigger than 150° in the air. Due to its superhydrophilicity, water wet it completely and then the remaining water was forming a water layer that can act as a lubricant to repel oils. Oil droplets move freely on this water-wetted coating surface, as a slippery wetting state was established. The water-wetted coating can return to the original superoleophobic state after removing the water by heating. In this way, a reversible wetting transition between superoleophobic state and slippery state can be realized by dropping water and removing water alternatively, as shown in Figure S1.
Photocatalytic activity and surface wetting property after UV illustration

Figure S2. (a) Photocatalytic activity of the coating; (b) Surface wetting behavior of the coating after UV illustration.

The obtained coating was applied as a catalyst for water purification. When immersed in methylene blue aqueous solution, it can be wetted completely due to its water-attracting property. After UV illustration, all the methylene blue dye in water were decomposed completely, leaving clean water eventually (see Figure S2a). When taking out from the cleaned water, a water film was retaining on the coating surface, and engineering oil droplet was sliding on this water-wetted coating freely (see Figure S2b).
**Stability of the coating**

Table S2. CA and SA of water and rapeseed oil on the superhydrophilic/superoleophobic coating after different treatments.

| Treatments                        | Water CA/° | Water SA/° | Dodecane CA/° | Dodecane SA/° |
|----------------------------------|------------|------------|---------------|---------------|
| Originally obtained coating      | 0          | /          | 152.0 ± 1     | 7.0 ± 1       |
| Thermal treatment / 200 °C, 24 h | 0          | /          | 151.5 ± 0.5   | 7.5 ± 0.5     |
| Subzero treatment/-18 °C, 24 h   | 0          | /          | 151.5 ± 0.5   | 7.5 ± 1       |
| Outdoor storage / 60 d           | 0          | /          | 151.3 ± 1     | 8.5 ± 1       |
| Water jetting ¹                  | 0          | /          | 151 ± 0.5     | 7.5 ± 1       |
| Water immersing ¹                | 0          | /          | 150.5 ± 0.5   | 8 ± 1         |

¹ After water jetting and immersing tests, the coating sample is heated at 100 °C to remove the water, and then it is used for CA and SA measurements.
Oil/water separation

The separation efficiency for the oil-water mixture was calculated by the following equation:

\[ \text{Separation efficiency (\%) = } \frac{m_1}{m_0} \times 100\% \]

where \( m_0 \) and \( m_1 \) are the weight of oil in the original oil-water mixture and the one collected after separation, respectively.

Figure S3. (a) The stability of permeating flux for the superhydrophilic/superoleophobic mesh; (b) The oil-repellency of the superhydrophilic/superoleophobic mesh after oil-water separation.

The permeating flux of our superhydrophilic/superoleophobic mesh was changing
slightly even after 20 cycles of oil-water separation, as shown in Figure S3a. After oil-water separation, residual oils on our superhydrophilic/superoleophobic mesh can slide off easily without any oil penetration (see Figure S3b), owing to the low adhesion force between the oil and the coating. This anti-oil fouling property allowed the coating deposited copper mesh, water skimmer device, and spoon device to retain its high oil-water separation efficiency even after 20 cycles of oil-water separation. These results indicated that our coating was a promising candidate for oil-water separation industries when deposited on a copper mesh.
The effect of silane type on the adhesion property of the sprayed coating

Figure S4. The effect of silane type on the adhesion property of the sprayed coating. The silane in coating a, b, c is BTMEPA, APTES, and the mixture of BTMEPA and APTES, respectively.

For coating fabrication, we just used two kinds of silanes, namely, bis(3-(trimethoxysilyl)propyl)amine (BTMEPA) and (3-aminopropyl)triethoxysilane (APTES). We found that the resulting coating had low adhesion force to glass slide if we just used only one kind of silane, either BTMEPA (Figure S4a) or APTES (Figure S4b). The obtained coatings were washed away when dropping
water on them. When BTMEPA and APTES were mixing for the coating fabrication, there was a good adhesive force between the coating and the glass slide, and the coating displayed water washing-resistant property, as shown in Figure S4c.

**Video captions**

Video S1 shows the superoleophobic wetting property of the resulting coating.

Video S2 shows the superhydrophilic wetting property of the resulting coating.

Video S3 shows the wetting transition from slippery state to superoleophobic state was achieved by removing the water-layer on coating through thermal treatment.