Electronic Supplementary Information

Facile fabrication of superhydrophobic meshes with different water adhesion and its influence on the oil/water separation

Jian Li *, Ruimei Kang, Yan Zhang, Mouji Li, Houde She, Fei Zha, Ziqiang Lei

Key Laboratory of Eco-Environment-Related Polymer Materials, Ministry of Education of China, Key Laboratory of Gansu Polymer Materials, College of Chemistry and Chemical Engineering, Northwest Normal University, Lanzhou 730070, China

Corresponding author email: jianli83@126.com;

Supplementary figure and movie captions:

Figure S1. FT-IR spectra of ZnO, ZnO modified with stearic acid and stearic acid.

Figure S2. Wettability of ZnO nanoparticles coated on the stainless steel substrates with water contact angle of 160° (a, ZnO modified with stearic acid) and (b, native ZnO) 0°, respectively.

Figure S3. The surface morphologies of the Zn O coated mesh surfaces before (a_1-a_3) and after (b_1-b_3) oil/water separation.

Movie S1. The separation process of light oil (kerosene)/water mixture based on the superhydrophobic ZnO coated mesh with high water adhesion.

Movie S2. The separation process of heavy oil (chloroform)/water mixture based on superhydrophobic ZnO coated mesh with high water adhesion.

Preparation of the hydrophobic ZnO NPs. The hydrophobic ZnO NPs were obtained by functionalizing the hydrophilic ZnO NPs with sufficient amount of stearic acid. In a typical process, ZnO NPs (1 g) were dispersed in 0.02 M stearic acid ethanol solution (50 mL) under stirring for 3 h. This procedure imparts hydrophobicity to the ZnO NPs by immobilizing octadecyl groups on their surface. After multistep washing and centrifugation, the obtained hydrophobic ZnO NPs were dried at 80 °C and ground to a fine powder using a mortar.

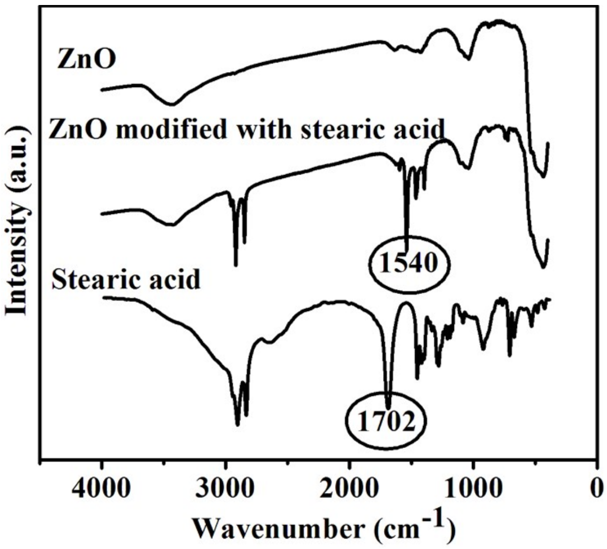

Fig. S1. FT-IR spectra of ZnO, ZnO modified with stearic acid and stearic acid.

Fig. S1 showed the IR spectra of hydrophilic ZnO, hydrophobic ZnO NPs modified with stearic acid and stearic acid. The peak at around 1702 cm^{-1} in IR spectrum of stearic acid belonged to carbonyl stretch of stearic acid,[1] which disappeared in the spectrum of hydrophobic ZnO NPs, indicating that the chemical reaction took place between ZnO and stearic acid. At the same time, in the spectrum of hydrophobic ZnO NPs the peaks at around 1540 and 1465 cm^{-1} are also observed which are ascribed to $m(COO)_{asym}$ and $m(COO)_{sym}$, respectively,[2] resulting from the formation of stearate.

However, the spectrum of hydrophilic ZnO NPs shows no evidence of those above-mentioned peaks at around 1540 and 1465 cm^{-1}. Thus, it can be reasonably inferred that ZnO NPs were successfully modified with stearic acid.

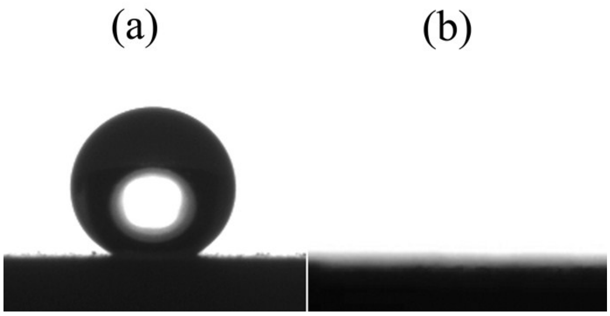

Fig. S2. Wettability of water droplets on the ZnO coated stainless steel meshes with water contact angle of 160° (a, ZnO modified with stearic acid) and (b, native ZnO) 0°, respectively.

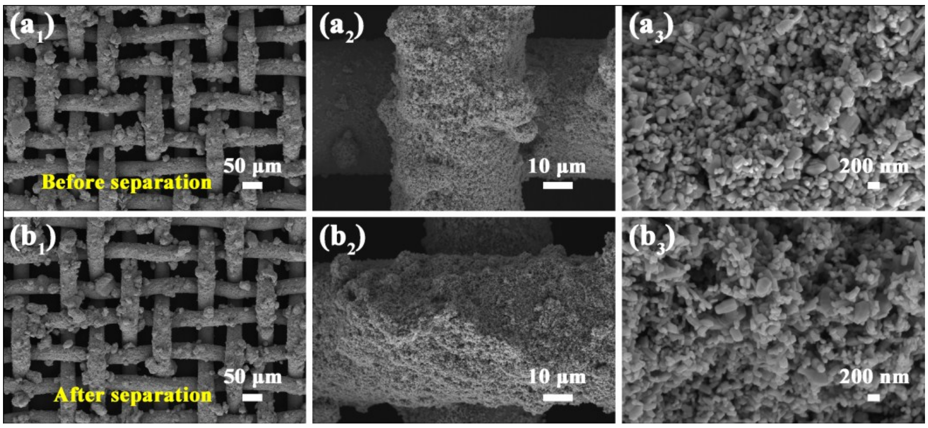

Fig. S3. The surface morphologies of the Zn O coated mesh surfaces before (a_1-a_3) and after (b_1-b_3) oil/water separation.

References

1 S. T. Wang, L. Feng, L. Jiang, One-step solution-immersion process for the fabrication of stable bionic superhydrophobic surfaces, *Adv. Mater.*, 2006, **18**, 767−770.

2 J. Li, Z. Jing, F. Zha, Y. Yang, Q. Wang, Z. Lei, Facile spray-coating process for the

fabrication of tunable adhesive superhydrophobic surfaces with heterogeneous chemical compositions used for selective transportation of microdroplets with different volumes, ACS Appl. Mater. Interfaces, 2014, 6, 8868−8877.