Supporting Information

Micro/nanoscale hierarchical structured ZnO mesh film for separation of water and oil

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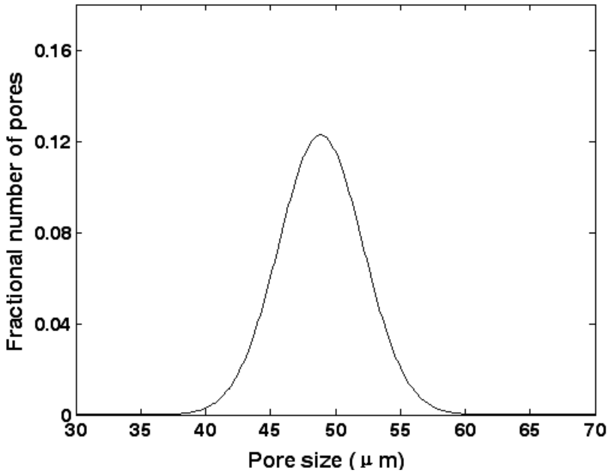

Figure S1. The pore size and pore size distribution of the aligned ZnO nanorod arrays-coated mesh films. These results indicate that the pore size of the films is uniform.

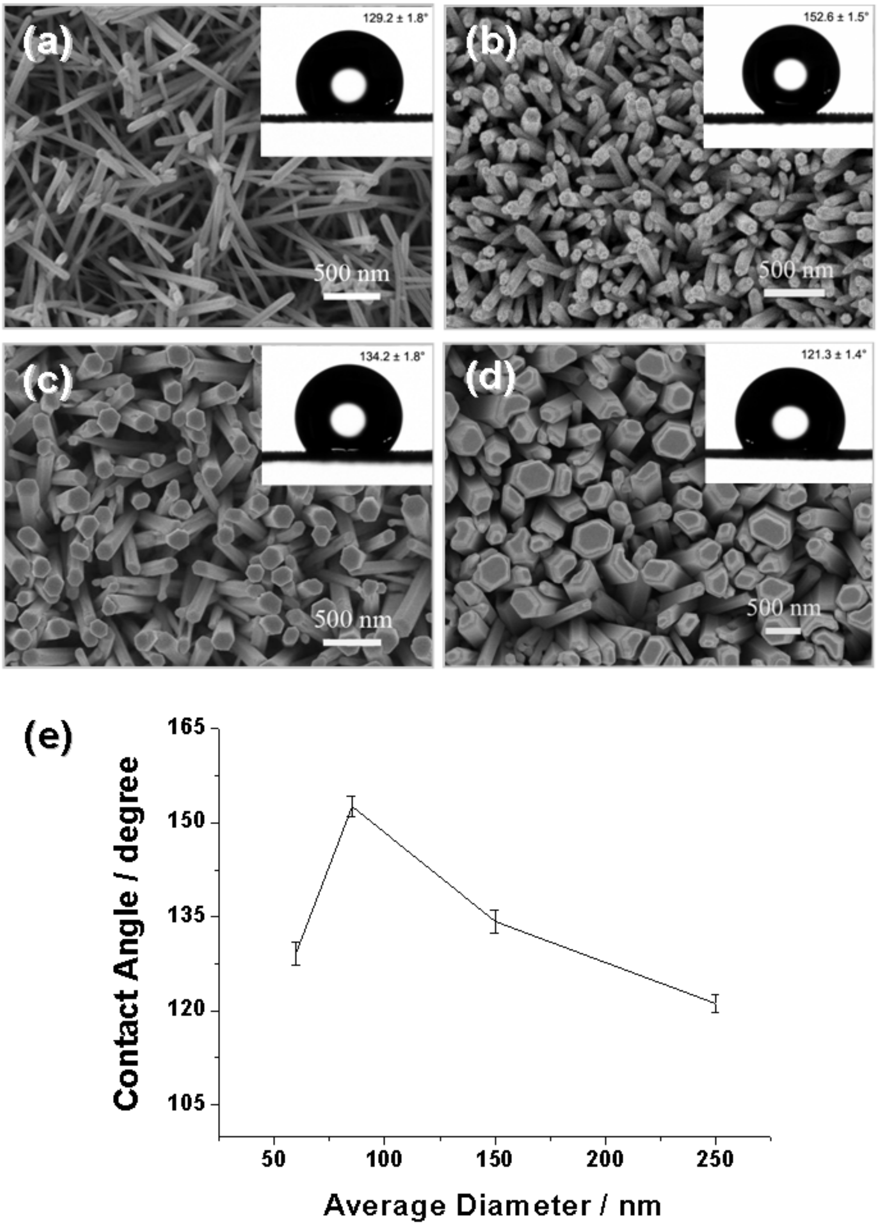

Figure S2. Surface wettability of the ZnO-coated mesh films changes as the average diameter of the ZnO nanorod. (a), (b), (c) and (d) are SEM top images of the as-prepared ZnO-coated stainless steel mesh films with different diameter, respectively. Insets show the corresponding contact angle photographs of the mesh films. (e) The relationship between surface wettability and the average diameter of the ZnO nanorod. These results indicate that the average diameter of the ZnO nanorod has important influence on surface wettability. Among them, the ZnO nanorod coated mesh film with the average diameter of 50 ~ 150 nm shows high hydrophobicity, and the nanorod with the average diameter of ~ 85 nm shows superhydrophobic.

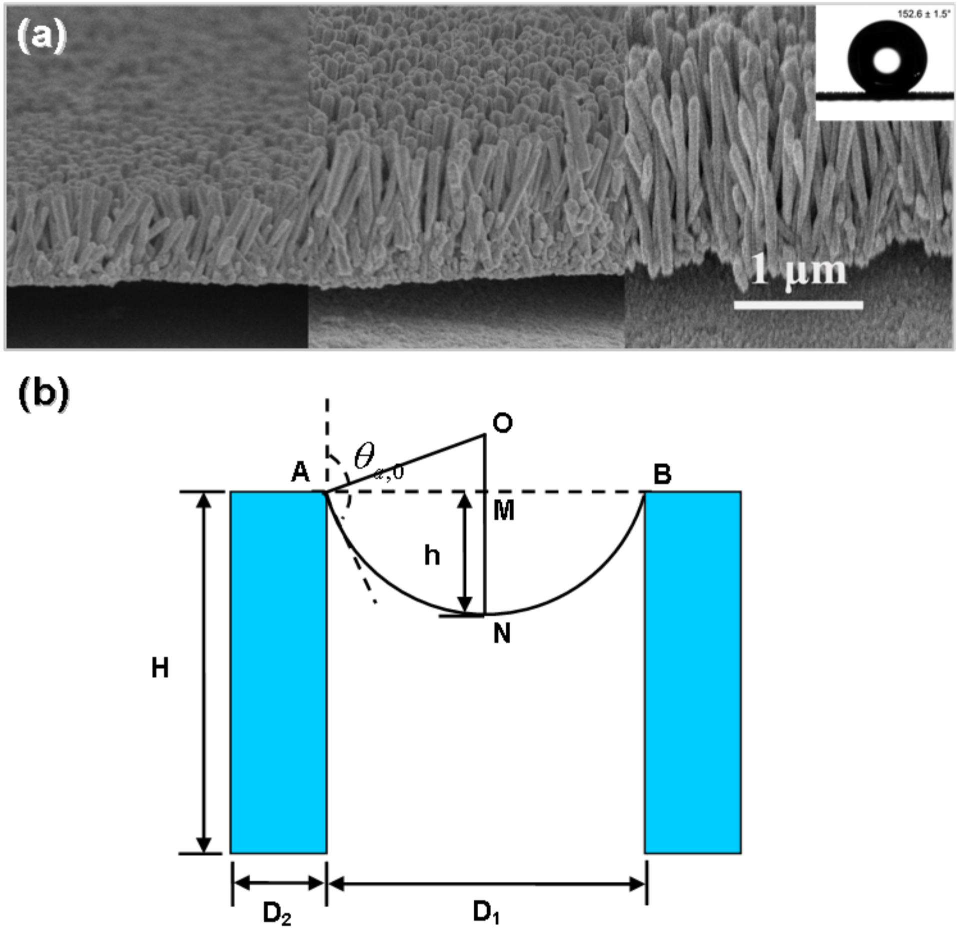

Figure S3. SEM images of the aligned ZnO nanorod array-coated mesh and the schematic suspended liquid protrusion shape on this mesh film. (a) SEM side view of the as-prepared ZnO-coated stainless steel mesh films with different length of the ZnO nanorods. Inset shows the corresponding contact angle photograph of the aligned ZnO nanorod arrays-coated mesh films. (b) The suspended liquid protrusion to a depth *h* on the ZnO nanorod array-coated mesh wire. Here we set the mesh with pore size of ~ 48 μm as an example. There is a threshold length of nanorod length to ensure the liquid on the mesh wire surface being Cassie superhydrophobic state. As long as the nanorod length is more than this threshold length, the liquid on this mesh film will be stably superhydrophobic. And the threshold of nanorod length can be described as follows:

The nanorod has a length of H, a diameter of D_1 (85.2 ± 36.8 nm) and a spacing of D_2 (225.4 ± 55.3 nm). The liquid exhibits its true advancing value $\theta_{a,0}$ (125.2 ± 2.6°) on the sides of the nanorod.

Assuming that the cross section of the liquid protrusion can be described as a segment of a circle, the critical value *h* can be calculated as follows:

$$h = MN = ON - OM = R - R\cos(\theta_{a,0} - 90^{\circ}) = R[1 - \cos(\theta_{a,0} - 90^{\circ})] = \frac{\frac{1}{2}D_1}{\sin(\theta_{a,0} - 90^{\circ})}[1 - \cos(\theta_{a,0} - 90^{\circ})] = 35.8nm$$

Thus as long as the nanorod length $H > h = 35.8nm$ is satisfied, the liquid on the wire surface behaves Cassie superhydrophobic state. Accordingly, this mesh film will be stably superhydrophobic. These experimental results confirm that the length of the ZnO nanorod in this work is long enough to ensure the aligned ZnO nanorod array-coated stainless steel mesh films being superhydrophobic.