Electronic Supplementary Information

Design and Fabrication of the Clustered Rugged ZnO Nanotube Films with Condensate Microdrop Self-Propelling Function

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Experimental Section

Material Fabrication: The CMDSP clustered rugged ZnO nanotube films can be fabricated on copper surfaces by facile three-step process. Firstly, the clustered rugged ZnO nanorods were in situ grown on a copper plate (99.9%) via direct electrodeposition. To remove contaminants, the Cu plates (with size 20×20×0.2 mm^3) were mechanically polished and ultrasonic rinsed in acetone, ethanol and deionized water for 5 min, each. After nitrogen drying, the electrodeposition of ZnO nanorods was carried out in a standard three electrodes system，where the Cu plate, Pt wire and the saturated calomel electrode (SCE) as working, counter and reference electrodes, respectively. The electrolyte was 0.05M Zn $(NO_3)_2 \cdot 6H_2O$ and 0.005 M EDA·HCl. Secondly, the ZnO samples on the copper plate were washed with deionized water and then used as the working electrodes for the second electrodeposition. The electrolyte for the second electrodeposition of ZnO nanorods was prepared by adding sodium hydroxide dropwise to the 0.05 M Zn $(NO_3)_2$ aqueous solution at 70 °C under continuous stirring until it turned clear. All electrodepositions were done at a potential of -1.10V vs SCE. The duration of the deposition was 1.0 h. The reaction temperature was kept at 70 °C using a water bath provided with a thermostat. Thirdly, the nanosamples were placed, together with a cup containing 10 μL heptadecafluorodecyltrimethoxysilane (Shin-Etsu Chemical Co., Ltd., Japan), into a glass container (Φ145 mm × 70 mm), which was sealed with a cap and then heated for 2.0 h at 120 °C.

Characterizations: The surface morphologies of the as-prepared nanosamples were studied using the high-resolution scanning electronic microscope (FEI Quanta 250 FEG, USA). The crystalline phase of the nanosamples were analyzed by powder X-ray diffraction using $Cu_{K\alpha}$ radiation (Bruker D8 advance, Germany) and The high-resolution transmission electron microscopy (HRTEM) and the selected area electron diffraction (SAED) patterns were recorded by FEI Tecnai G2 F20 S-Twin, UAS. A high-speed microscope imaging system (Keyence VW-9000, Japan) was used for studying dynamic condensation behaviors of the sample surfaces. All the nanosample were fastened on a cooling stage (~2 °C) in a controlled environment of ambient temperature of ~25 °C and the relative humidity of ~80%.

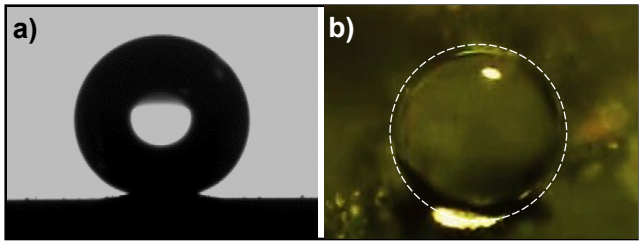

Figure S1. Superhydrophobicity of the as-prepared nanosample surface for big-scale water droplets. (a) Optical image of the contact angle on the nanosample surface, the contact angle is 157°. (b) Optical image of a spherical condensate microdrop on the nanosample surface.