Electronic Supplementary Information (ESI)

Electricity-induced Switchable Wettability and Controllable Water Permeation Based on 3D Copper Foam

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Experimental Details

Materials.

Ethanol and acetone (Dongfanglongshun Co. Ltd., Beijing, China), KH1231 (Sinopharm Chemical Reagent Co., Ltd., Beijing, China), Sodium sulfate (Sinopharm Chemical Reagent Co., Ltd., Beijing, China) were used as purchased. All the reagents were of analytical grade.

Preparation of the switchable and controllable wettability film.

The original copper foam as substrate was cut into small pieces, rinsed sequentially with deionized water and acetone, and dried at room temperature. Then the foam was immersed in KH1231's ethanol solution (1% v/v). After that it was picked out, rinsed with deionized water and dried in the air.

Instruments and Characterization.

SEM images were measured by a JEOL JSM-7500 scanning electron microscope. XPS pattern was characterized by a Thermo Escalab 250Xi spectrometer using an AlKα X-ray source with 1486.6 eV voltage, and XRD pattern was characterized by a Bruker D8-advanced X-ray diffractometer with 40 kV voltage and 40 mA current. Contact angle was measured by a Dataphysics OCA-20 contact angle analyzer.

Electrolysis Process of Anode and Cathode.

The electrolysis process was operated in a simple electrolytic cell. 0.1 mol/L sodium sulfate solution was used as the electrolyte. In the anode process, the resultant copper foam was chosen as the anode while a platinum filament was the cathode. In the cathode process, the resultant copper foam was chosen as the cathode while a platinum filament was the anode. The voltage added was 10 V, using Unit-T UTP3705 DC Power Supply. After electrolysis the copper foam was taken out from the electrolyte, and washed with deionized water so as to get rid of the sodium sulfate. After completely dried, a contact angle test was then operated.

Demo Controllable Permeation Experiment.

The resultant copper foam was fixed in a polytetrafluoroet hylene (PTFE) clamp, and two glass tubes were fixed on each side. Water was poured into the upper glass tube. A platinum filament was put under the water. The voltage added was 10 V.

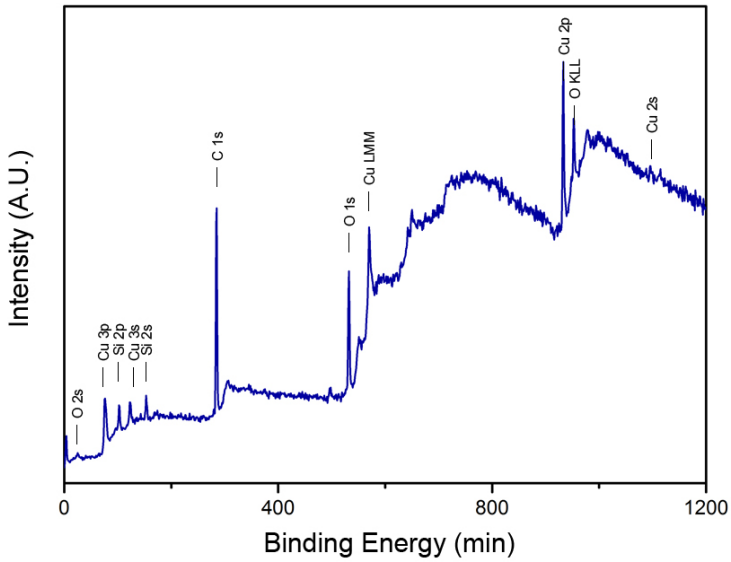

Fig.S1 XPS pattern of the as-prepared KH1231-modified copper foam. The main peaks at the binding energy of 285.6, 532.3, 932.6 and 102.2 eV are marked with C 1s, O 1s, Cu 2p and Si 2p, respectively. The strong C 1s peak was assigned to the alkane chains, while the SI 2p peak was belonging to the N-dodecyltrimethoxysilane molecules as well.

Fig.S2 The electrolytic cell for [redacted] um filament are connected to the positive or negative pole [redacted]

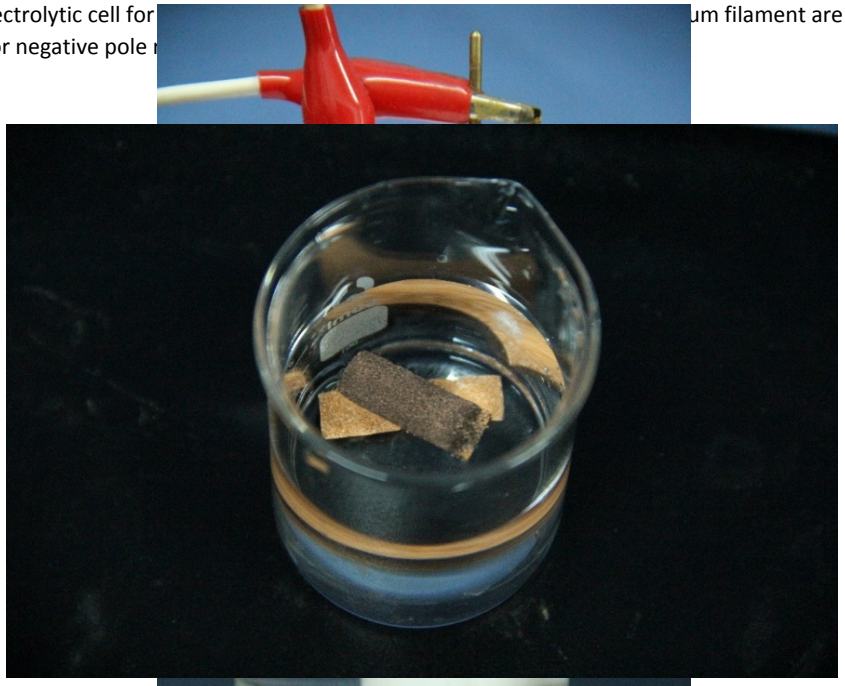

Fig.S3 A surface with the [redacted] properties that an ordinary hydrophobic surface doesn't [redacted] ing to the bottom, while a superhydrophobic KH1231-m[redacted] e anode process.

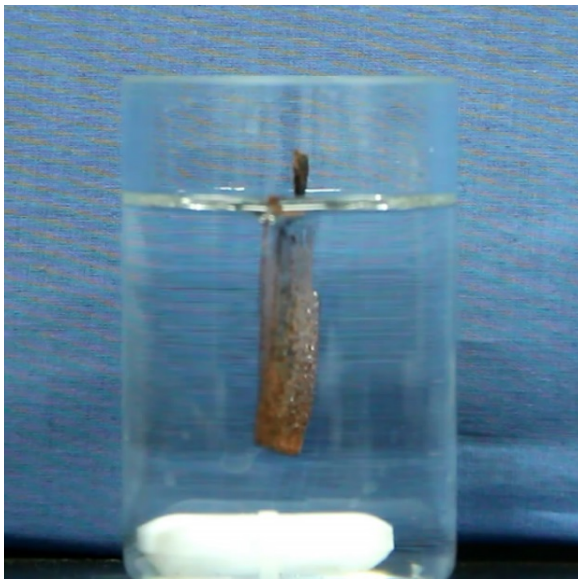

Fig.S4 A larger piece of modified foam for the demo electrode experiment. It showed the same result in the electrode process.

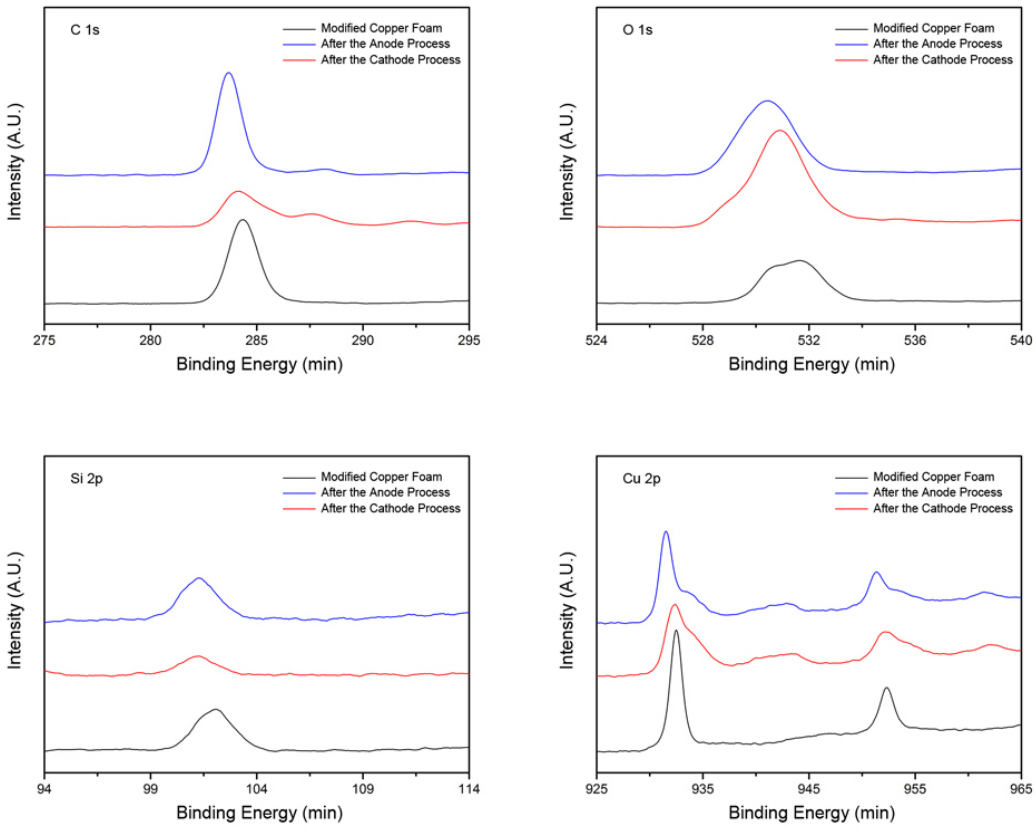

Fig.S5 XPS pattern for the four main peaks of C 1s, O 1s, Cu 2p and Si 2p of the modified foam before the electrode process, after the anode process and after the cathode process respectively. The changes in chemical composition generated by the electrode process can be verified in the patterns.