Supplementary Information:

Controlled transportation of droplets and higher fog collection efficiency on a multi-scale and multi-gradient copper wire

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Experimental section:

Fabrication of copper wires with wettable gradient and Laplace pressure gradient through gradient anodic oxidation

A series of copper wires with uniform diameter of 150 μm were burnished with sandpaper and cleaned with plentiful deionized water for several times. Then the copper wires fixed on the glass sheet were anodically oxidized with a 0.05mol/L sodium hydrate (NaOH) electrolyte solution. In order to obtain wettable gradient and Laplace pressure gradient on the copper wires, a narrow-strip cathode and pump were used to form current and time gradient. The electrochemical process was performed at a constant current of 0.5 A. After the anodic oxidation treatment, the copper wires were washed thoroughly with freshly distilled water for several time, then dried at 70^{o}C under vacuum for 1 h.

Characterization of microstructure

The surface structure of copper wire was observed by scanning electron microscope (SEM, Quanta FEG 250, FEI) at 25 kV. The movement behavior of water droplets was observed via the optical contact angle meter system (OCA 40, Data physics Instruments GmbH, Germany) with time scale. The chemical composition was analyzed by X-ray photo electron spectroscopy (XPS) (AXIS-Ultra instrument from Kratos Analytical) and energy disperse spectrometer (EDS) (JSM-6500F, JEOL). Water CAs were measured with an optical contact-angle meter system (OCA40 Micro, Dataphysics Instruments GmbH, Germany).

Supplementary Figure Legend: Fig. S1-S5

Fig. S1:

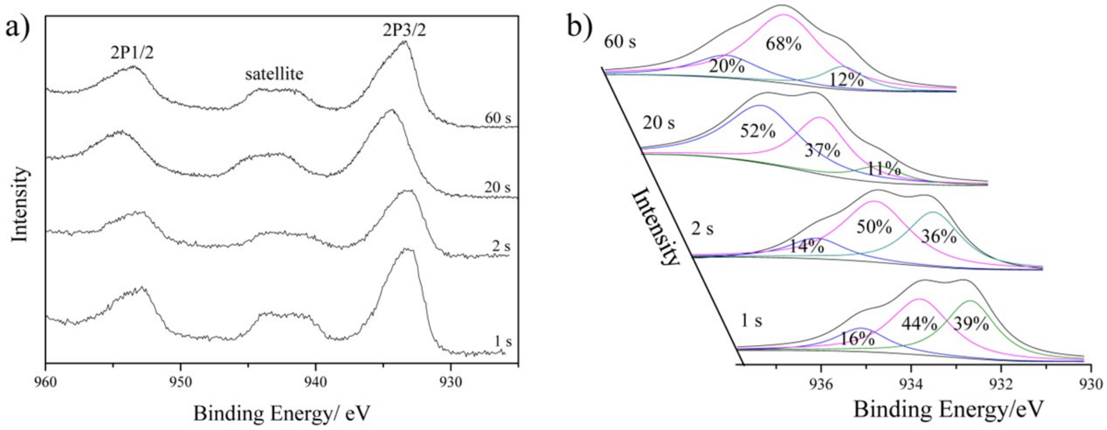

Fig. S1 (a) Cu 2p core-level XPS spectra of different samples prepared at different oxidation time. (b) Cu 2p3/2 XPS spectra of copper wire with different anodic oxidation time.

Fig. S2:

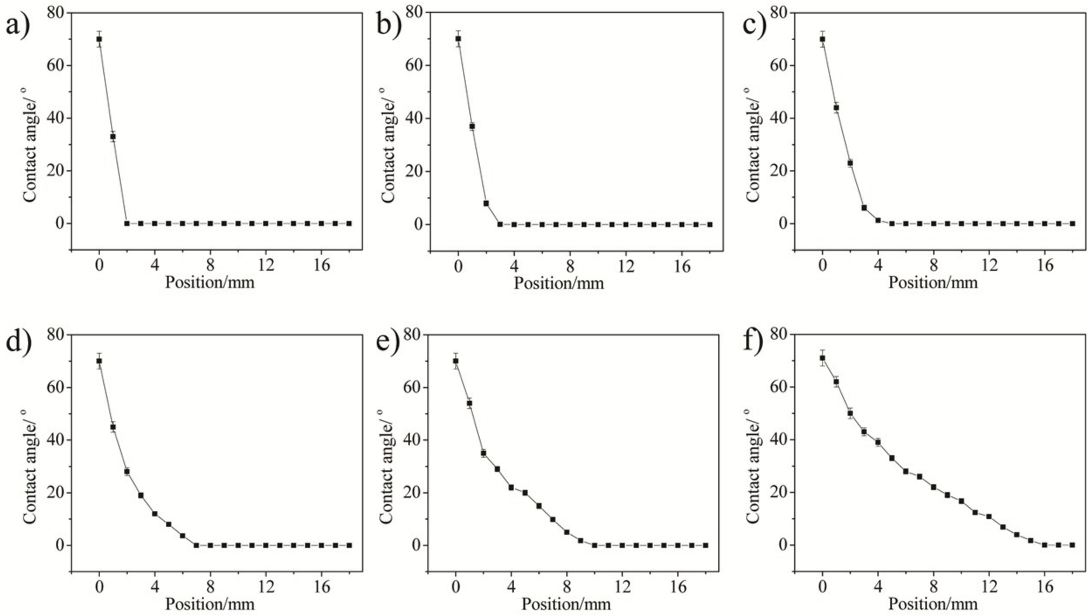

Fig. S2 The change of contact angle on different position of copper wire oxidized at different volume flow velocity of the electrolyte (Current: 0.5 A). (a) 5.3 L/h, (b) 7.9 L/h, (c) 13.2 L/h, (d) 18.5 L/h, (e) 26.5 L/h, (f) 42.4 L/h. By changing the volume flow velocity of the electrolyte, copper wires with different wettable gradient could be successfully obtained.

Fig. S3:

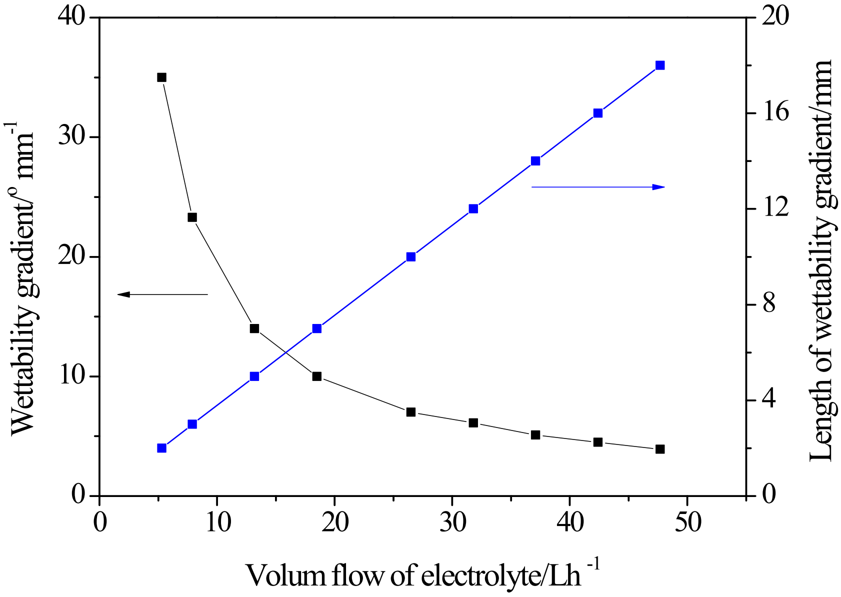

Fig. S3 The relationship between wettable gradient, the length of wettable gradient and volume flow velocity of electrolyte.

Fig. S4:

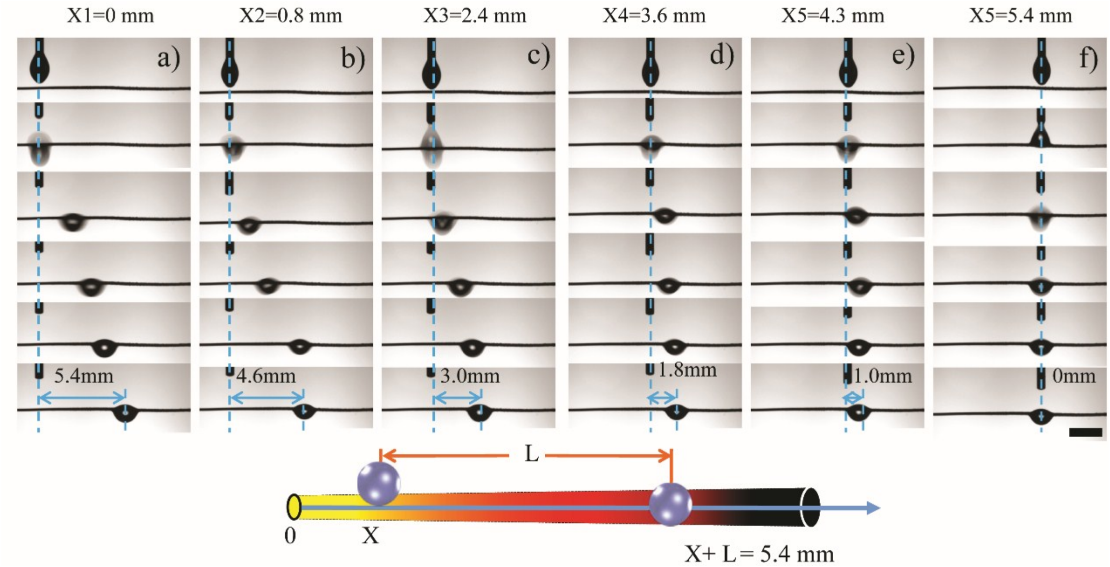

Fig. S4 The oil droplet movement behavior on Sample-A when droplets are placed at different position (The zero position is defined as the boundary between unoxidized part and oxidized part): (a) 0 mm, (b) 0.8 mm, (c) 2.4 mm, (d) 3.6 mm, (e) 4.3 mm, (f) 5.4 mm. The volume of the oil droplet (dichloroethane) is 1 μL. The scale is 2 mm.

Fig. S5:

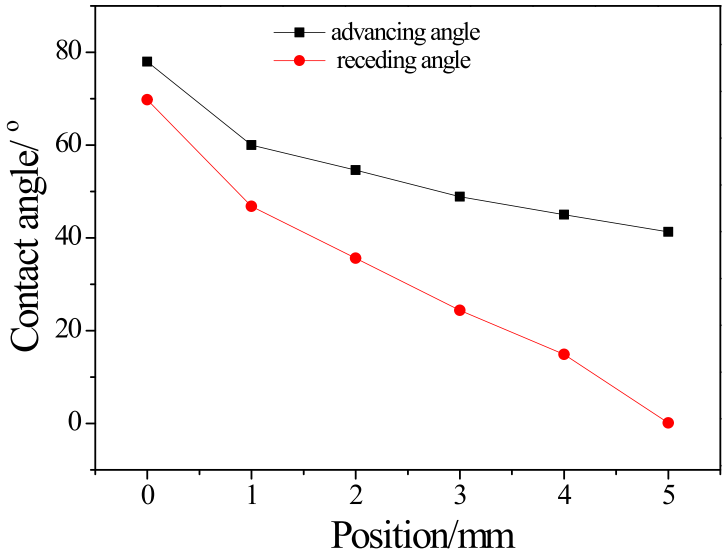

Fig. S5 The values of advancing and receding angle of Sample-A at different position (The zero position is defined as the boundary between unoxidized and oxidized part).

Supplementary Table:

Table S1. The results of EDS: O, Cu percent content and O/Cu after different oxidation time.

Time/s	0	2	10	30	60
O/%	4.36	28.28	34.03	34.03	44.57
Cu/%	34.53	22.92	20.67	20.12	18.95
O/Cu	0.13	1.23	1.65	1.69	2.35