Supplementary material (ESI) for Soft Matter

Supplementary Information

***Fabrication of polypyrrole (PPy) nanotube arrays*:**

The PPy nanotube arrays were prepared by a template method followed by electrochemical polymerization. A 60 μm thick anodized aluminium oxide (AAO) membrane, which consisted of an array of parallel and straight channels with a diameter of 200 nm, was used as a template. Firstly, a thin layer of gold was sputtered on one side of the AAO membrane making it conductive. The pores of the AAO membrane were then filled with an aqueous solution containing pyrrole monomers (0.1 mol/L) and dodecylbenzenesulfonic acid (HDBS) (0.03 mol/L). Electropolymerization was subsequently carried out to obtain the PPy nanotube arrays. The electrochemical deposition was conducted at 0.55 mV for 1800 s, using Ag/AgCl as the reference electrode and a platinum plate as the counter electrode. The AAO membrane containing the PPy nanotubes was sunsequently immersed in NaOH aqueous solution (3 mol/L) for 1 hour at room temperature (20 ºC) to dissolve the alumina membrane. After rinsing with water, a free-standing PPy nanotube films was obtained.

***Instruments and Characterization*:**

The SEM images of the substrates were obtained by a field-emission scanning electron microscope (JSM-6700F, Japan).

Contact angles were measured on an OCA20 machine (Data-Physics, Germany) at ambient temperature. The oil drops (about 2 μL) were dropped carefully onto the PPy nanotube film, which was immersed in electrolyte.

All the electrochemical switching experiments were performed in $LiClO_4$ aqueous solution (0.1 mol/L) at room temperature. A platinum plate was used as the counter electrode and Ag/AgCl was used as the reference electrode. An electrochemical station was used to control the electrochemical potential applied on the PPy films. An optical microscope lens and a charge-coupled device (CCD) camera system were used to capture the images during the switching process.

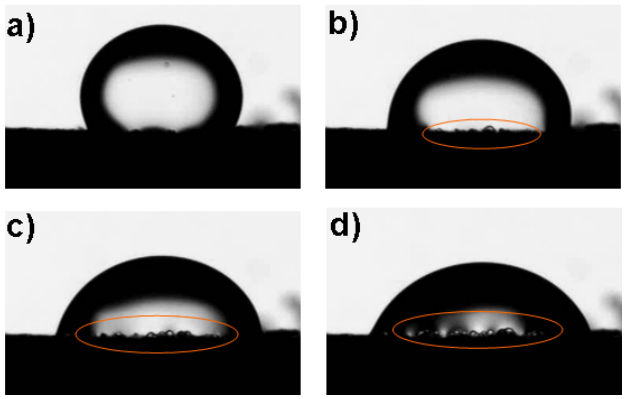

Fig. S1 a-d) The electrolyte between the oil drop and PPy microstructures was squeezed out when the oil drop spread on the PPy nanotube arrays proving a transition of Cassie state to Wenzel state.