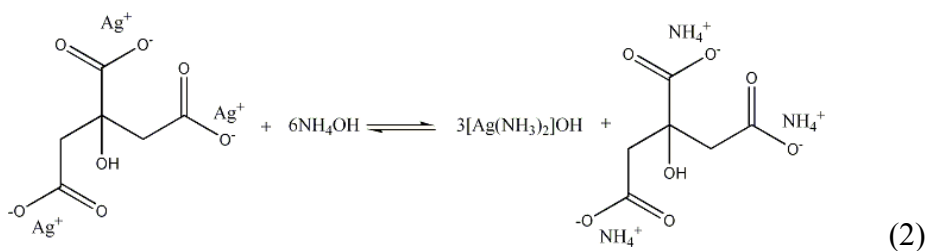
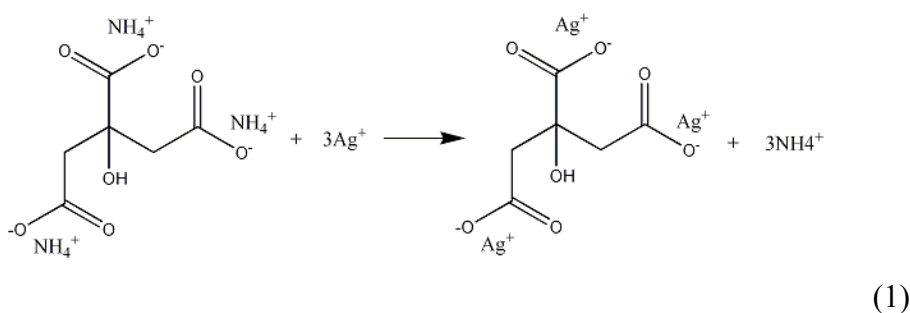


Experimental part

The substrate is copper plate (cold-rolled alloy C194) which has a nominal composition of 2.4% iron, 0.03% phosphorus, and 0.1% zinc, with the balance of copper. The copper plates were pretreated by electrolytic degreasing and acid cleaning process, then were rinsed by deionized water. The electroless deposition was conducted in the bath containing 13g/L AgNO₃, 19g/L C₆H₅O₇(NH₄)₃, 30g/L NaH₂PO₂·H₂O, and 30g/L H₃BO₃. The reaction was taken place in 50°C water bath. The pH was adjusted to 8 by NH₃·H₂O. Three major steps of reactions are taking place during this process, shown in Equation (1), (2) and (3). The as pre-treated plates with a size of 2cm×6cm were immersed into the solution for 5min to get the special hierarchical morphology. Then the specimen was washed with distilled water, after that, the specimen were dried with a hair drier.

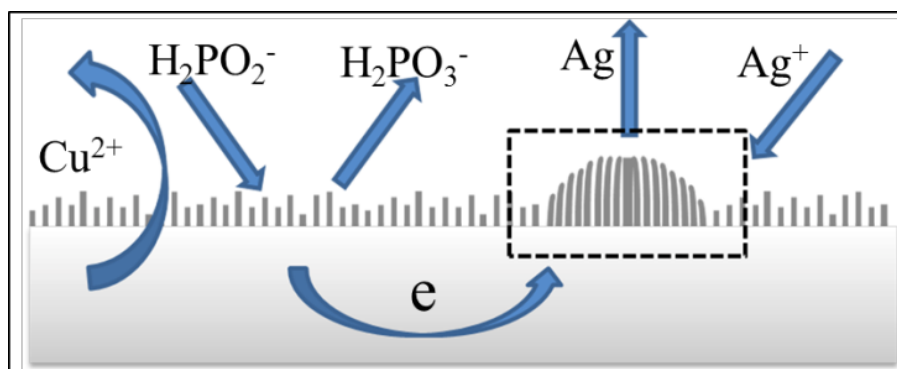


The as-prepared specimen were immersed in the ethanol solution(0.02mol/L) of n-hexadecanethiol at 50°C for 30min. Then they were cleaned ultrasonically with ethanol for 10min. Subsequently, they were dried at room temperature.

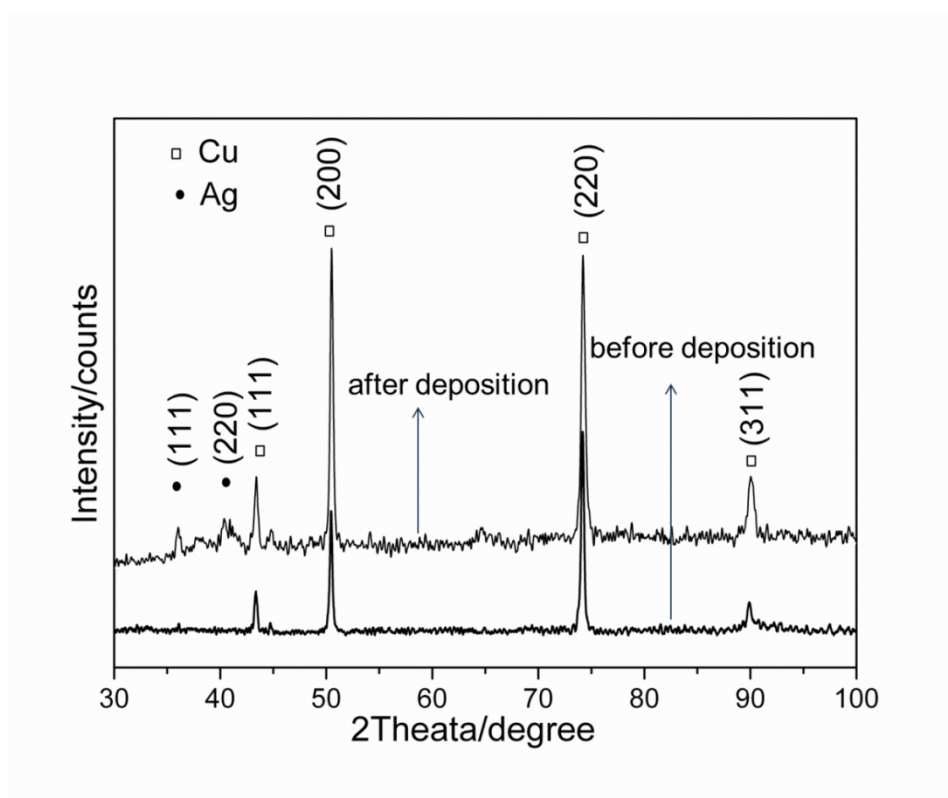
All of the reagents above are of chemical grade bought from Sinopharm Chemical Reagent Co.,Ltd.

The structure of as-deposited silver products were characterized by scanning electron microscopy (SEM, FEI SIRION 200). Water contact angle and sliding

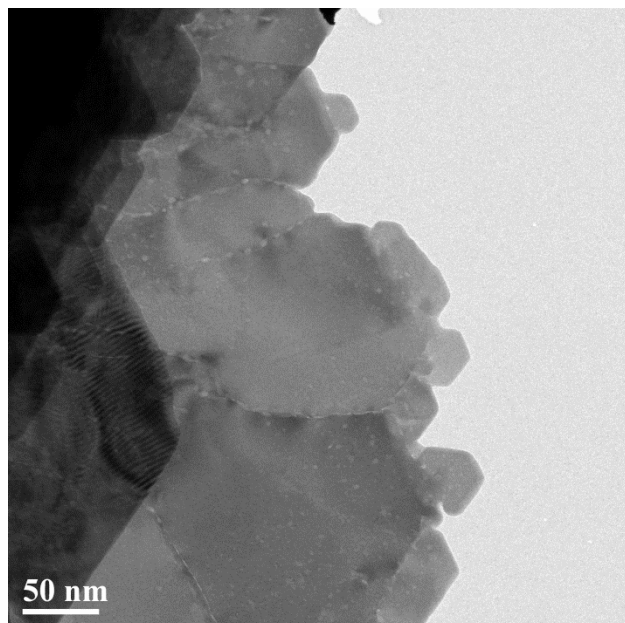
angle(SA) of the films were measured with 4 μ L water droplet at ambient temperature using an optical contact angle meter (Data physics OCA20). The surface chemical composition was investigated by X-ray photoelectron spectroscopy (XPS, Kratos AXIS Ultra^{DLD}). X-ray diffraction pattern was recorded from 20° to 100°, using Rigaku D/MAX-III A X-ray polycrystalline diffractometer with Cu K α radiation ($\lambda=0.15418$ nm).



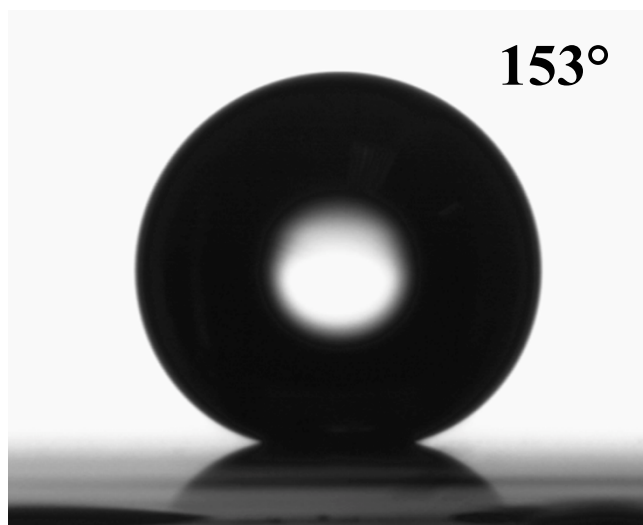
SI 1 The schematic diagram of the micro-battery mechanism on the copper surface.



SI 2 XRD spectra of copper plates before and after deposition of Ag for 5min.

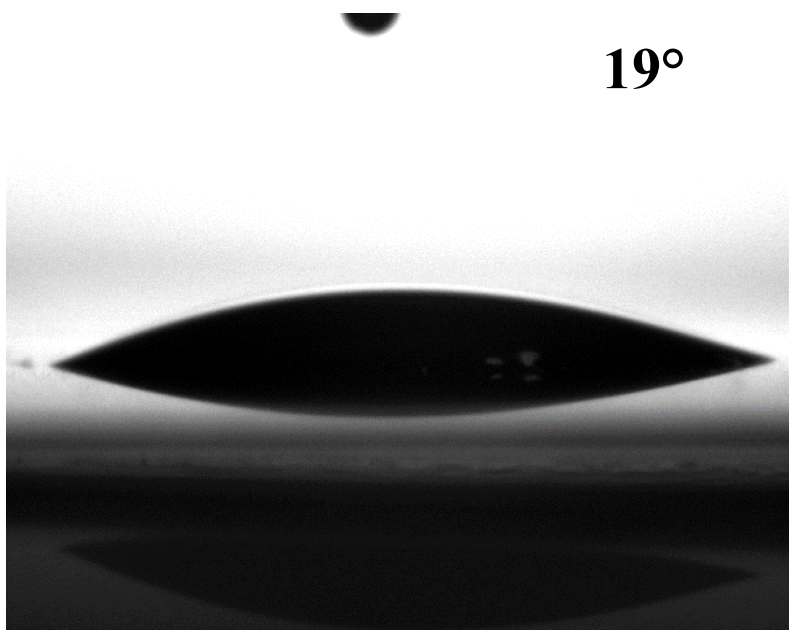


SI3 TEM image of the silver nanosheet prepared by galvanic exchange reaction.

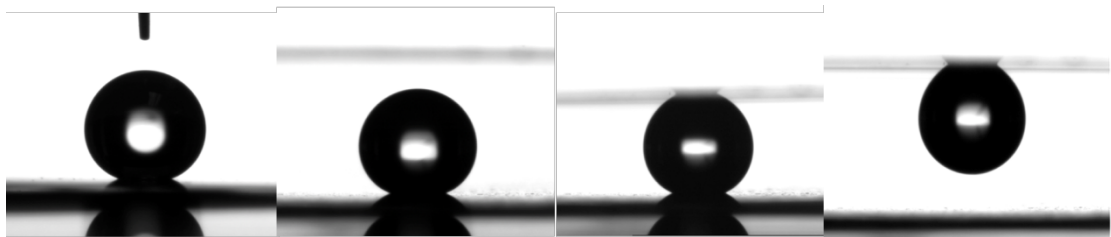


SI 4 The contact angle of the silver film after modification.

SI 5 Shown in the attached movie file



SI 6 The contact angle of the hierarchical silver film immediately after deposition.



SI 7 Water transport experiment