Supporting Information

A cellulose fibers-supported hierarchical forest-like cuprous oxide/copper array architecture as a flexible and free-standing electrode for symmetric supercapacitors

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Calculation process of Cu_2O theoretical specific capacitance

The theoretical pseudocapacitance of metal oxide can be calculated as (J. Mater. Chem. A, 2014, 2, 18229-18235; Adv. Mater., 2014, 26, 1044-1051):

$$C = \frac{n \times F}{M \times V} \quad (1)$$

where *n* is the mean number of the electrons transferred in the redox reaction, *F* is the Faraday constant, *M* is the molar mass of the metal oxide and *V* is the operating voltage window. Then, we obtained the theoretical capacitance of Cu_2O: (2×96485.3383/0.65/143.091) F g^{-1} ≈ 2075 F g^{-1}.

Calculation process of mass loading of Cu_2O

The mass of Cu_2O was calculated according to the following steps. Firstly, the mass of the Cu_2O/Cu/cellulose hybrid paper was weighed (coded as m_1) by electronic balance. Secondly, this electrode was dipped into a N_2-saturated 0.1 M HCl solution for about 10 min until no obvious color change occurred. During this step, the Cu_2O layer was removed by the HCl. The resultant was washed with a large amount of distilled water and completely dried at room temperature, and then weighed again (coded as m_2). Finally, the mass of Cu_2O attached on the electrode was calculated to be (m_1-m_2). The mass loading of Cu_2O per area is 0.26 mg cm^{-2}.

Calculation process of Brunauer–Emmett–Teller (BET) surface area of Cu_2O component

The BET surface areas of the Cu/cellulose paper and Cu_2O/Cu/cellulose hybrid paper are 16.6 and 13.2 m^2 g^{-1}, respectively. In addition, the mass percent of Cu_2O in the

Cu_2O/Cu/cellulose hybrid paper is around 1.3%. Therefore, we can roughly calculate the surface area of Cu_2O component: [(16.6-13.2)/1.3%] $m^2 g^{-1} \approx 261.5 m^2 g^{-1}$.

Table S1. Comparison of specific capacitance, specific energy and cycling stability of some Cu_2O-based symmetric/asymmetric supercapacitor devices.

Electrodes	Type	Maximum specific capacitance (F g^{-1})	Specific energy (W h kg^{-1})	Cycling stability	Potential range (V)	Electrolyte	Refs
Cu_2O@Cu nanoneedle arrays//active carbon	Asymmetric	77 (5 mV s^{-1})	35.6 (0.9 kW kg^{-1})	92% (10000 cycles, 1 A g^{-1})	0–1.8	1 M KOH	[54]
Rose rock-shaped nano-Cu_2O anchored graphene	Symmetric	92 (1 A g^{-1})	25 (0.6935 kW kg^{-1})	–	0–1.4	6 M KOH	[52]
Cu_2O-$Cu(OH)_2$ nanoflakes/graphene/stainless steel	Symmetric	104 (5 A g^{-1})	20.4 (3.6 kW kg^{-1})	87% (2000 cycles, 10 A g^{-1})	0–1.2	0.5 M Na_2SO_4	[57]
Graphene/polypyrrole/Cu_2O–$Cu(OH)_2$/Ni foam	Symmetric	225 (10 A g^{-1})	20 (8 kW kg^{-1})	90% (2000 cycles, 10 A g^{-1})	0–0.8	0.5 M Na_2SO_4	[58]
Cu_2O/CuO/Co_3O_4 core-shell nanowires//activated graphene	Asymmetric	–	12 (0.162 kW kg^{-1})	–	0–1.4	3 M KOH	[56]
Forest-like Cu_2O/Cu array structure	Symmetric	409 (1.9 A g^{-1})	24.0 (0.625 kW kg^{-1})	90.2% (10000 cycles, 30.8 A g^{-1})	0–0.65	1 M KOH	This work

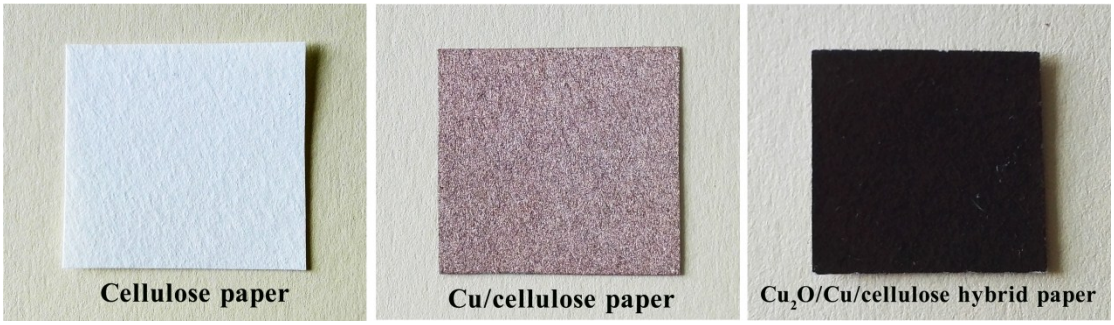

Figure S1. Optical photographs of the cellulose paper, Cu/cellulose paper and Cu_2O/Cu/cellulose hybrid paper.

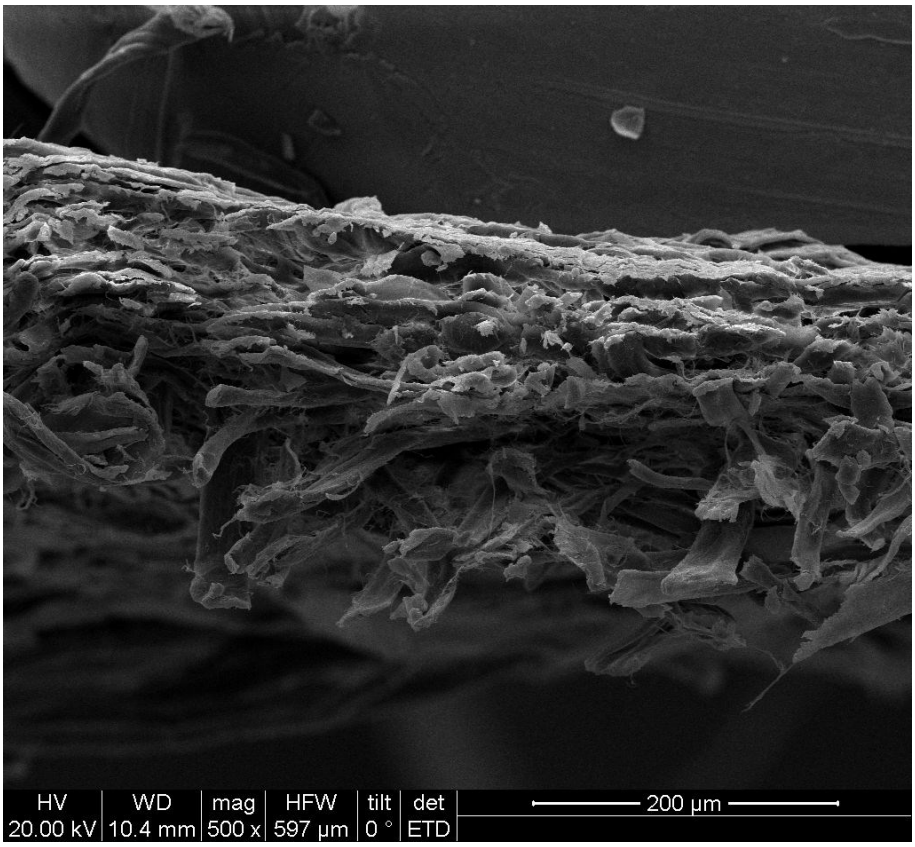

Figure S2. Cross-section SEM image of the cellulose paper to present its three-dimensional fibers framework structure.

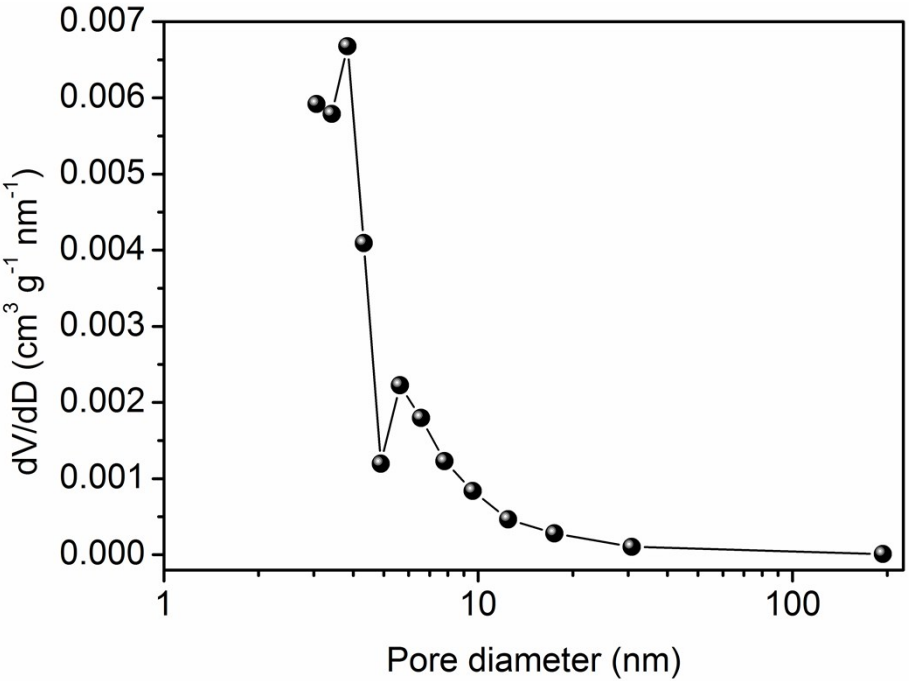

Figure S3. Barrett–Joyner–Halenda (BJH) desorption pore size distribution of the Cu_2O/Cu/cellulose hybrid paper.

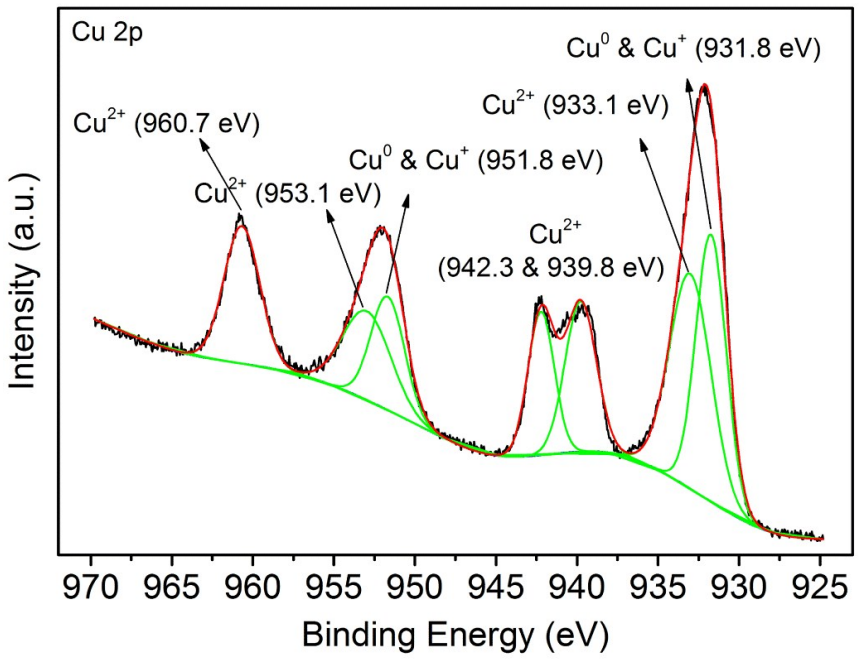

Figure S4. High-resolution XPS spectrum of Cu 2p core level of the Cu_2O/Cu/cellulose hybrid paper after the electrochemical tests to demonstrate the plentiful generation of CuO or $Cu(OH)_2$.

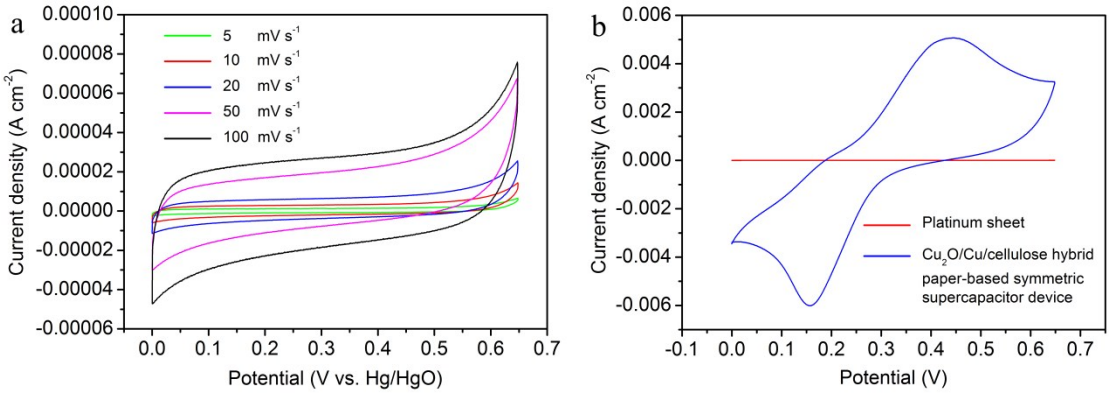

Figure S5. (a) CV curves of the platinum sheet at various scan rates measured in a three-electrode configuration. (b) CV curves of the platinum sheet and Cu_2O/Cu/cellulose hybrid paper-based symmetric supercapacitor device at the scan rate of 5 mV s^{-1}.

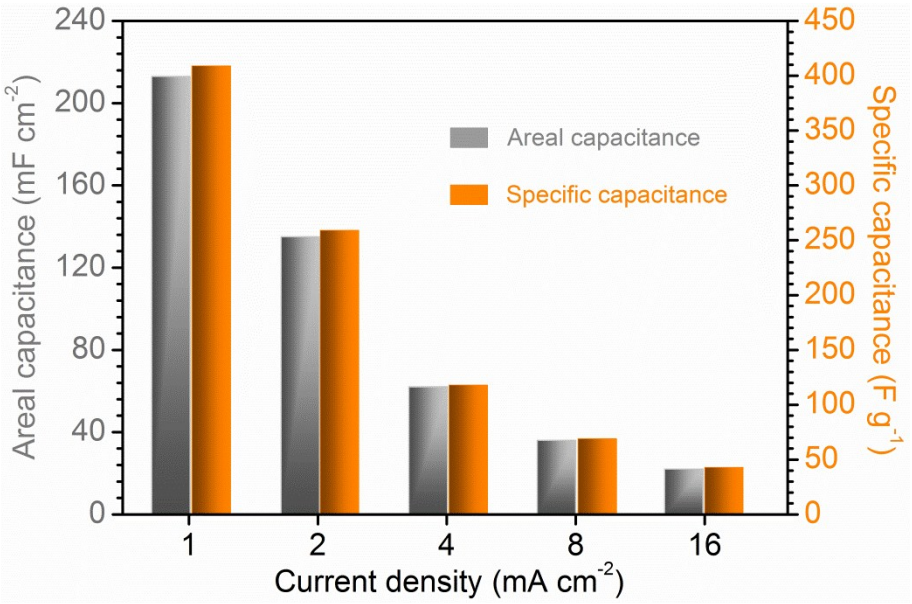

Figure S6. Areal and specific capacitances of the Cu_2O/Cu/cellulose hybrid paper-based symmetric supercapacitor device at various current densities