

Electronic supplementary information

Facet-dependent nonenzymatic glucose sensor properties of Cu₂O cubes and octahedra

Linli Tang^a, Jian Lv^a, Chuncai Kong^{*ab}, Zhimao Yang^{ab}, and Jianhui Li^{*c}

a.School of Science, MOE Key Laboratory for Non-Equilibrium Synthesis and Modulation of Condensed Matter, State Key Laboratory for Mechanical Behavior of Materials, Xi'an Jiaotong University, Xi'an 710049, ShaanXi, People's Republic of China. E-mail: kongchc@gmail.com.

b.Collaborative Innovation Center of Suzhou Nano Science and Technology, Xi'an Jiaotong University Suzhou Academy. Suzhou 21500, People's Republic of China

c.Department of Surgical Oncology, Shaanxi Provincial People's Hospital, Third Affiliated Hospital of Medical College of Xi'an Jiaotong University, Xi'an 710049, Shaanxi, People's Republic of China. E-mail: lijhmd@163.com

Experimental sections

Materials

Cupric sulfate (CuSO₄·5H₂O), Ethylene Diamine Tetraacetic Acid (EDTA), sodium hydroxide (NaOH) and glucose (C₆H₁₂O₆) were obtained from Aladdin reagent. All chemicals used in our experiment were of analytical grade and used without further purification. Deionized water (18.25 MΩ·cm) from a MilliQ Academic water purification system (Millipore Corp.) was used in all preparations.

Preparation of the Cu₂O cubes and octahedra

A typical synthesis of Cu₂O cubes structures was as follows: 2 mmol CuSO₄·5H₂O and 1 mmol EDTA were dissolved in 40 mL deionized water using a breaker, and after 30 min, heated to 55°C, then 5 mL of 3 M NaOH solution was added into the above solution, after being stirred for 5 min. 10 mL of 0.11 M C₆H₁₂O₆ solution was added into the solution under a constant stirring at 55°C for 1.0 h to obtain the desired products,

and then the samples were centrifuged at 12000 rpm for 1 min (XIANYI TG16-WS centrifuged). The precipitates were collected and washed with deionized water and anhydrous ethanol many times, respectively. Finally they were dried at 60°C for 6 h in a vacuum oven. The Cu₂O octahedra were synthesized according to our previous works.¹

1. L. Tang, J. Lv, S. Sun, X. Zhang, C. Kong, X. Song and Z. Yang, *New J. Chem.*, 2014, **38**, 4656-4660.

Characterization

The crystalline phase of the samples was characterized by the X-ray diffractometer (Bruker-AXS D8 ADVANCE) with Cu-K α ($\lambda = 1.54060 \text{ \AA}$) in the range of 20~80°. The morphology of the samples was investigated by field-emission scanning electron microscopy (FESEM) using a JEOL (JSM-7000F) at an accelerating voltage of 20 KV.

Electrochemical measurements

A nonenzyme amperometric electrochemical sensor was prepared by casting Nafion-impregnated Cu₂O powders onto a glassy carbon electrode (GCE) at room temperature. Before modification, the bare GCE with a diameter of 5.0 mm was polished to a mirror-like surface with 0.5 μm and 50 nm alumina slurry, respectively, and then washed ultrasonically in deionized water and ethanol for a few minutes, followed drying at room temperature. The modified electrode was prepared as follows: 5 mg of the as-prepared Cu₂O powders were respectively dispersed in 5 mL of Nafion solution (0.05%, Sigma-Aldrich), and then sonicated for 20 min to obtain homogeneous dispersed solution. 20 μL of the above suspension was dropped onto the pretreated GCE (denoted as Cu₂O/Nafion/GCE), and dried at room temperature, respectively. Electrochemical measurements were carried out on a CHI 660E electrochemical workstation (Shanghai Chenhua Co. Ltd., China). The as-prepared Cu₂O/Nafion/GCE was used as the working electrode with a Pt foil as the counter electrode and Hg/HgO as the reference electrode. C-V and CA were performed in 100 mL of 0.1 M NaOH aqueous solution.

Further, CA was operated by successively injecting different concentration of glucose into 100 mL of 0.1 M NaOH aqueous solution under the potential of +0.65 V. EIS was performed on a VersaSTAT MC workstation, the impedance Z was expressed in terms of a real (Z') and an imaginary (Z'') component. All the measurements were carried out at room temperature.

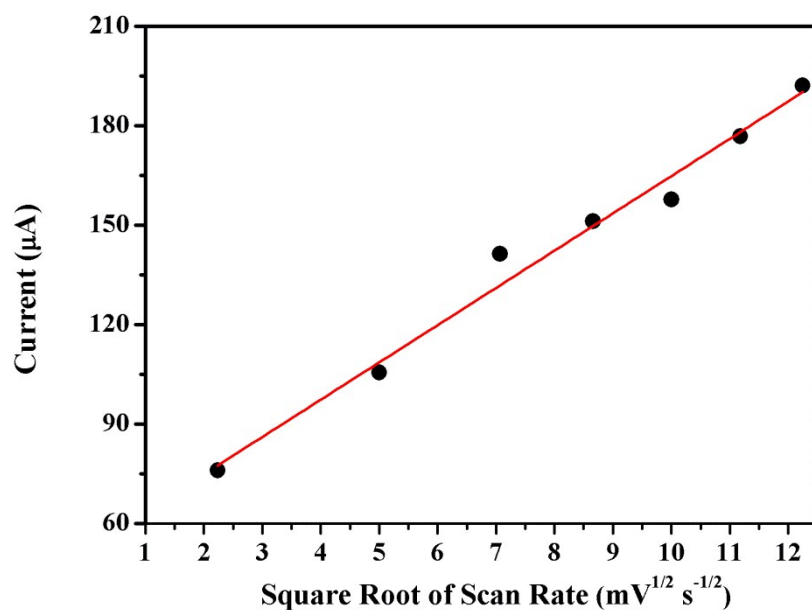


Fig. S1 The relations between peak currents and the square root of scan rate.

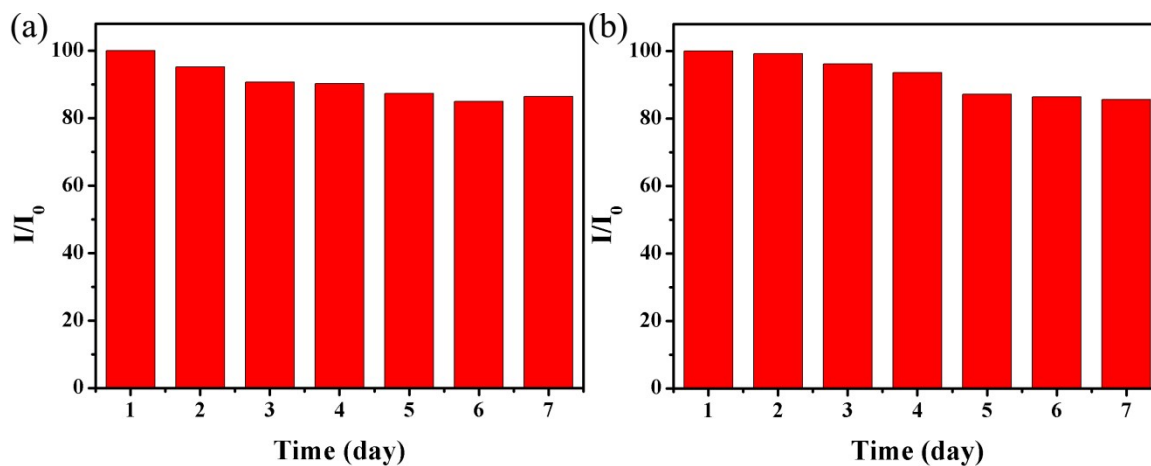


Fig. S2 Long-term stability of the (a) cubic and (b) octahedral Cu_2O -Nafion-GCE electrodes.

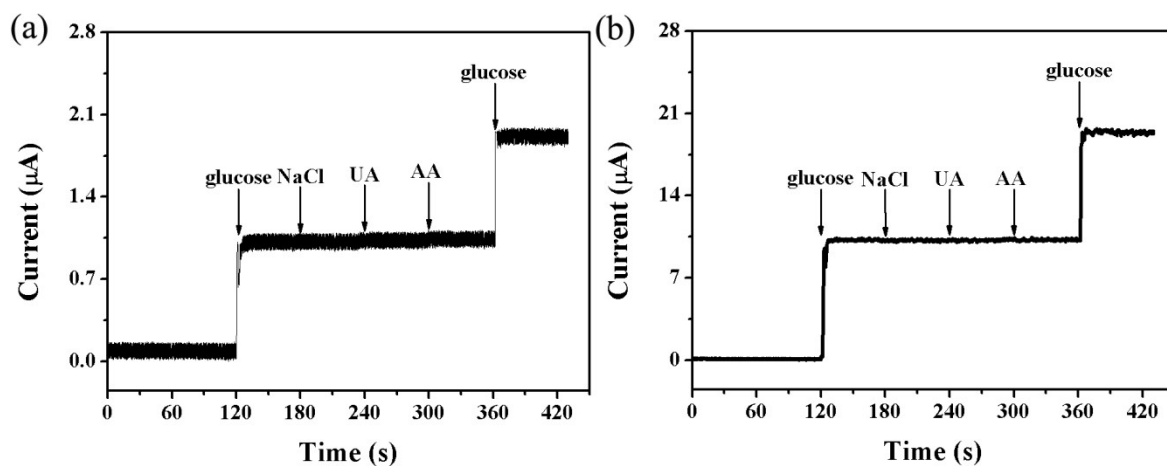


Fig. S3 Anti-interference test of the (a) cubic and (b) octahedral Cu_2O -Nafion-GCE electrodes in 0.1 M

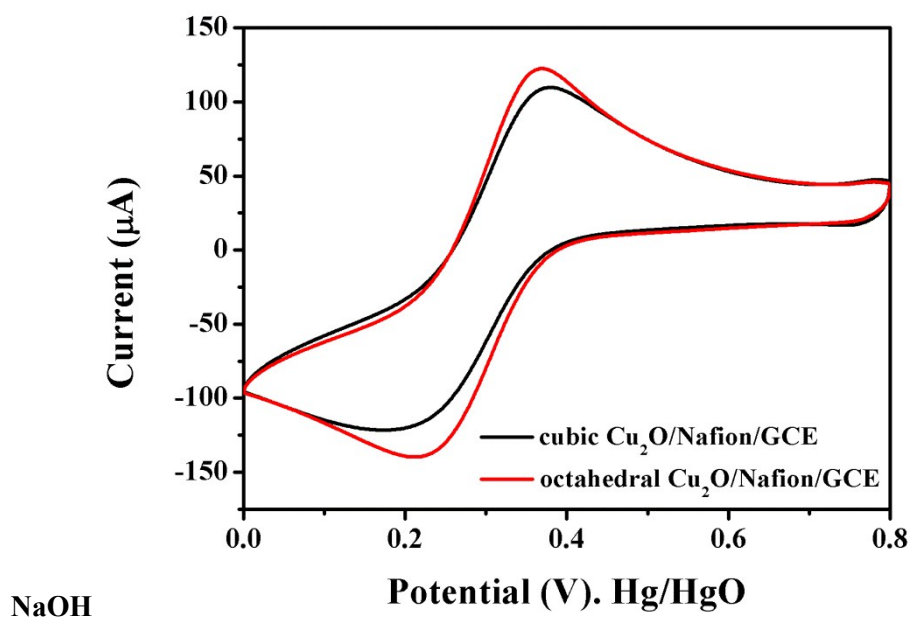


Fig. S4 The C-V curves of the (a) cubic and (b) octahedral Cu_2O -Nafion-GCE electrodes in 5 mM $\text{K}_3[\text{Fe}(\text{CN})_6]$ with 0.1 M KCl solution at the scan rate of 100 mV/s.

Table S1 Determination of glucose concentration in the blood serum samples by the electrodes based on the

Cu₂O crystals (n = 3).

Samples	Hospital (mM)	Our sensors (mM)	R.S.D (%)
1 ^a	4.63	4.83	6.70
2 ^a	4.03	4.01	5.49
3 ^b	5.54	5.36	4.37
4 ^b	5.34	5.19	4.20

^a octahedral Cu₂O-Nafion-GCE electrode.

^b cubic Cu₂O-Nafion-GCE electrode.