Electronic Supplementary Information

A very facile strategy for the synthesis of ultrathin CuO nanorods towards non-enzymatic glucose sensing

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Experimental Section

Chemicals

Cu(NO₃)₂ and NaOH were obtained from Aladdin reagent. All chemicals used in our experiment were of analytical grade and used without further purification. Deionized water (18.2 MΩ cm) from a Milli-Q Academic water purification system (Millipore Corp.) was used in all preparations.

Synthesis of CuO nanorods

In a typical procedure, Cu(NO₃)₂ (0.10 mmol) was dissolved in anhydrous ethanol (30 mL) using a beaker under a constant ultra-sonic for 10 min at room temperature. And then the beaker was kept in a water bath at 75 °C. When the temperature of the inner solution reached 75 °C for 2 min, a NaOH ethanol solution (0.02 M) was added into the beaker. Once the NaOH ethanol solution was added, a light blue precipitate formed gradually (see Scheme S1).

The mixture was kept stirring for further 5 min after adding the NaOH ethanol solution. Afterwards, a volume pure water was introduction into the above light-blue reaction system, and it can be seen that brown products were immediately formed along with the adding of water. About 15 min after adding over the water, the precipitations were allowed to cool to room temperature naturally. Finally, the obtained products were centrifuged at 10000 rpm for 5 min (XIANYI TG16-WS centrifuge). The precipitates were centrifuged three more in anhydrous ethanol.

Characterization
The transmission electron microscopy (TEM) and high resolution transmission electron microscopy (HRTEM) analysis as well as selected-area electron diffraction (SAED) analysis were performed on a JEOL JEM-2100 transmission electron microscope operating at an accelerating voltage of 200 kV. Sample for the TEM analysis was prepared by ultrasonic dispersion for 5 min with ethanol (3 mL) in a 5 mL centrifuge tube. Then, the products were dropped onto a carbon-coated copper grid and dried in air before TEM analysis. Powder X-ray diffraction (XRD) pattern was recorded on a Bruker AXS D8 ADVANCE diffractometer operated at 40 kV voltage and 40 mA current using Cu Kα radiation (λ = 1.5406 Å). Surface analysis for the as-prepared products was performed by an X-ray photoelectron spectroscopy (XPS) using an Al mono Kα X-ray source operated at 90 W (England, Kratos Axis Ultra DLD). The vibration property was characterized by a LabRAM HR800 Raman spectroscopy. The chemical composition and purity of the products were examined by electron energy dispersive X-ray (EDX) analysis. Nitrogen adsorption measurements were measured at 77 K by a Micromeritics ASAP 2020 system utilizing Barrett–Emmett–Teller (BET) calculations for surface areas.

**Preparation of CuO-Nafion-glassy carbon modified electrode and electrochemical measurements**

An enzyme-free amperometric electrochemical sensor was fabricated by casting Nafion impregnated CuO powders onto a glassy carbon electrode at room temperature. The modified electrode was prepared as follows: 2 mg of the as-prepared CuO powders was dispersed in 2 mL Nafion solution (0.05%, Sigma–Aldrich). 20 μL of the suspension with dispersed CuO was dropped on the pre-treated glassy carbon electrode (denoted as CuO/Nafion/GCE), and dried at room temperature. Before modification, the bare GCE of 5.0 mm in diameter was polished to a mirror-like surface with 0.5 μm, 0.05 μm and 50 nm alumina slurry, and then washed ultrasonically in deionized water, 50% (v/v) nitric acid solution, ethanol, and deionized water for a few minutes, respectively. The as-prepared CuO/Nafion/GCE was used as the working electrode with a platinum foil as the counter electrode and an Ag/AgCl as the reference electrode. Electrochemical measurements were carried out on an Ametek VMC-4 electrochemical analyzer with a conventional three-electrode system in a 0.1 M KOH aqueous solution.

![Fig. S1 XRD pattern of the precursor of Cu(NO₃)₂/NaOH/ethanol synthesized at high temperature.](Image)
**Fig. S2** FTIR spectrum of the blue product as shown in Scheme 1.

**Fig. S3** TEM image and the corresponding SAED pattern of the precursor of Cu(NO$_3$)$_2$/NaOH/ethanol synthesized at high temperature.
Fig. S4 Linear sweep voltammograms collected for the as-prepared CuO/Nafion/GCE in a range of glucose concentrations between 0 and 5 mM at a scan rate of 50 mV s$^{-1}$ in a 0.1 M KOH solution.

Fig. S5 (a) The amperometric response of the 1D CuO nanorods-modified electrodes to 100 μM glucose in 0.1 M KOH at +0.55 V over 2000 second. (b) The amperometric response to 100 μM glucose over a 30 day period.
Fig. S6 (a) Nitrogen adsorption–desorption isotherm of the as-prepared ultrathin CuO nanorods. (b) Nitrogen adsorption–desorption isotherm of the CuO nanobelts.

Fig. S7 (a) Amperometric response of the CuO nanobelts/Nafion/GCE with successive addition of different amounts of glucose to 0.1 M KOH at +0.55 V vs. Ag/AgCl. (b) The corresponding current vs. glucose concentration calibration curve.

Table S1. Comparison of the key performance characteristics of some of existing catalysts for enzyme-free electrooxidation of glucose.

<table>
<thead>
<tr>
<th>Type of electrodes</th>
<th>Potential (V)</th>
<th>Sensitivity (μA mM⁻¹ cm⁻²)</th>
<th>Linear range (up to, mM)</th>
<th>LOD (μM)</th>
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</tr>
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<td>Porous CuO</td>
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<td>CuO nanoparticles</td>
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<td>0.5</td>
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<td>4.0</td>
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<td>404.5</td>
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<td>1.0</td>
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References


