One-pot hydrothermal growth of three-dimensional CuO microflowers on Ni foam as hybrid electrode for sensing glucose

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Table S1. The reactive condition needed for the synthesis of CuO with different morphology.

Morphology	Size of Ni foam (width ×length)	Cu(NO$_3$)$_2$·3H$_2$O （mM）	CO(NH$_2$)$_2$ （mM）
Microflower	1.5 cm×3 cm	2	10
Microurchin	1.5 cm×3 cm	0.2	1
Microsheet	1.5 cm×3 cm	10	50

Table S2. The surface area of CuO with different morphologies

Different CuO morphology	BET surface area (m²/g)
Urchin-like	15.0082
Flower-like	18.5432
Sheet-like	1.1111

Note: The reactive conditions of three CuO microstructures are consistent with the reactive conditions listed in Table S1 except for absence of Ni foam.
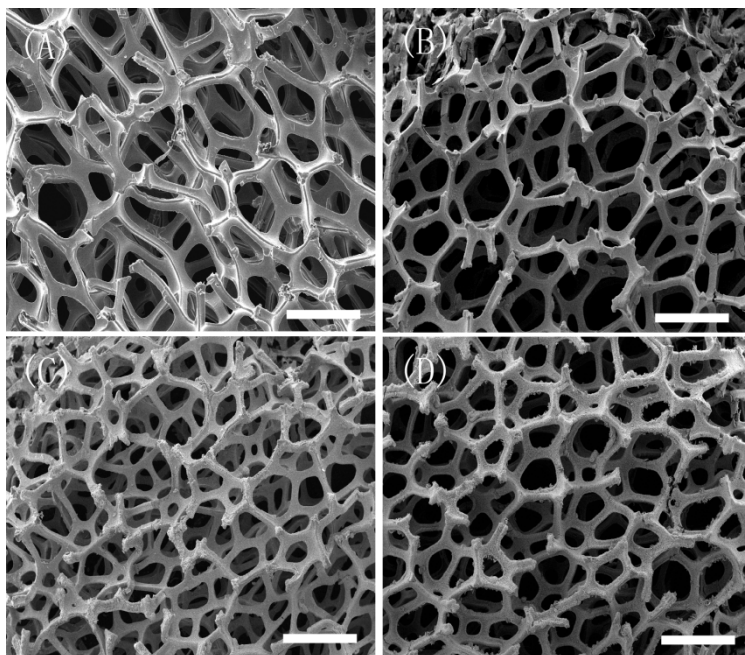
Fig. S1 SEM images of Ni foam, CuO microurchin/Ni foam, CuO microflower/Ni foam and CuO microsheet/Ni foam (scale bar=500 μm).
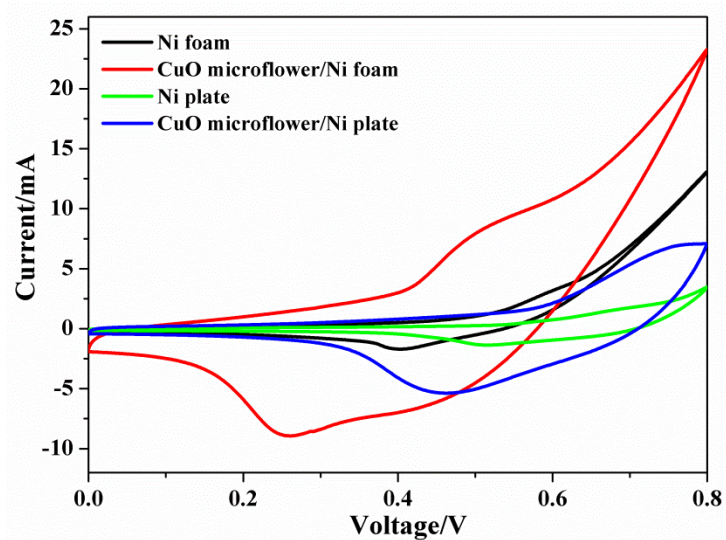

Fig. S2 CVs of Ni foam electrode, CuO microflower/Ni foam, flat Ni plate and CuO microflower/Ni plate in 0.1 M NaOH solution.
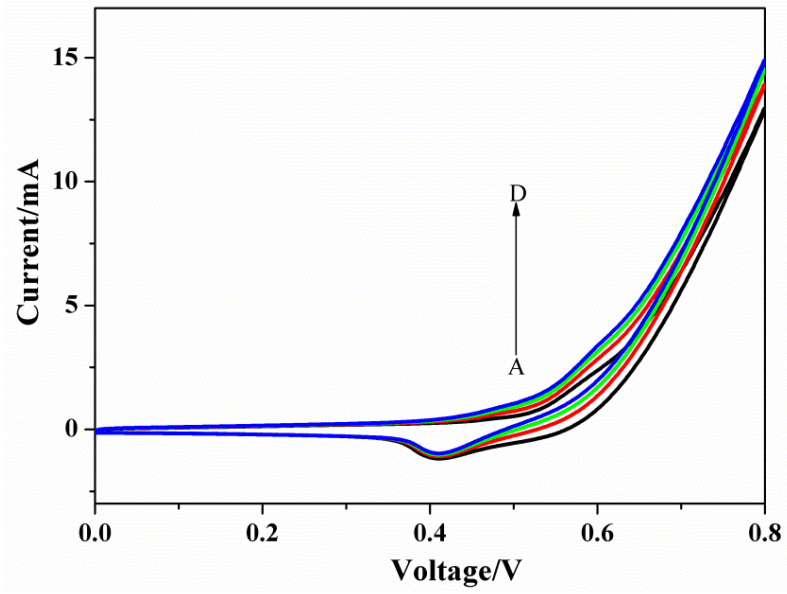
Fig. S3 CV curves of Ni foam electrode in 0.1 M NaOH solution containing 0.2, 0.4, 0.6 mM glucose, respectively.
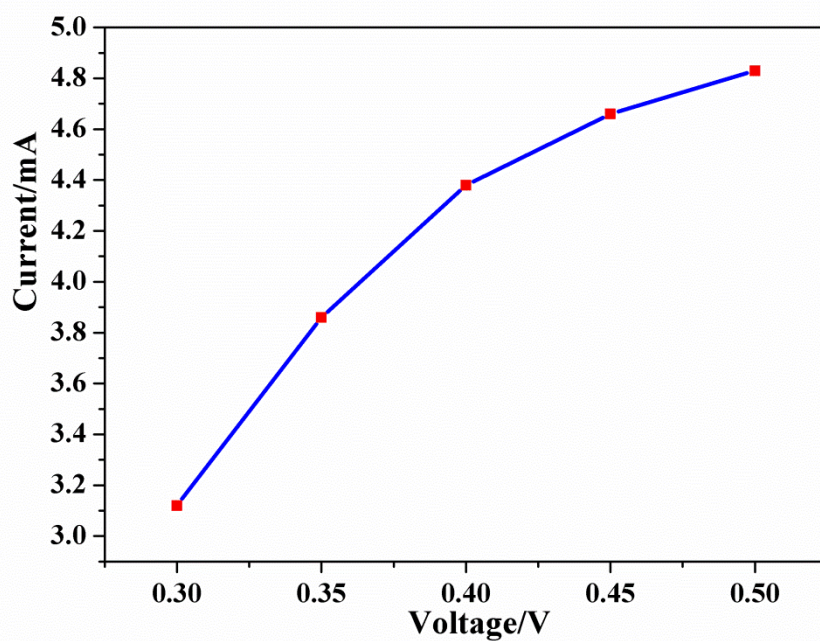
Fig. S4 Effect of potential on amperometric response at the hybrid electrode of CuO microflower/Ni foam.
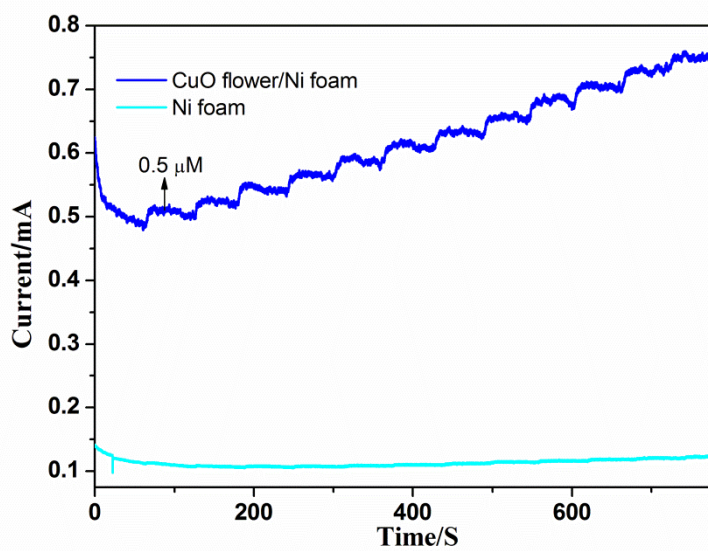

Fig. S5 Amperometric response of Ni foam electrode and CuO microflower/Ni foam electrode to 0.5-6 μM glucose in 0.1 M NaOH solution.

The calculation method of electroactive surface area of electrode:

The electroactive surface area of electrode was calculated according to the following Randles-Sevcik equation[1], and the corresponding calculation procedure is shown as follows:

$$Ip=2.69\times10^5AD^{1/2}n^{2/3}\gamma^{1/2}C$$

where n is the number of electrons participating in the redox reaction, A is the area of the electrode (cm^2), D is the diffusion coefficient of the molecule in solution ($cm^2\cdot s^{-1}$), C is the concentration of the probe molecule in the bulk solution ($mol\cdot cm^{-3}$), and γ is the scan rate of the potential perturbation ($V\cdot s^{-1}$). In this study, 20 mM $Fe(CN)_6^{4-/3-}$ redox system was used as electrolyte for cyclic voltammetry measurement. In this system, n is 1, and D is $6.7\times10^{-6}cm^2s^{-1}$. In the cyclic voltammetry test, the scan rate of the potential perturbation is 20 mVs^{-1}, and the value of peak current obtained form the cyclic voltammograms is 3.23 mA. The relevant values were substituted into Randles-Sevcik equation, afterthat the electroactive surface area of electrode (1.65 cm^2) can be obtained.

Reference:
[1] S. Hrapovic, Y. Liu, K. B. Male, J. H. T. Luong, Anal. Chem. 2004, 76, 1083-1088.

Table S3. The performance comparison between CuNWs/GTE and the other reported glucose sensors.

Electrode	Detection limit (µM)	Sensitivity (µAmM^{-1}cm^{2-})	Linear range	Reference
CuO flowers/Ni foam	0.16	1084	0.5 µM-3.5 mM	This work
CuO nanospheres/glass carbon electrode	1	404	Up to 2.6 mM	33
CuO nanofibers /glass carbon electrode	0.8	431	6 µM-2.5 mM	34
CuO nanocubes/graphene	0.7	1360	2 µM-4 mM	35
CuO nanoparticles / single-walled carbon nanotubes	0.05	1610	0.05 µM-1.8 mM	2
NiO nanoparticles/ single-walled carbon nanotubes	0.3	907	1 µM-1 mM	36
Cu nanoparticles/ multi-walled carbon nanotubes	2	992	0.5 mM-1 mM	37

Table S4. Amperometric determination of glucose in human blood serum samples.

Sample	Concentration (mM)	Added (mM)	Found (mM)	RSD[a] (%)	Recovery (%)
1	4.6	0.5	4.9	3.3	96
2	5.3	0.5	5.4	2.8	92
3	6.8	0.5	7.4	3.5	101
4	11.5	0.5	12.7	4.2	106

[a] RSD (%) calculated from three repetitive trials.