Supplementary Materials

Simple-preparation of Cu-Ni/CuO-NiO by solution plasma for the application in glucose enzyme-free sensor

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The detailed description for XRD results of NO, CNO and CO catalysts with 2θ angles and diffraction planes in Fig. 1 are as the following:

We can see that CO (red curve) has more obvious diffraction peaks at 32.54°, 35.46°, 35.56°, 38.76°, 38.92°, 46.27°, 48.70°, 51.41°, 53.55°, 58.33°, 61.56°, 66.22° and 68.15°. These are corresponding to (110), (002), (-111), (111), (200), (-112), (-202), (112), (020), (202), (-113), (-311) and (220) crystal plane of CuO (JCPDS No. 89-5899), respectively. In addition, there are two diffraction peaks of Cu (111) and (200) crystal plane (JCPDS NO. 70-3039) at 43.34° and 50.48°, which shows that we successfully prepared copper and copper oxide (CO) by solution plasma method and heat treatment. For NO (black curve), there are obvious diffraction peaks at 37.24°, 43.29° and 62.90°, which correspond to (110), (-111) and (111) crystal plane of NiO (JCPDS No. 89-7131), respectively. At the same time, the diffraction peaks of the (111), (200), (220) crystal planes of Ni (JCPDS No. 70-1849) appeared at 44.48°, 51.83° and 76.35°, indicating that we successfully prepared nickel and nickel oxide (NO) by solution plasma method and heat treatment. Finally observed CNO (blue curve) and it can be seen from the figure that after the introduction of Cu and CuO on the basis of Ni and NiO, the positions of the diffraction peaks of NO and CNO are not much different. For carefully comparing the NO (red) and CNO (black) patterns, it can be seen the diffraction peaks at about 37° and 43° are broadened to a certain extent, the same diffraction peak of 2θ around 43 ° has also changed to a certain extent. It is worth noting the strongest diffraction peak at about 43° of CNO is similar with that of NO probably because the lattice constant of Cu and NiO are too close to distinguish them clearly by XRD detection. The most obvious case is that the diffraction peak at about 62°. Compared with the peak shape of NO, the obvious broaden diffraction peak of CNO at 62° may relative to NiO and CuO, respectively.

Table S1 Comparison of the reproducibility and stability of other previously related materials nonenzymatic glucose sensor with this work.

Electrodes	RSD (the same electrode)	RSD (different electrodes)	Long-term stability	Reference
Cu/Ni/C	2.07%	3.01%	60 days - 90%	[1]
CuNi/fMWCNTs	2.6%	3.2%	30 days - 90%	[2]
Ni/Cu/CNTs	3.6%	4.9%	25 days - 90%	[3]
Cu-xCu_2O NPs	1.02%	——	6000 s - 92.2%	[4]
Cu-MOF	——	5%	7 days - 85%	[5]
NiO-NC@rGO	2.2%	3.1%	10 days - 95%	[6]
Ni(II)-CP/C60	4.37%	1.16%	30 days – 93%	[7]
CNO/GNs	1.72%	3.28%	42 d - 90.68%	This work

References:

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Table S2. Detection of glucose in human blood samples.

Commercial glucose meter[a] (mM)	This method (mM)	Recovery (%)
5.4	5.62	104.1
	5.26	97.4
	5.80	107.4

[a] Commercial glucose meter: Yuwell 580 glucose meter, Jiangsu Yuyue medical equipment & supply Co., Ltd, China.

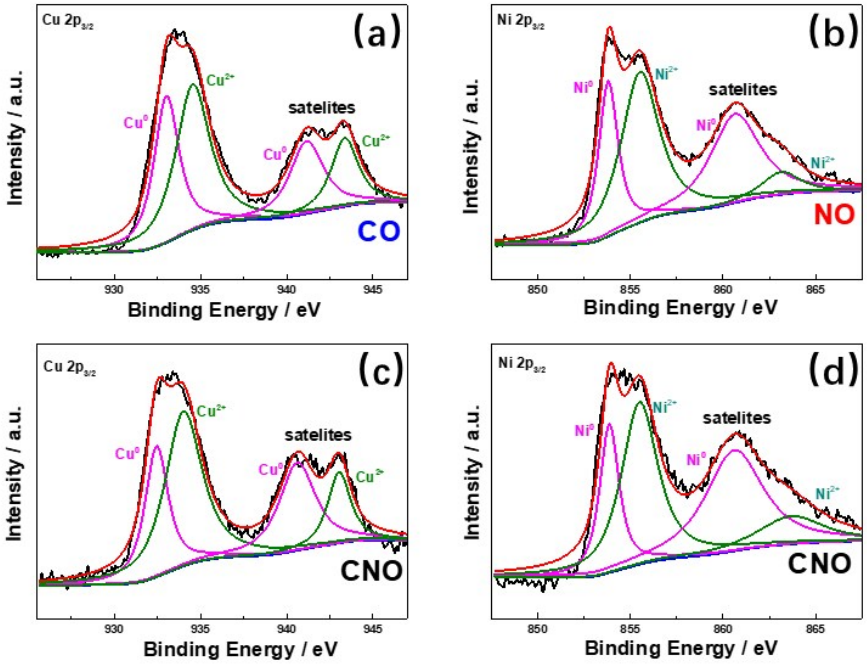

Fig. S1. XPS spectra of (a) Cu $2p_{3/2}$ for CO, (b) Ni $2p_{3/2}$ for NO, (c) Cu $2p_{3/2}$ for CNO and (d) Ni $2p_{3/2}$ for CNO.

In order to explore further evidences for the elemental composition of the as-prepared CNO, the XPS measurements were conducted for three samples (Fig. S1). As depicted in Fig. S1a and Fig. S1c, in the Cu $2p_{3/2}$ region, we can easily see that the values for CNO manifest an obvious negative shift comparing with the binding energy of Cu^0 and Cu^{2+} for CO. Meanwhile the binding energy of Ni^0 and Ni^{2+} for CNO (Fig. S2d) also smaller than that for NO (Fig. S1b). These negative shifts are owing to the electronic interaction which could make the Cu and Ni element easier to convert between zero-valence, divalence and trivalence during the catalytic process for better catalytic performance. Combined with the XRD and XPS results, Cu, CuO, Ni and NiO are indeed co-exist in CNO sample.