Supplementary Information

One-step synthesis of Pt-NiO nanoplate arrays/reduced graphene oxide nanocomposites for nonenzymatic glucose sensing

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Fig. S1 Digital image of 10 mL dispersion of GO before (A) and after urea reduction (B). (C) SEM image of rGO. (D) AFM image of GO. (E) Raman spectroscopy of GO (a) and rGO (b). (F) FT-IR spectroscopy of GO (a) and rGO (b). (G) XRD patterns of GO (a) and rGO (b). Raman spectra were performed at room temperature with a LabRAM HR spectrometer and an argon ion laser operating at a wavelength of 632.8 nm as the excitation (Jobin Yvon Ltd, France). Atomic force microscopy (AFM) measurements were carried out with an AJ–III (Shanghai Aijian Nanotechnology, China) using a tapping mode. Standard silicon cantilevers (spring constant 0.6–6 N m⁻¹) were used under their resonance frequency (typically, 60–150 kHz). Fourier transform infrared spectroscopy (FT-IR) was recorded on a Perkin–Elmer Spectrome 100 spectrometer (Perkin–Elmer Company, USA) using KBr pellets.

The reduction of GO by urea into rGO was confirmed by SEM, AFM, Raman spectra, FT-IR and XRD. Fig. S1 showed the digital image of 10 mL dispersion of GO before (Fig. S1A) and after (Fig.

S1B) urea was added. It clearly showed that the color of dispersion was changed from yellow to black. The result illustrated the GO could be reduced by urea. Fig. S1C showed the SEM image of the product after the urea was added, showing a typical surface of rGO. Fig. S1D shows AFM images of the GO. The thickness of GO is found to be 0.602 nm, which is consistent with literatures. Raman spectra, FT-IR and XRD were further used to examine the degree of the GO reduction. As shown in Fig. S1E, the intensity ratio of D/G was increased obviously in comparison with that of the GO spectrum, indicating the deoxygenation in rGO [1,2]. Fig. S1F showed the FT-IR spectrum of GO (curve a) and rGO (curve b). For GO, the peaks at 3423, 1722, 1621 and 1065 cm⁻¹ are assigned to the -OH stretching vibrations, C=O stretching vibrations in carboxylic acid, the vibrations of the residual water and C–O stretching vibrations, respectively [3]. For rGO, the new peaks at 1580 and 1215 cm⁻¹ are attributed to absorbance of C=C conjugation and C-C band [4], suggesting the reduction of GO. Fig. S1G shows the XRD patterns of GO (curve a) and rGO (curve b). It is found that GO exhibits a strong peak at 13.6 ° and a weak peak at 24.8 ° corresponding to the carbon (002), suggesting GO has been successfully prepared [5-7]. But for rGO, it is observed that only a wide peak at 20-28 ° (curve b), confirming the reduction of GO [7]. The above results indicated that urea is an effective and environmentally friendly reductant.



Fig. S2 AFM image of the Pt-NiO/rGO.



Fig. S3 SEM images of Pt-NiO formed on rGO surface with different Pt/Ni molar ratios: (A) 1:50,(B) 1:200 and (C) 0:1.

The effect of Pt/Ni ratio (1:50, 1:200 and 0:1) on the morphology of Pt-NiO/rGO nanocomposite was investigated. Fig. S3 showed the SEM images of Pt-NiO formed on rGO surface with different Pt/Ni ratios. At the Pt/Ni molar ratio were 1:50, 1:200 and 0:1, the Pt-NiO formed nanoparticles with average diameter of 150 nm (Fig. S3A), 100 nm (Fig. S3B) and 200 nm (Fig. S3C), respectively. These results clearly indicated that the appropriate Pt/Ni ratio also played an important role in controlling the morphology of Pt-NiO nanoplate arrays.



Fig. S4 (A) CVs of different volume of Pt-NiO/rGO constructed sensors in 0.1 M KCl solution containing 5.0 mM K₃Fe(CN)₆. Insert: I_p of Pt-NiO/rGO/GCE versus the volume of Pt-NiO/rGO constructed sensor. (B) CVs of different volume of Pt-NiO/rGO constructed sensor in 0.1 M NaOH in the presence of 0.5 mM glucose. Insert: In the absence of 0.5 mM glucose. Scan rate: 50 mV s⁻¹.



Fig. S5 CVs of Pt-NiO/rGO/GCE with different Pt/Ni molar ratios: (A) 1:50, (B) 1:200 and (C) 0:1 in 0.1 M NaOH in the absence (a) and presence (b) of 0.5 mM glucose. Scan rate: 50 mV s⁻¹. (D) The optimal catalytic potential ($E_{\text{oxidation}}$) and the largest catalytic current density (j_{cat}) for glucose oxidation at Pt-NiO/rGO/GCE versus the Pt/Ni molar ratio.



Fig. S6 CVs of Pt-NiO/rGO/GCE in 0.1 M pH=7.0 PBS (curve a) and 0.1 M NaOH (curve b) in the presence of 0.5 mM glucose. Scan rate: 50 mV s⁻¹. Inset: The j_{cat} versus the pH of the electrolyte solution.

Blood serum sample (mM)	Diluted samples (mM)	Added (mM)	Determined by colorimetric enzymatic method (mM)	Determined by our nonenzymatic sensor (mM)	Recovery (%)	RSD (%,n=5)
10.20	1.02	0.50	1.51	1.50	98.68	3.95
	5.10	1.00	6.12	6.19	101.48	4.16
	10.20	1.50	11.62	11.46	97.95	4.39

Table S1. Determination of glucose in blood serum sample.

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