Electronic Supplementary Material (ESI) for RSC Advances.

Surpporting Information

Controlled Synthesis of Graphene-$Gd(OH)_3$ Nanocomposites and Their Applications for Detection of Ascorbic Acid

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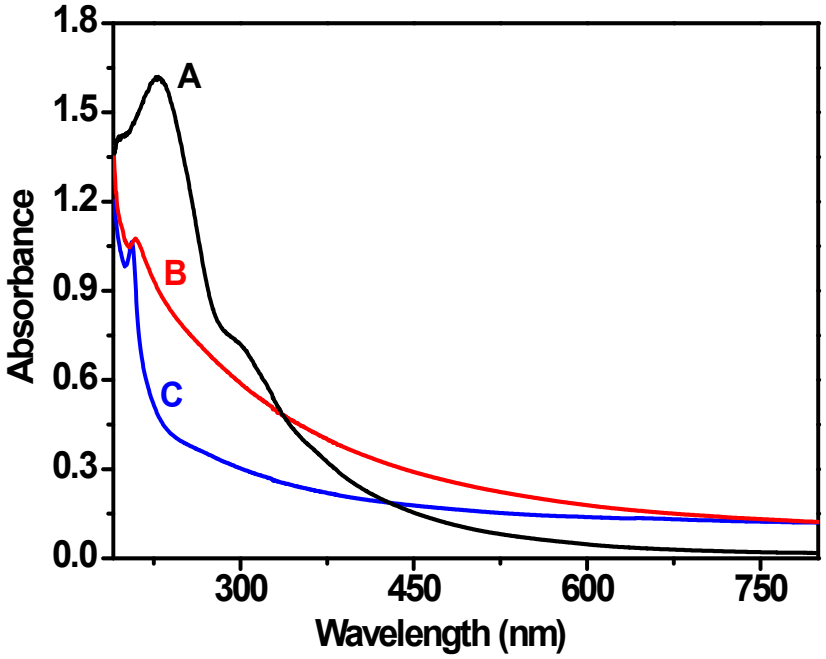

Fig. S1. UV-vis spectra of GO (A), GR-$Gd(OH)_3$-1 (B) and GR-$Gd(OH)_3$-2 (C).

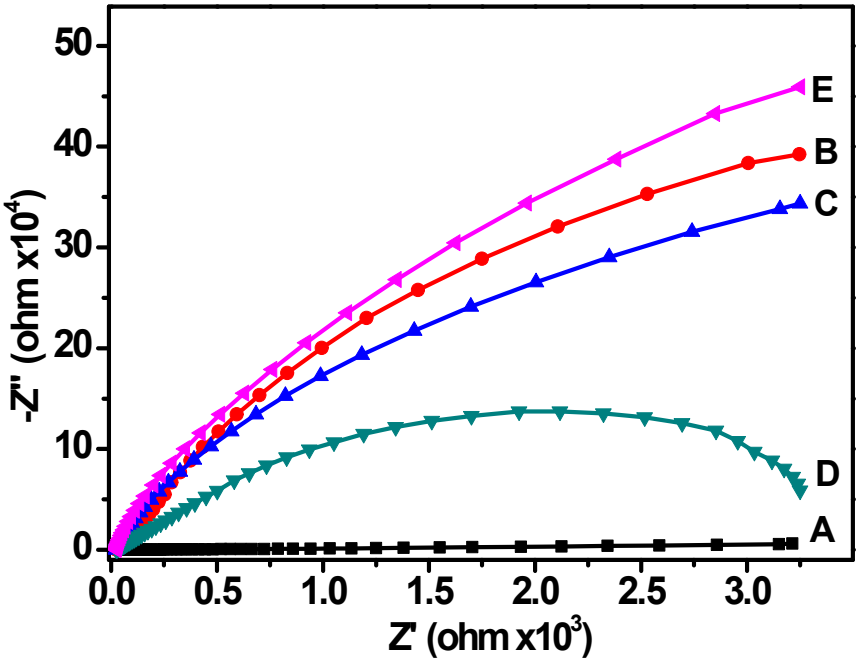

Fig. S2. EIS of GCE/GR (A), GCE/$Gd(OH)_3$ (B), GCE/GR-$Gd(OH)_3$-1 (C), GCE/GR-$Gd(OH)_3$-2 (D) and bare GCE (E) in 0.1 M PBS-0.5 mM AA aqueous solution recorded in the frequency range of 0.0-4.0 x 10^4 Hz.

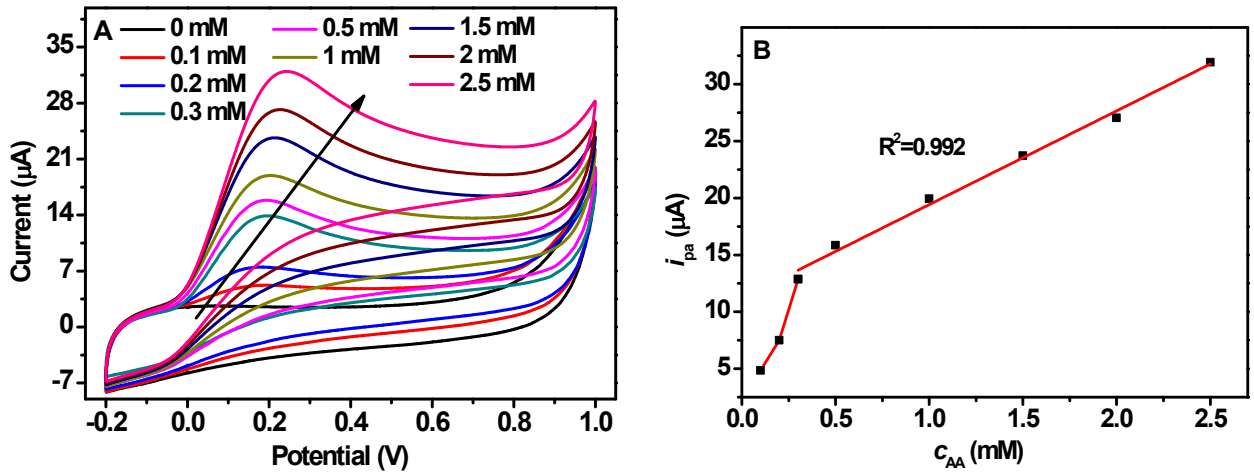

Fig. S3 A) CV of GCE/GR-Gd(OH)$_3$-2 in 0.1 M PBS (pH = 7.0) at varying concentration of AA (0.1-2.5 mM) and B) the relationship between i_{pa} and c_{AA}.

Holding the protential of oxidation peak at 0.185 V with the c_{AA} ranged from 0.3-2.5mM, a linear relationship between i_{pa} and c_{AA} was found. The resulting calibration plot is a straight line, with a coefficient of 0.992, given by the equation:

$$i_{pa}(\mu A) = 8.23 c_{AA}(\mathrm{mM}) + 11.19 \qquad (S1)$$

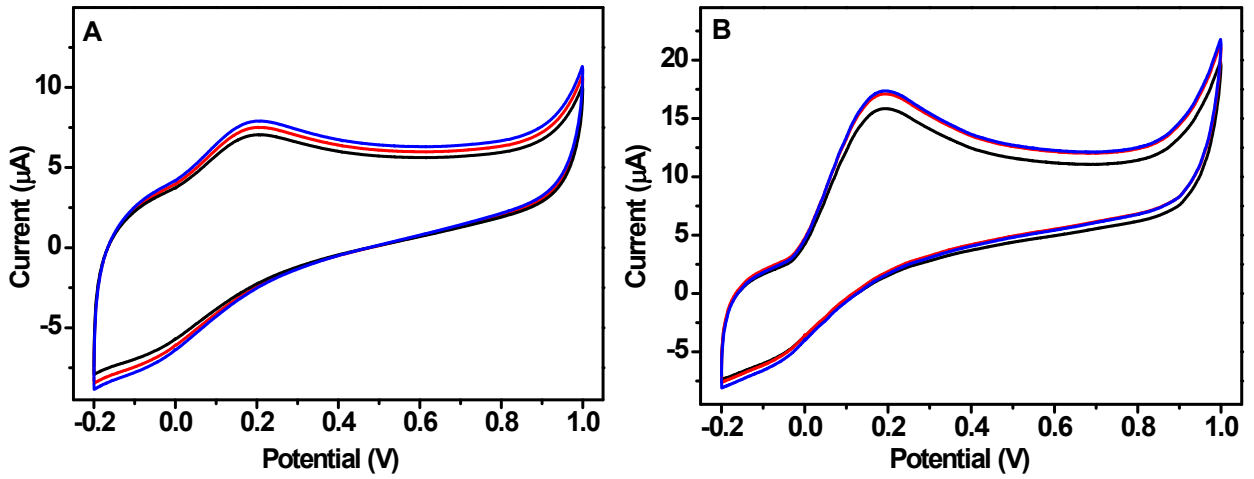

Fig. S4 CV curves of GCE/GR-Gd(OH)$_3$-1 (A) and GCE/GR-Gd(OH)$_3$-2 (B) in 0.1 M PBS with 0.5mM AA at 100 mV s^{-1}. In each case the measurements were performed for three times to check the reproducibility.

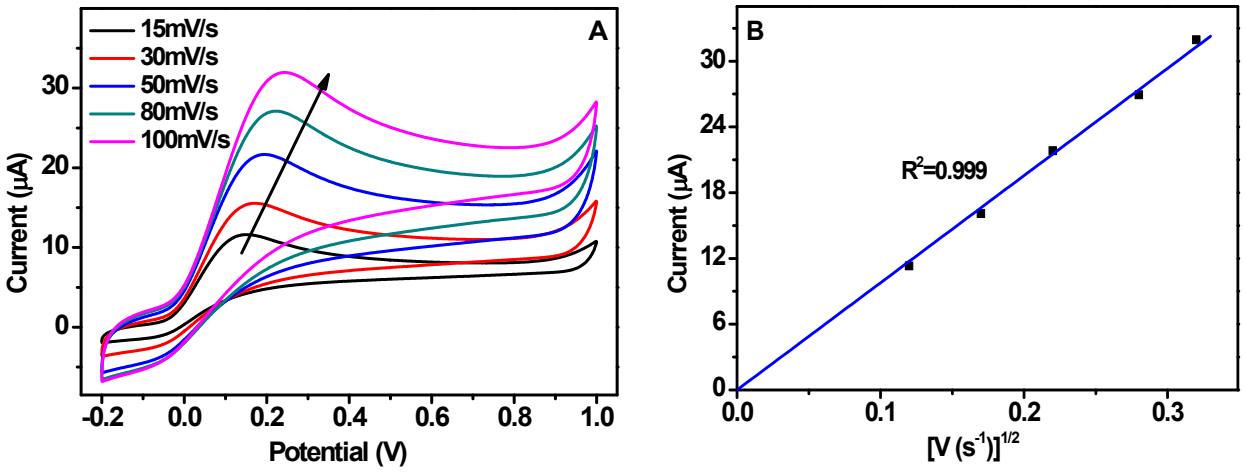

Fig. S5 (A) CV of GCE/GR-$Gd(OH)_3$-2 in 2.5 mM AA aqueous solution at varying scan rate (15-100 mV/s) and (B) the relationship between i_{pa} and $V^{1/2}$.

Table S1. BET specific surface area (S_{BET}) and total pore volume of $Gd(OH)_3$, GR-$Gd(OH)_3$-1 and GR-$Gd(OH)_3$-2.

Sample	$Gd(OH)_3$	GR-$Gd(OH)_3$-1	GR-$Gd(OH)_3$-2
S_{BET} ($m^2 \cdot g^{-1}$)	3.23	18.02	32.38
Total pore volume ($cm^3 \cdot g^{-1}$)	0.29	0.36	0.41

Calculation of the lowest limit of detection (LOD)

The LOD of GCE/GR-Gd(OH)$_3$-1 and GCE/GR-Gd(OH)$_3$-2 can be calculated to be 0.06 mM and 0.05 mM, respectively. Nine blank experiments of GCE/GR-Gd(OH)$_3$-1 and GCE/GR-Gd(OH)$_3$-2 were carried out in 0.1 M PBS without AA, from which nine oxidation peak currents were obtained. Then LOD of modified GCE can be calculated by the equations shown below (based on S/N=3) :

$$SD = \sqrt{\frac{\Sigma\left(x_i - \overline{x}\right)^2}{n-1}}$$

$$\mathrm{LOD} = \frac{3SD}{s}$$

where x_i is the oxidation peak current of the nine experiments, $\overline{x}$ is the averaged value of x_i, n is the times of experiments. SD is standard deviation. s is the slope determined by the curves of a linear relationship between i_{pa} and c_{AA} of electrodes. Taking the calculation process of LOD of GCE/GR-Gd(OH)$_3$-1 for example, s is 7.34, determined by equation 1 shown in the maintext. The detailed calculation of the LOD is as bellow:

x_1/μA	x_2/μA	x_3/μA	x_4/μA	x_5/μA	x_6/μA	x_7/μA	x_8/μA	x_9/μA	$\overline{x}$ /μA
2.683	2.598	2.817	2.528	2.833	2.741	2.479	2.475	2.849	2.667

Calculation of the relative standard deviation (RSD)

Taking the calculated method of RSD of GCE/GR-Gd(OH)$_3$-1 for example, the detailed calculation is shown bellow:

$$SD = \sqrt{\frac{\Sigma\left(x_i - \overline{x}\right)^2}{n-1}}$$

$$RSD = \frac{SD}{\overline{x}} = \frac{\sqrt{\frac{\Sigma\left(x_i - \overline{x}\right)^2}{n-1}}}{\overline{x}}$$

where x_i is the oxidation peak current of GCE/GR-Gd(OH)$_3$-1, $\overline{x}$ is the averaged value of x_i , n is the number of the experiment, SD is the standard deviation.

x_1/μA	x_2/μA	x_3/μA	$\overline{x}$ /μA
7.511	7.902	7.045	7.486