Supplementary Material

A facile one-step folic acid modified partially oxidized graphene for high sensitivity tumor cell sensing

Wenyu Gao[a♀], Qing Zheng[a, b♀], Zongxu Shen[a], Hao Wu[a], Yuehui Ma[c], Weijun Guang[c], Songmei Wu[a], Yu Yu[a*], Kejian Ding[a *]

[a] School of Science, Beijing Jiaotong University, Beijing 100044, P R China

[b] School of Chemistry, Beijing Institute of Technology, Beijing 100081, P.R. China

[c] Institute of Animal Sciences, Chinese Academy of Agricultural Sciences, Beijing 100083, P R China

♀ These authors have equal contribution to this work.

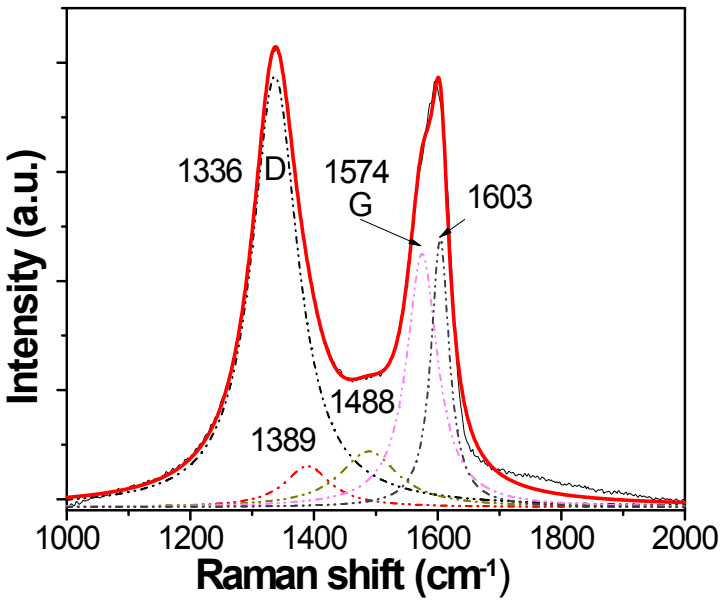

Figure S1. Raman peak-differenating analysis of POG-2.

Table S1. The proportions of O bonding C and C/O atomic ratios of Graphene, POG-1, POG-2, POG-3 and GO.

Samlpe	Proportion of O bonding C calculated by C 1s spectra (%)	C/O atomic ratio by the XPS survey
Graphene	< 1%	34.6
POG-1	8.6%	8.4
POG-2	11.3%	6.9
POG-3	15.8%	5.4
GO	> 50%	2.2

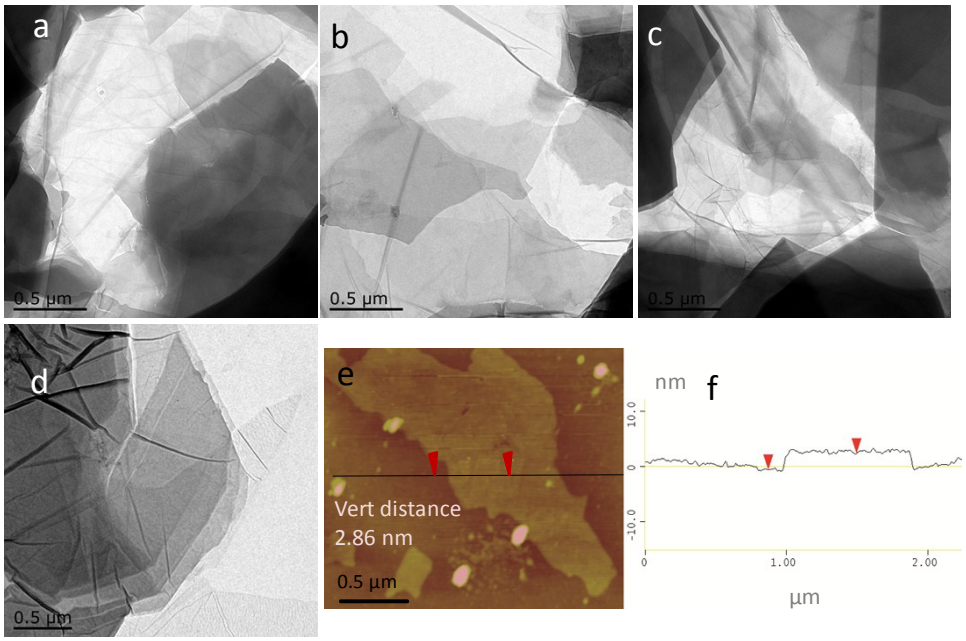

Figure S2. TEM images of POG-1(a), POG-2 (b), POG-3(c) and graphene oxide (d). AFM image (e) and height profile (f) of POG-2.

***In vitro* cytotoxicity measurement**

In vitro cytotoxicity of the POG was determined using a cell counting kit (CCK-8). The cells (3000 cell/well) were seeded in 96-well plates. POG (0, 5, 10, 20 and 40 µg mL^{-1}) were then added to the wells in triplicates and incubated for 24 hours. After the incubation period, 10 µL of WST-8 (commercially available as CCK-8 reagent) was added to each well, and they were

incubated in the dark at 37 ºC for 2 hours. Then the absorbance of each well was measured by an ELISA reader at 450 nm. Cell viability was calculated using the following equation:

$$\text{Cell viability (\%)} = (OD - OD_{\text{Blank}})/(OD_{\text{control}} - OD_{\text{Blank}}) \times 100$$

Where "*OD*" is the optical density of the cells incubated with the samples, "OD_{control}" is the optical density of the cells incubated with the media only (positive control), and "OD_{Blank}" is the optical density of the media with CCK-8 reagent but without cells.

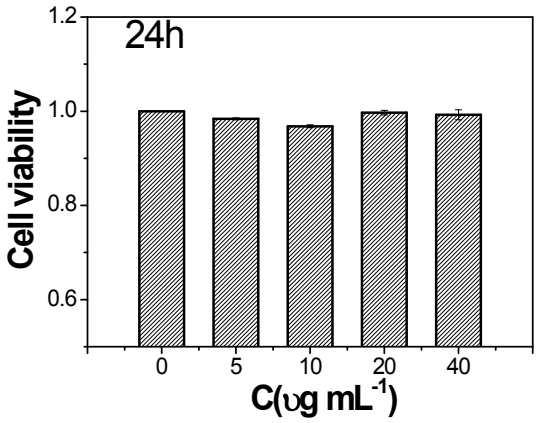

Figure S3. Cell viability of HeLa cells treated with different concentrations of POG after 24 h.

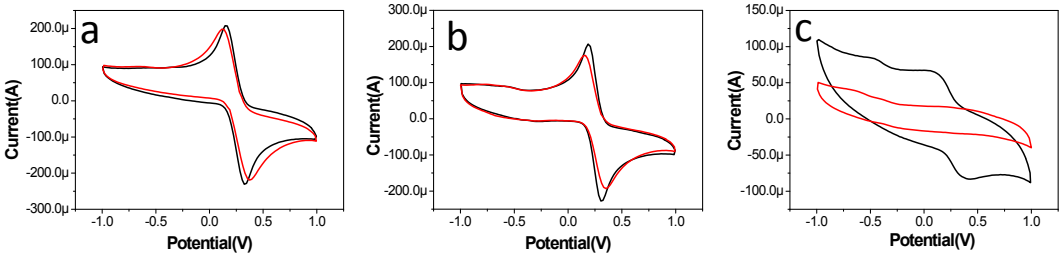

Figure S4. CV measurements of G (black curve in a) and G-EDC-NHS-FA (red curve in a), POG-2 (black curve in b) and POG-2-EDC-NHS-FA (red curve in b), GO (black curve in c) and GO-EDC-NHS-FA (red curve in c).

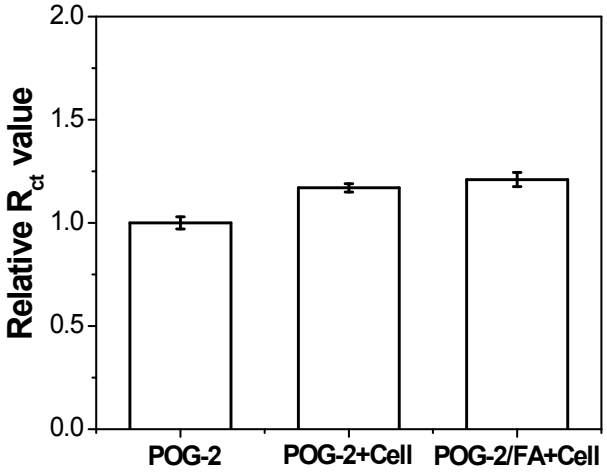

Figure S5. The EIS changes induced by HeLa cells (200 cell mL^{-1}) on the POG-2 modified surface without FA and on the POG-2 modified surface with physically adsorbed FA respectively.

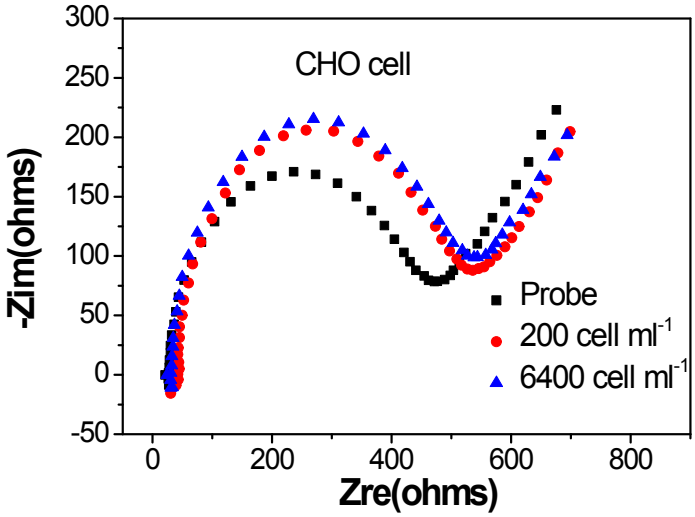

Figure S6. The Nyquist plots of impedance spectra recorded from 0.01 to 10^5 Hz for CHO cells (cell concentration: 200 and 6400 cell mL^{-1}).

Microscopy analysis

For microscopy analysis, the cells in PBS solution were transferred onto a glass culture dish and cytosensor imitating Petri dish (the Petri dish was fabricated as GCE electrodes). Twenty minutes later, an optical microscope was used to observe the cell morphology. As shown in Fig. S5, the black arrows indicate the folic acid modified surface and the red arrows in Fig. S5b point to the immobilized cells.

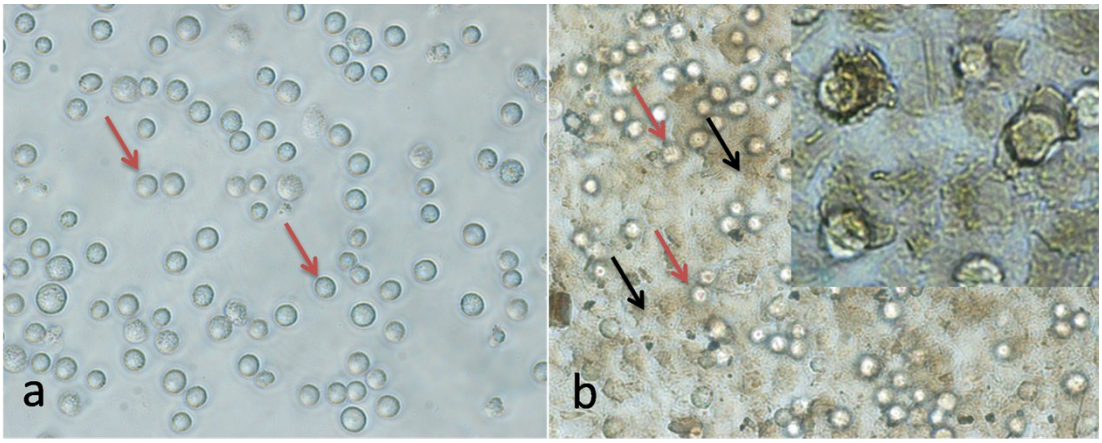

Figure S7. Microscopy assay for cell immobilization on glass culture dish (a) and cytosensor imitating Petri dish (b).

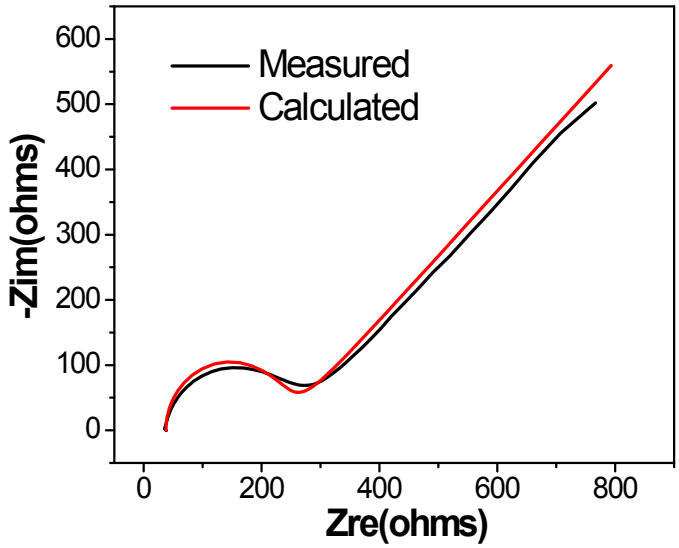

Fig. S8 The fitting by an R(C(RW)) equivalent circuit for POG-2

Table S2 Results of Fitting Parameters to the Equivalent Circult Model for POG-2

Symbol	Value	% error
R (ohms)	37.68	1.409
C (uF)	2.88	2.529
W (m ohms)	1.60	2.475
R_{ct} (ohms)	**197.9**	**1.942**