biosensors

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SUPPORTING INFORMATION

Development of a Sensitive Self-Powered Glucose Biosensor based on an Enzymatic Biofuel Cell

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Table S1. Comparison of the performance of previously developed enzymatic biofuel cells or hybrid enzymatic biofuel cells for self-powered glucose sensing.

Electrode	Catalyst (Anode/Cathode)	Fuel	Oxidant	Operating conditions	P_{max} ($\mu W\ cm^{-2}$)	OCV (V)	Dynamic range (mM)	Ref.
Anode: Pt-Ir wire Cathode : carbon cloth	NAD-GDH/BOD	Glucose	O_2	0.1 M phosphate buffer pH 7.0, 10 mM glucose Air-saturated buffer	11.8	0.43	1 - 10	[1]
Anode: TTF-CF Cathode: CF (microneedle electrodes)	GOx/Pt-Rh alloy	Glucose	O_2	0.1 M phosphate buffer pH 7.4, 80 mM glucose Air-saturated buffer	170	0.38	10 - 80	[2]
Anode: TTF-PCI Cathode: PCI (screen printed electrode array)	GOx/BOD	Glucose	O_2	1 M phosphate buffer pH 7 , 100 mM glucose Air-saturated buffer	120	0.57	1 - 25	[3]
Anode: MWCNTs-ink Cathode: Ag_2O/Ag (stretchable textile-based electrodes)	GOx/-	Glucose	-	0.1 M PBS buffer pH 7, 50 mM glucose	160	0.44	0 - 50	[4]
Anode: CoPc/PBA/Buckypaper Cathode: PBA/Buckypaper	GOx/MnO_2	Glucose	-	0.1 M PBS buffer pH 7, 20 mM glucose	136	0.65	0.5 - 8	[5]
PBSE/Buckypaper based on MWCNTs	PQQ-GDH/laccase	Glucose	O_2	0.1 M phosphate buffer pH 6.0, 45 mM glucose Air-saturated buffer	67.86	0.682	0.5 - 35	[6]
Anode: rGO/poly(TBO) Cathode : PBSE/MWCNTs	NAD-GDH/ GOx-HRP	Glucose	H_2O_2	0.1 M phosphate buffer pH 7.4, 40 mM glucose Air-saturated buffer	31.3	0.65	0.1 – 7.0	This work

CF = carbon fibers; TTF = tetrathiafulvalene; PCI Porous carbon ink; GOx = glucose oxidase; GDH = glucose dehydrogenase; HRP = horseradish peroxidase; BOD = bilirubin oxidase

TBO = toluidine blue; MWCNTs = multi-walled carbon nanotubes; CoPc = cobalt phthalocyanine; PBA = pyrenebutyric acid; PBS = Phosphate buffered saline;

PBSE = 1-pyrenebutyric acid *N*-hydroxysuccinimide ester.

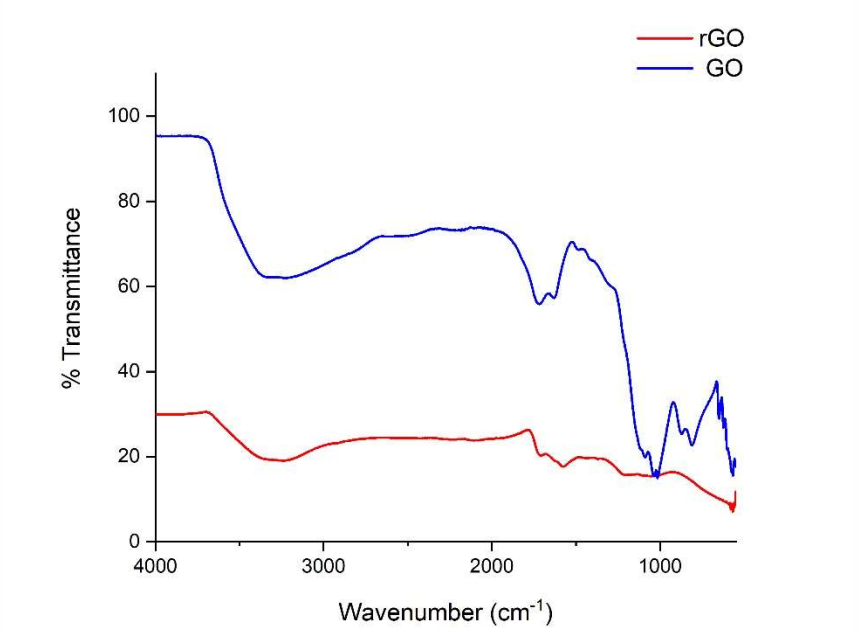


Figure S1. IR spectra for rGO and GO.

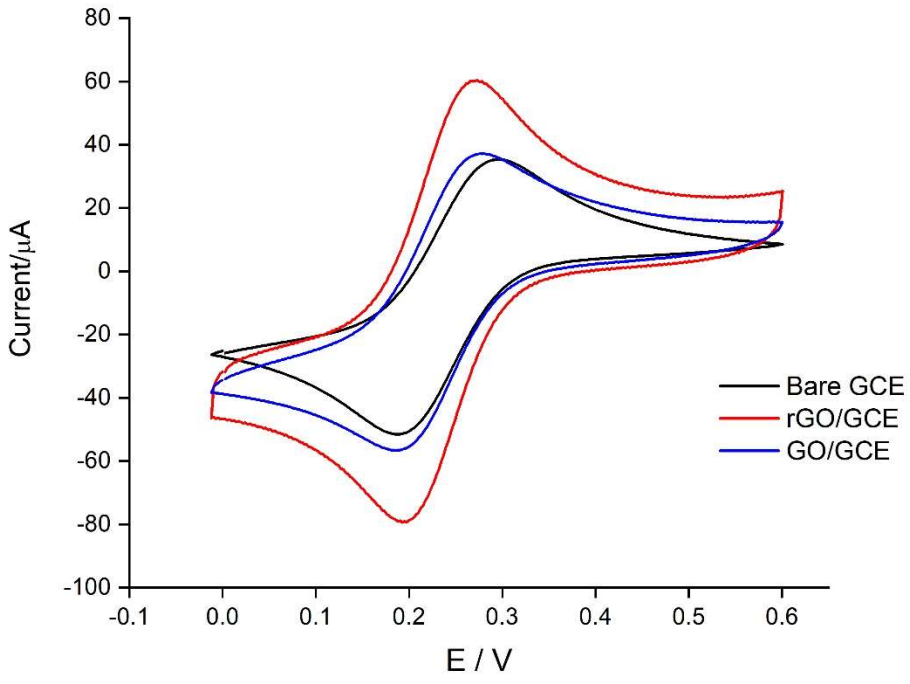
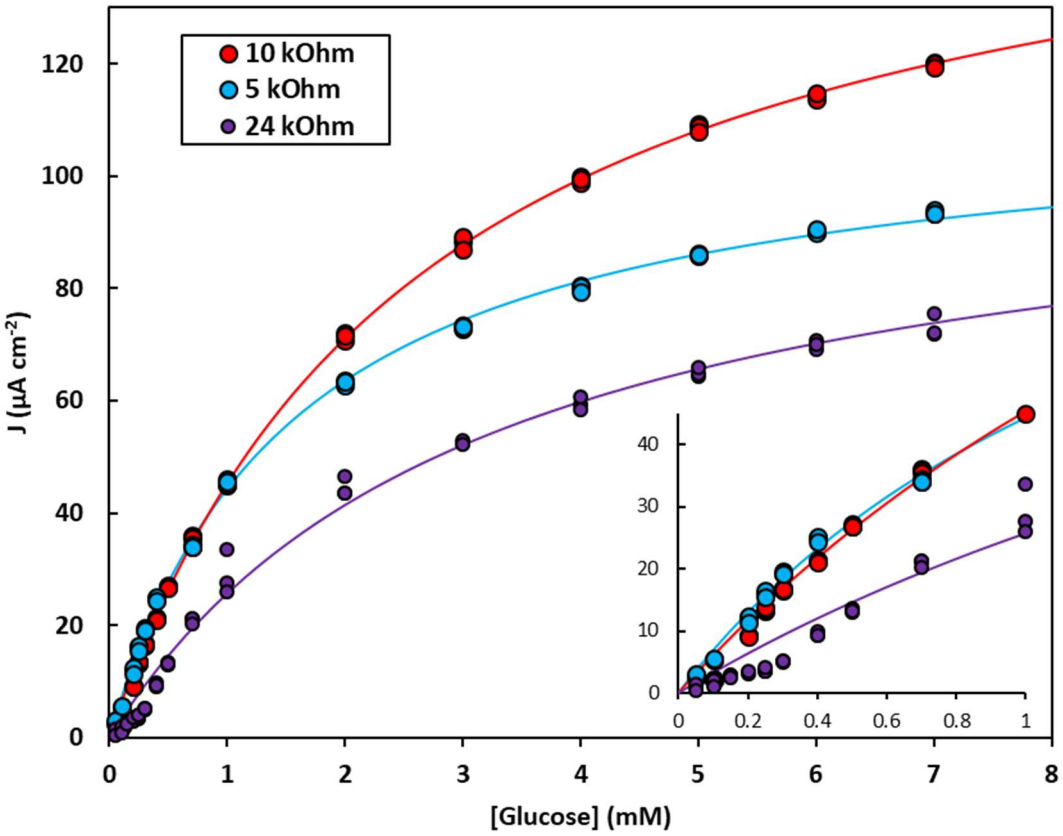


Figure S2. Cyclic voltammograms of the modified electrodes in the solution of 5 mM $Fe(CN)_6^{3+}$ containing 0.1 M KCl at the scan rate of 50 mV/s.

Table S2. Comparison of the Michaelis-Menten parameters, including K_m and J_{max}, for the results in Figure 3.

GDH amount (μg)	K_m (mM)	J_{max} (μA cm^{-2})	J_{max}/ K_m (μA mM^{-1} cm^{-2})
5	5.6	79.1	14.1
10	7.1	123.7	17.4
15	11.9	101.9	8.6



Resistance (kΩ)	K_m (mM)	J_{max} (μA cm^{-2})	R^2
5	1.547±0.030	112.8±0.8	0.9989
10	2.666±0.059	165.9±1.6	0.9991
24	3.191±0.225	107.5±3.4	0.9951

Figure S3. Calibration curve for the self-powered detection of glucose (n = 3) in a membrane-less cell configuration, using the optimized electrodes and different resistor settings. The calibration curve can be well described using a Michaelis-Menten law and used across a broad concentration range (A), with the parameters indicated in the table.

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