

Supplementary Material

A sensitive and facile electrochemical paper-based sensor for glucose detection in whole blood using Pd/CB-Ni@rGO modified electrode

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Electrodes characterization by Cyclic voltammetry

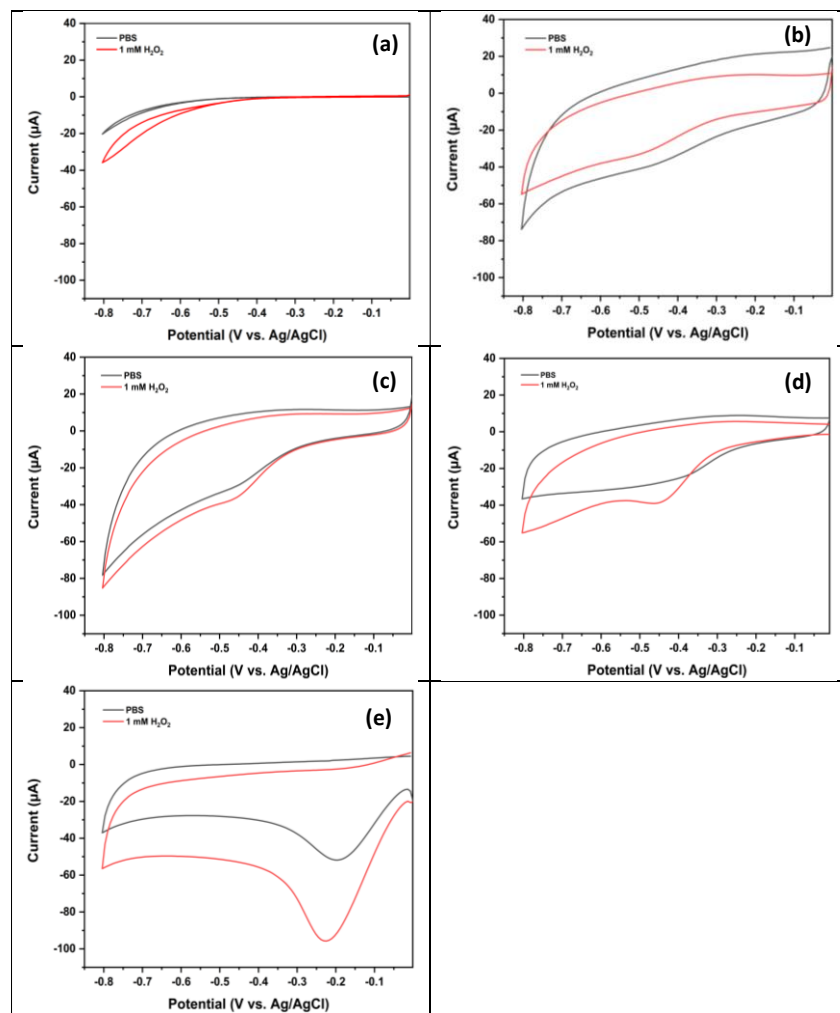


Fig. S0 Cyclic voltammograms of PBS and 1 mM H_2O_2 in PBS pH 7.4 on (a) bare-SPE, (b) GO, (c) Ni@rGO, (d) CB-Ni@rGO and (e) Pd/CB-Ni@rGO at 100 mV/s of scan rate.

In comparison to Fig. S0 (a), (b), (c), and (d), the PBS in Fig. S0 (e) exhibits a reduction peak that resembles the one observed for H_2O_2 . The reduction peaks of PBS and H_2O_2 show similarities but occur at slightly different potentials, approximately at -0.199 V and -0.24 V. The reason behind the resemblance between the PBS peak and that of H_2O_2 can be attributed to the reduction of the Pd oxide¹⁻⁴.

Electrodes characterization by FTIR

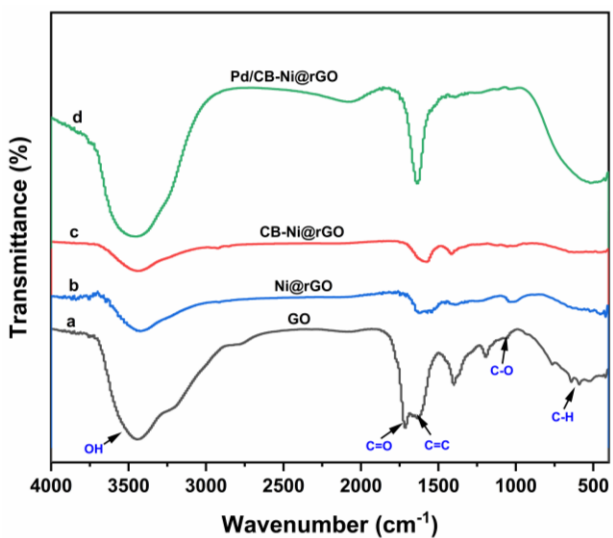


Fig. S1 FTIR spectrum of (a) GO, (b) Ni@rGO, (c) CB-Ni@rGO and (d) Pd/CB-Ni@rGO.

Morphology and size distribution analysis

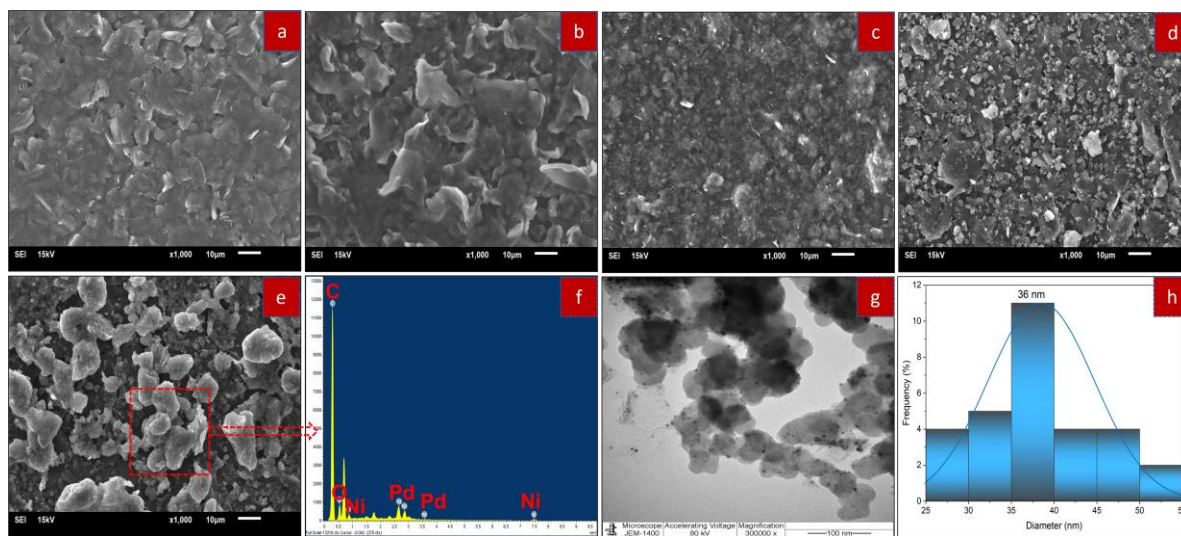


Fig. S2 SEM image of (a) bare-SPE, (b) GO, (c) Ni@rGO, (d) CB-Ni@rGO, (e) Pd/CB-Ni@rGO, (f) elements analysis by EDS, (g) TEM image of Pd/CB-Ni@rGO and (h) particles size distribution.

Repeatability, reproducibility, and long-term stability study

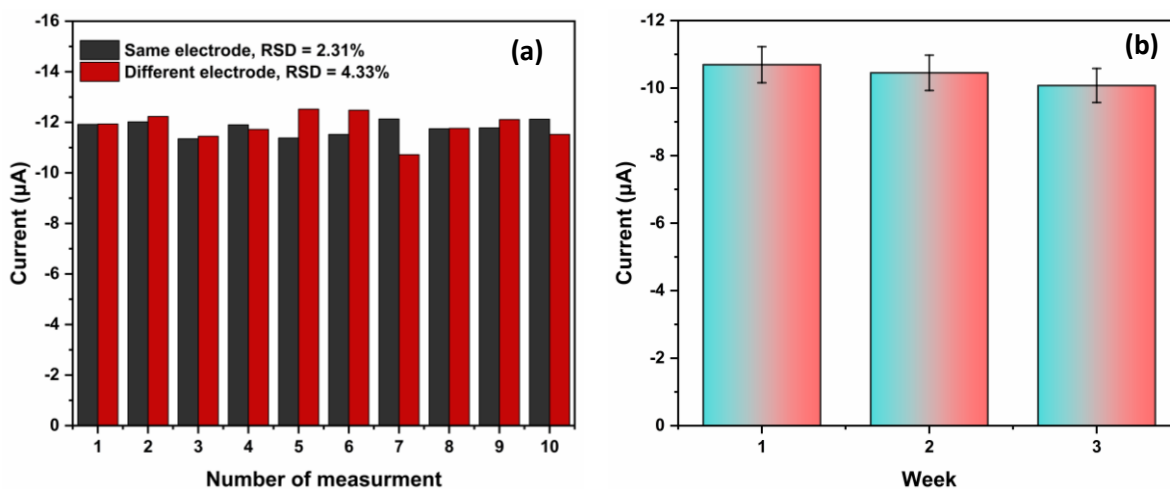


Fig. S3 (a) Repeatability and reproducibility study of 1 mM H₂O₂ in PBS, pH 7.4 on Pd/CB-Ni@rGO electrode and (b) Long-term stability of Pd/CB-Ni@rGO electrode on 1 mM H₂O₂ in PBS, pH 7.4.

SEM image of blood separation

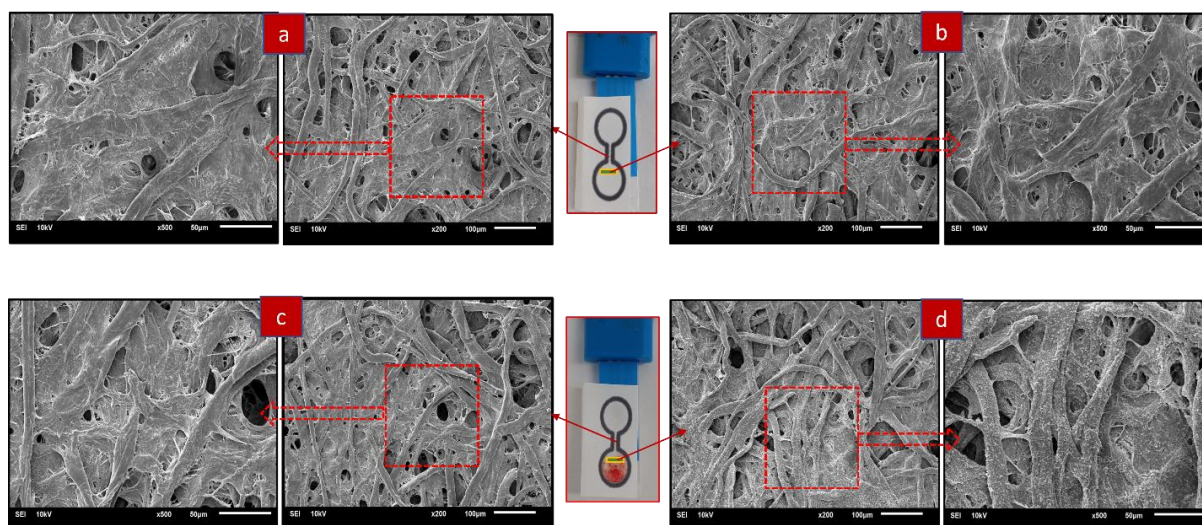


Fig. S4 SEM image of filter paper after drying overnight (before blood separation): above row (a) flow channel and (b) sample zone containing hemostatic agent, and below row (c) after blood separation and (d) plasma flow channel blood separation zone.

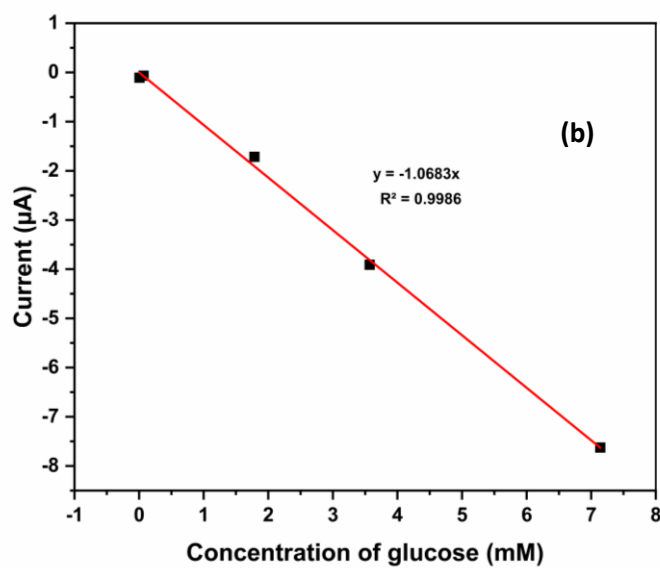
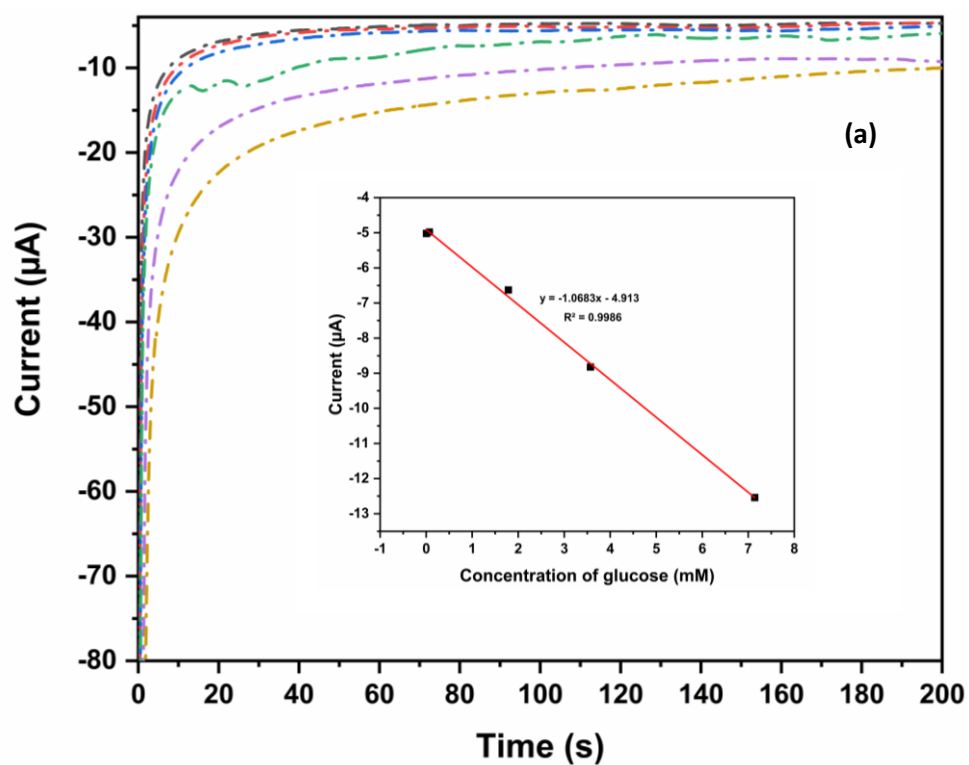


Fig. S5 (a) Chronoamperograms of glucose assay based on proposed Pd/CB-Ni@rGO. Inset; a matrix-matched standard curve with the linear range at 7 to 7140 μM ($r^2 = 0.99$, $n = 3$) (b) a calibration curve having the matrix-matched fresh blood for blood analysis.

Table S1 Comparing H₂O₂ measurement with and without hemostatic agents and its fouling effect.

Without hemostatic agent		With hemostatic agent	
Repetition (time)	Current (μA)	Repetition (time)	Current (μA)
1	-101.00	1	-123.40
2	-93.63	2	-124.50
3	-83.31	3	-120.90
4	-80.51	4	-120.90
5	-65.32	5	-118.90

Compare with previous studies.

Table S2 Comparison of the sensing characteristics of several point of care device (POC) and Pd-based glucose sensors

Electrode	Applied potential. (V vs. Ag/AgCl)	Electrolyte	Long term Stability	Selectivity (Interfered by)	Linear range (mM)	LOD (μ M)	Ref
Pd/CB-Ni@rGO*	-0.3	PBS, pH 7.4	94.17%, 3 weeks	Not interfered from UA, Glu, Asp, AA, NaCl and BSA	0.007–7.14	0.82	This work
Pd@Pt NCs *	-0.05	PBS	NA	Not interfered from fructose, saccharose, maltose, sorbitol, AA, and UA	2.4–10.6	0.15	5
PB/Ti ₃ C ₂ Tx/GOx/Nafion /SPIL-GE (POC) *	-0.05	PBS, pH 7.4	NA	Not interfered from UA, AA, and hemoglobin	0.0–0.50 & 0.0–15.0	24.5	6
Arduino Due and LMP9100-EVM (POC) *	-0.55	PBS, pH 7	80%, 8.57 weeks	Not interfered from AA and UA	1.2–7.8	23	7
Pd-Mn/rGO-GC **	-0.1	0.1 M NaOH	85.58%, 2.86 weeks at 4 °C	Not interfered from DA, H ₂ O ₂ , UA, AA, L- Arginine	0.0161-1.152 & 1.125-4.875	1.25	8
PtPd/PHNG-2 **	-0.15	PBS, pH 7.0	93.05%, 3 weeks	Not interfered from AA, UA, DA and AP	0.1 - 4	1.82	9
Pd ₃ Ag-LBP/C-GCE **	-0.1	0.1 M NaOH	NA	Not interfered from NaCl, AA, AP and UA	1 to 20	-	10
Pd–CSP/C **	-0.05	0.1 M NaOH	NA	Not interfered from NaCl, AA, AP, and UA	2.5–40	1.06	11
Enzymatic modified on red blood cell membrane *	-0.3	PBS, pH 7.4	Low stability due to potential drift	Not interfered from AA, UA, or GA	2.5–40	1060	12

Electrode	Applied potential. (V vs. Ag/AgCl)	Electrolyte	Long term Stability	Selectivity (Interfered by)	Linear range (mM)	LOD (μ M)	Ref
PdNS/f-CNT-SPCE **	+0.3	PBS, pH 7.4	NA	(AA), paracetamol (PCM), (DA), and galactose (Gal)	1–41	95	13
Pd-NiAl-LDH-GS **	+0.5	0.1 M NaOH	90%, after 4.29 weeks	<10% interfered from AA, UA, DA, AED, L-Cys, and Gly	0.0005–10	0.234	14
Pd/MnO ₂ -Nickel foams **	+0.45	0.1 M NaOH	95%, 100 CV cycles	Slightly interfere from UA, AA, Mal, DA, LA but at 20 μ M	0.065-0.455	NA	15
np-PdAuNi-GCE **	0	0.1 M NaOH	92%, 4.29 weeks	AA	0.005-0.1	1.7	16
Pd-CoCNTs -GC **	+0.5	0.1 M NaOH	88.8%, 96 hr	UA, DA and AA	0.01–2.4	1	17

* Enzymatic glucose sensor

** Non-enzymatic glucose sensor

NA: not available

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