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Carbon-supported Nickel/Nickel Oxide Nanohybrid Composite as a High-Performance Sensor for Electrochemical Non-Enzymatic Glucose Detection

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Synthesis of graphitic carbon nitride (g-C_3N_4)

Bulk G-C_3N_4 was prepared according to a previously reported approach[1]. In this process, 3 g of melamine was grinded for 10 minutes. Then, the resulting compound was transferred to a silica crucible for calcination at 550 °C (heating rate of 5 ^{0}C/min), and holding the sample at the same temperature for 3 h until a yellow powder of bulk g-C_3N_4.

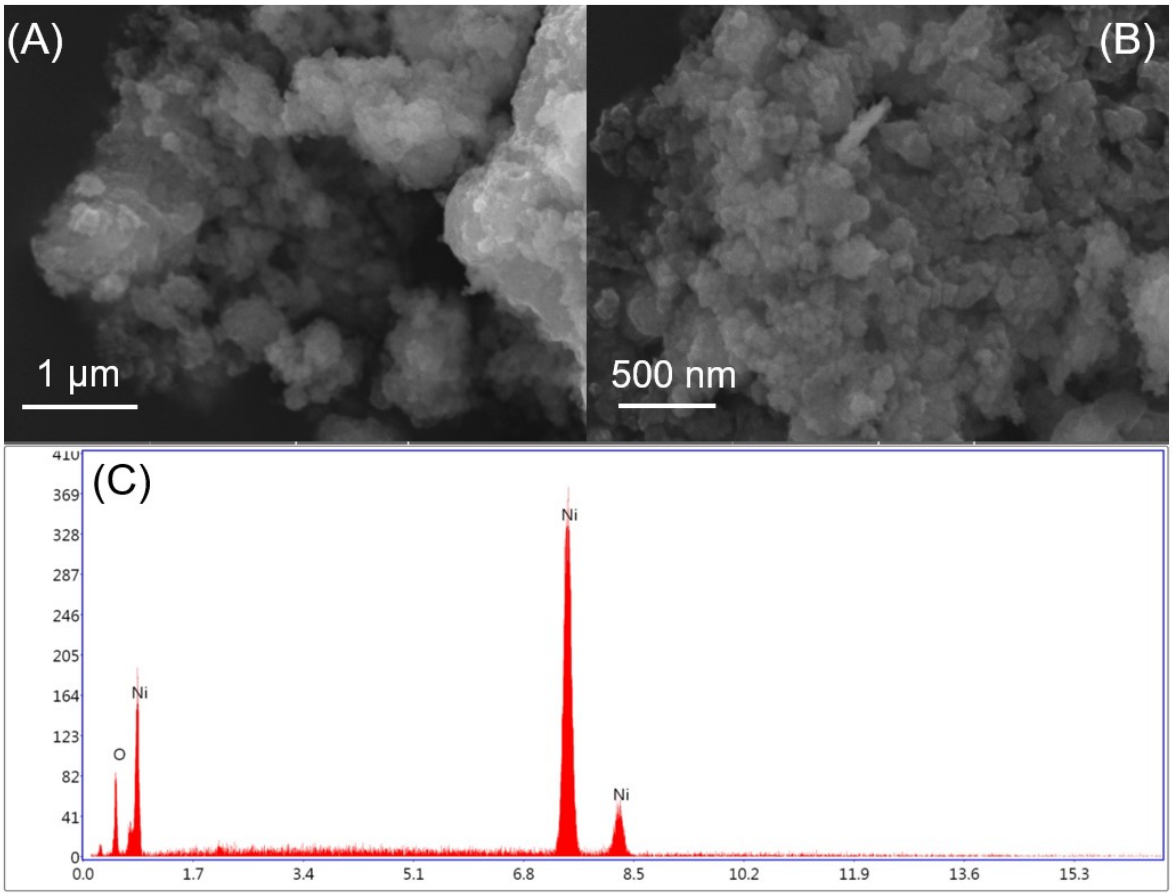

Figure S1 (A)-(B) SEM micrographs and **(C)** Energy dispersive spectrum of Ni/NiO sample.

Table S1. The weight percentage of each element in Ni/NiO and Ni/NiO@C samples

Compound	Element	Weight (%)	Atomic (%)	Intensity	Error (%)	K ratio
Ni/NiO	Ni	89.86	70.72	393.30	2.43	0.9065
	O	10.14	29.28	29.35	11.62	0.0418
Ni/NiO@C	Ni	50.48	19.30	321.48	10.93	0.4642
	O	25.48	35.75	73.39	2.91	0.4642
	C	24.04	44.94	27.25	12.59	0.0668

was obtained from EDS.

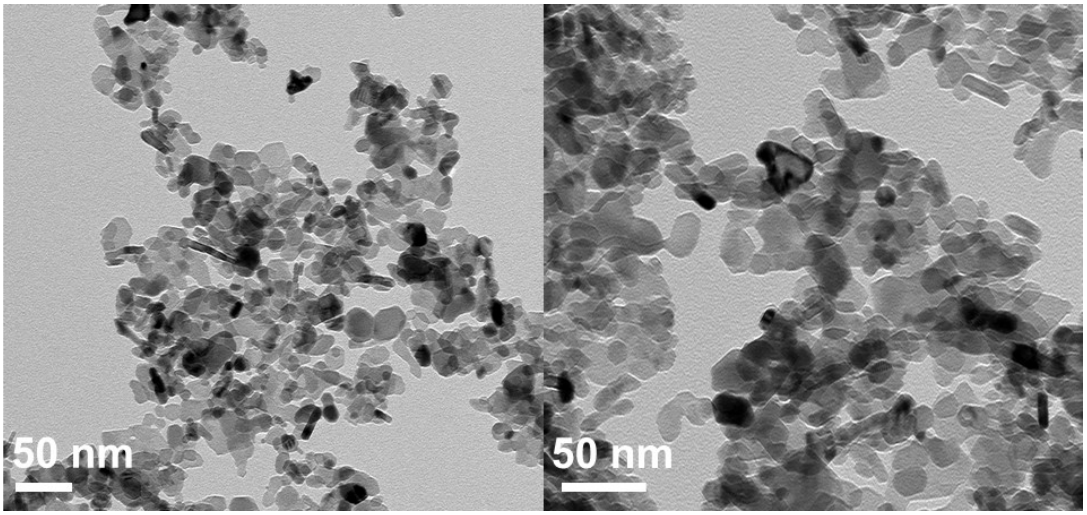

Figure S2. TEM images of Ni/NiO sample.

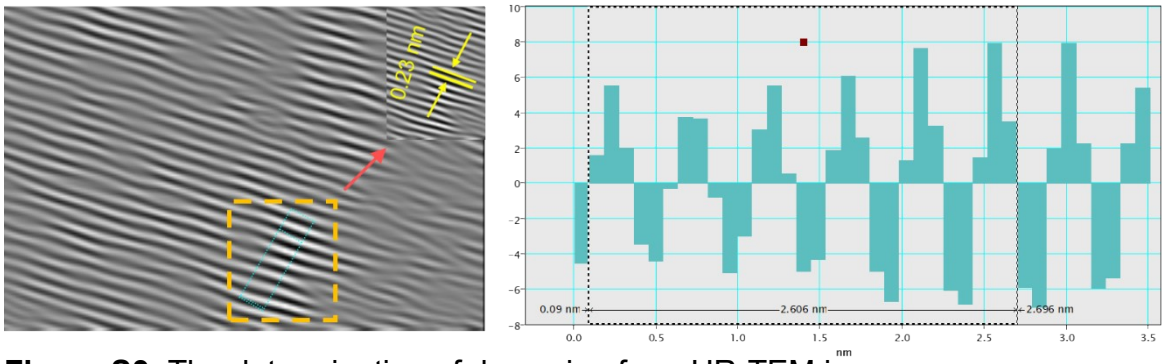

Figure S3. The determination of d-spacing from HR-TEM images

Electrochemical Characterization of Ni/NiO and Ni/NiO@C material

Before the electrochemical measurements, the electrode surface properties of Ni/NiO and Ni/NiO@C modified GCE were examined by using electrochemical impedance on benchmark ferricyanide $[Fe(CN)_6]^{3-/4-}$ redox system. In the Nyquist diagram, the semicircle signifies the charge transfer resistance (Rct), which is related to the kinetics of electron transfer at the electrode surface, while the linear portion denotes diffusion[2, 3]. **Figure S4** represents the Nyquist plots of 0.1 M KCl containing 5 mM $[Fe(CN)_6]^{3-/4-}$ at GCE **[Curve (iii)]**, Ni/NiO/GCE **[Curve (ii)]** and Ni/NiO@C/GCE **[Curve (i)]**. From **Figure S4**, a semicircle with a larger diameter is attained for bare GCE while a smaller semicircle was observed in Ni/NiO/GCE and Ni/NiO@C/GCE in the frequency range of 0.01 Hz to 100 kHz. For bare GCE, Ni/NiO/GCE, and Ni/NiO@C/GCE, the Rct values of 26.3, 6.1, and 2.3 kΩ, respectively. Compared with bare GCE and Ni/NiO/GCE, Ni/NiO@C/GCE showed a very smaller semicircle with lower Rct which indicates the higher electrocatalytic activity. The higher electrocatalytic activity of Ni/NiO@C is observed due to the presence of conductive carbon, oxygen vacancies and surface defects on the crystal lattice system which accelerate the charge transfer

process on the electrode-electrolyte interface. This could be the reason for the improved electrochemical response at the electrode-electrolyte interface.

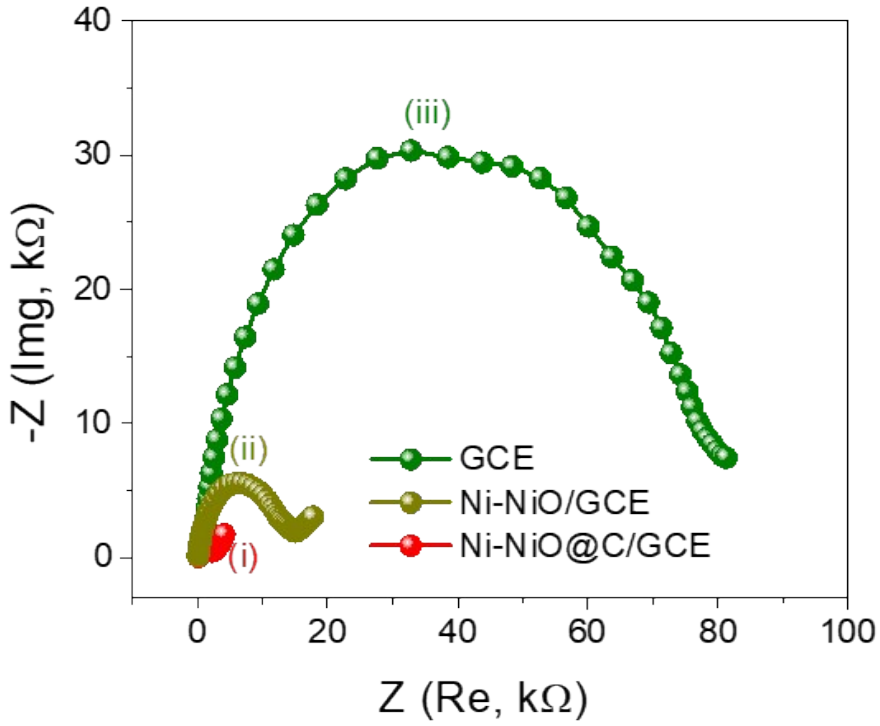

Figure S4. Electrochemical impedance performance of unmodified GCE [Curve (iii)], Ni/NiO/GCE [Curve (ii)], and Ni/NiO@C/GCE [Curve (i)] in 0.1M KCl containing 5 mM $[Fe(CN)_6]^{3-/4-}$.

References

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