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Electronic Supplementary Information

High performance non-enzymatic glucose sensor based on nickel hydroxide modified nitrogen-incorporated nanodiamond

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List of items included in ESI†:

1. **Fig. S1†** HRXRD pattern of the as-prepared 150 nm $Ni(OH)_2$-NDD electrode.

2. **Fig. S2†** CVs of the 100 nm Ni-NDD electrode taken during the $Ni(OH)_2$ growth process in 0.1 M NaOH. The potential was continuously cycled between 0.1 and 0.6 V at a scan rate of 10 mV/s.

3. **Fig. S3†** Amperomertic responses and the corresponding calibration plots of the 50, 100, 150, 200, and 250 nm $Ni(OH)_2$–NND electrodes to successive additions of 200 μM glucose in 0.5 M NaOH at various applied potentials.

4. **Fig. S4†** Cyclic voltammograms of the 150 nm Ni-NND electrode in 0.5 M NaOH in the presence of different concentrations of (A) glucose, (B) AA, (C) AC, and (D) UA at a scan rate of 10 mV/s.

5. **Fig. S5†** Calibration plots of peak current density versus concentration for glucose, AA, AC and UA.

6. **Fig. S6†** An FESEM image of the 150 nm $Ni(OH)_2$-graphite electrode. The inset presents the scheme of the $Ni(OH)_2$-graphite electrode.

7. **The study on the effect of NaOH concentration on the response of glucose.**

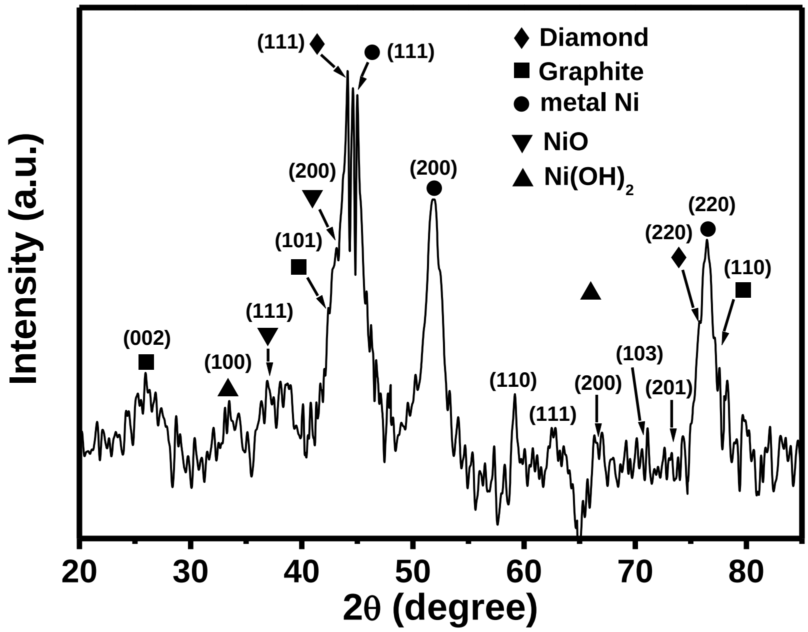


Fig. S1† HRXRD pattern of the as-prepared 150 nm $Ni(OH)_2$-NDD electrode.

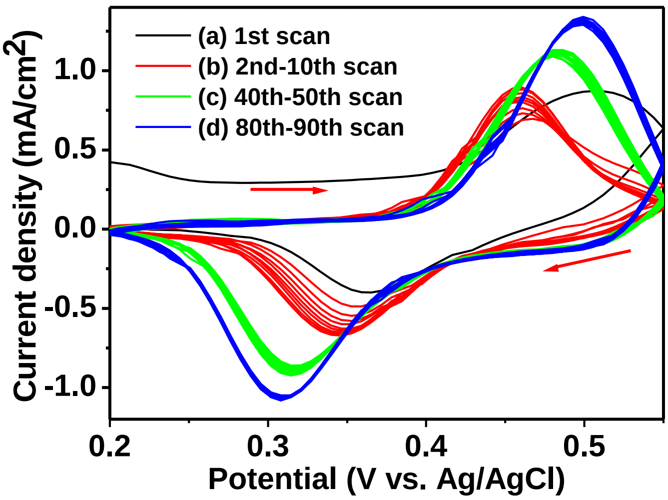
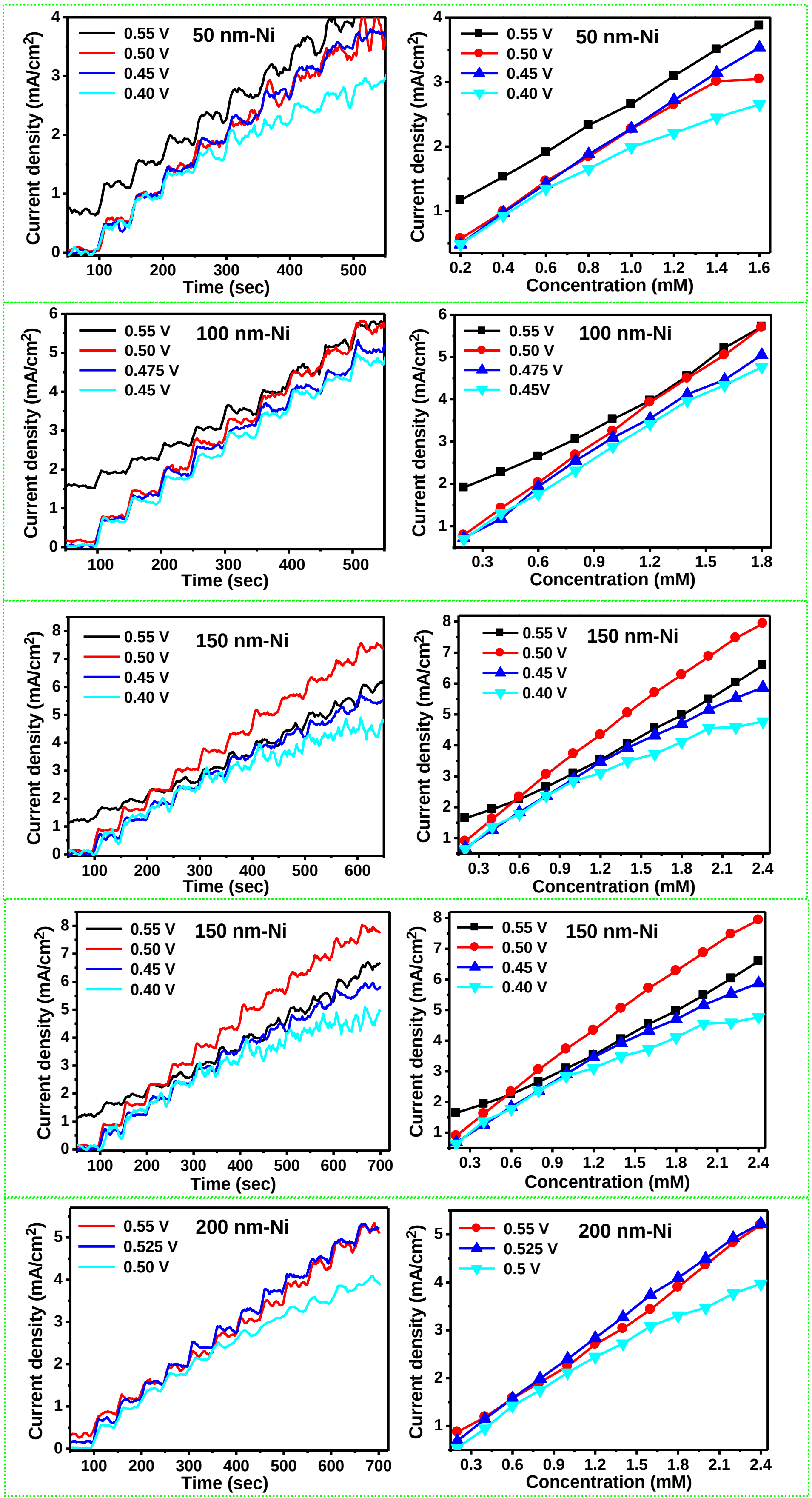


Fig. S2† CVs of the 100 nm Ni coated NDD electrode taken during the growth of $Ni(OH)_2$ in 0.1 M NaOH solution. The potential was continuously cycled between 0.1 and 0.6 V at a scan rate of 10 mV/s.


50 nm-Ni
0.55 V
0.50 V
0.45 V
0.40 V
Current density (mA/cm²)
Time (sec)
Concentration (mM)
100 nm-Ni
0.475 V
0.45V
150 nm-Ni
200 nm-Ni
0.525 V
0.5 V

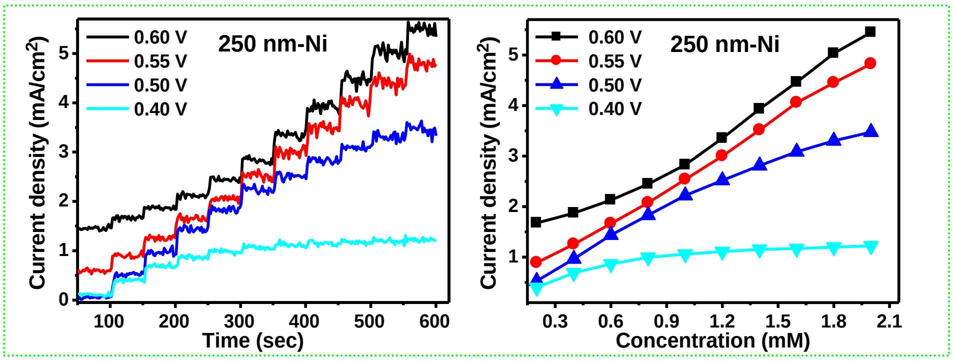


Fig. S3† Amperomertic responses and the corresponding calibration plots of the 50, 100, 150, 200, and 250 nm $Ni(OH)_2$–NND electrodes to successive additions of 200 μM glucose in 0.5 M NaOH at various applied potentials.

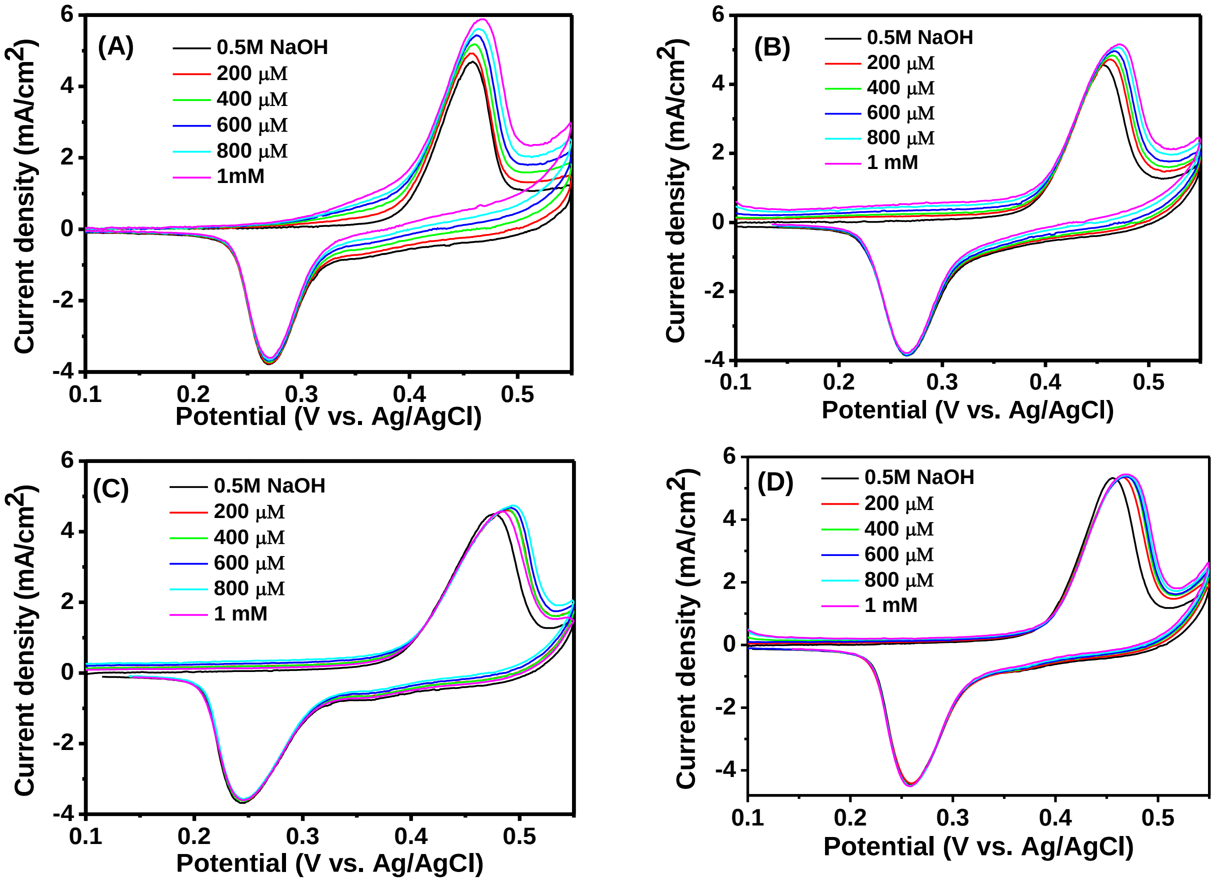


Fig. S4† Cyclic voltammograms of the 150 nm Ni(OH)2-NND electrode in 0.5 M NaOH in the presence of different concentrations of (A) glucose, (B) AA, (C) AC, and (D) UA at a scan rate of 10 mV/s.

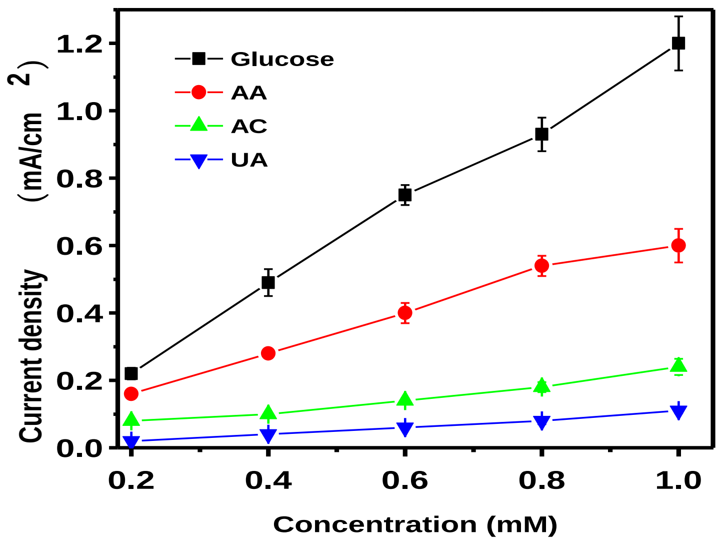


Fig. S5† Calibration plots of peak current density versus concentration for glucose, AA, AC and UA.

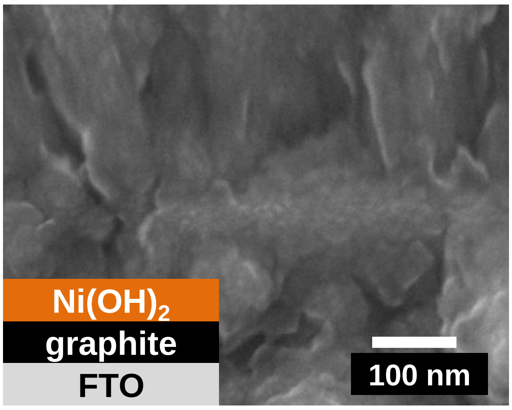


Fig. S6† FESEM image of the 150 nm $Ni(OH)_2$-graphite electrode. The inset presents the scheme of the $Ni(OH)_2$-graphite electrode.

Effect of NaOH concentration on the response of glucose:

The effect of NaOH concentration on the response of glucose was investigated by amperometry. Fig. S7 displays the amperometric response of the 150 nm $Ni(OH)_2$-NND electrode to 500 μM glucose in different concentrations of NaOH (0.05, 0.1, 0.5 and 1 M) at various applied potentials of 0.3–0.65 V. Plots of the current response of the 150 nm $Ni(OH)_2$-NND electrode versus applied potential in the absence and presence of 500 μM glucose in different concentrations of NaOH are shown in Fig. S8(A) and S8(B), respectively, in which the response in the absence of glucose can be referred to the background current. As the applied potential increases, the electro-oxidation of glucose either reaches a peak and then decreases (for low NaOH concentrations of 0.05 M and 0.1 M) or undergoes a point of inflection (for high NaOH concentrations of 0.5 M and 1 M).

Overall the 1 M NaOH has yielded the most electro-oxidation of glucose. However, it also produces the highest background current so that while operating at >0.5 V, the surface of the working electrode is found to be covered with bubbles, which deviates the signal with considerable noise. As a result, the 0.5 M NaOH is chosen to be the most appropriate solvent to achieve the lowest background current with superior glucose detection signal.

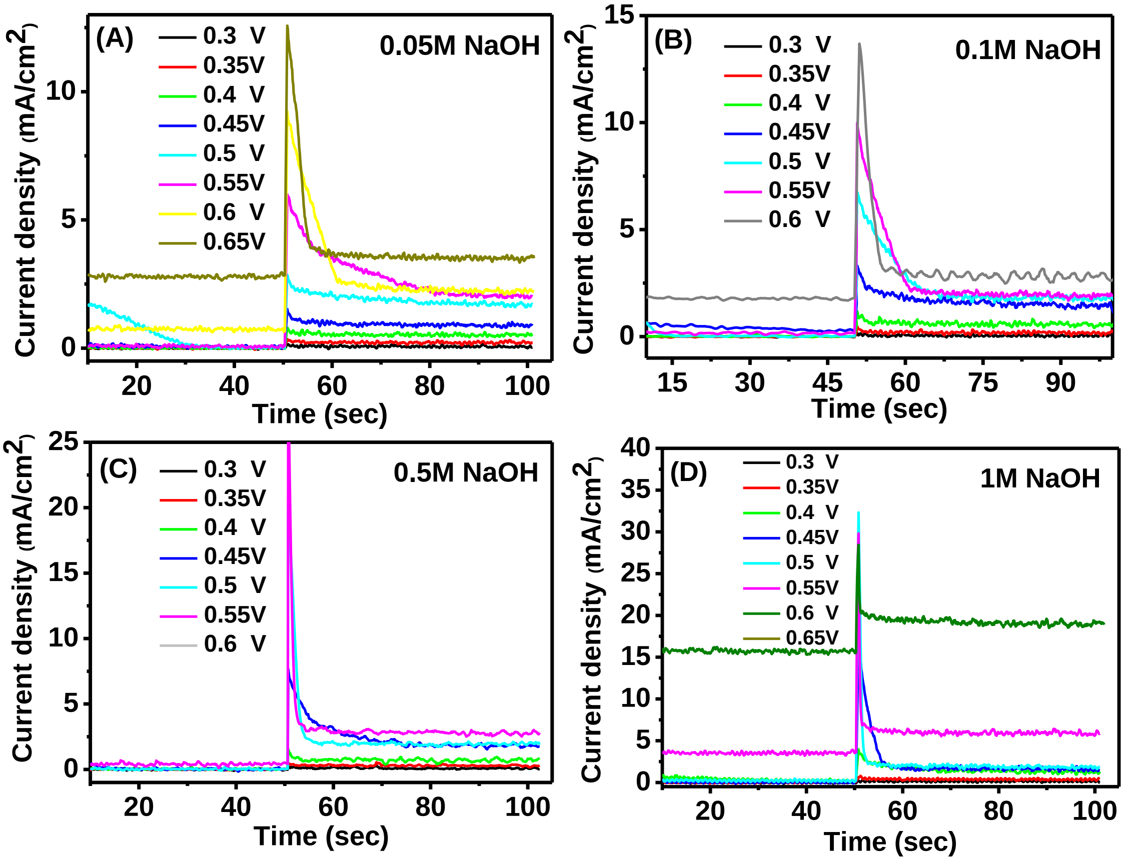


Fig. S7 Amperometric response of the 150 nm Ni(OH)2-NND electrode to 500 μM glucose in different concentrations of NaOH at various applied potentials ranging from 0.3 to 0.65 V.

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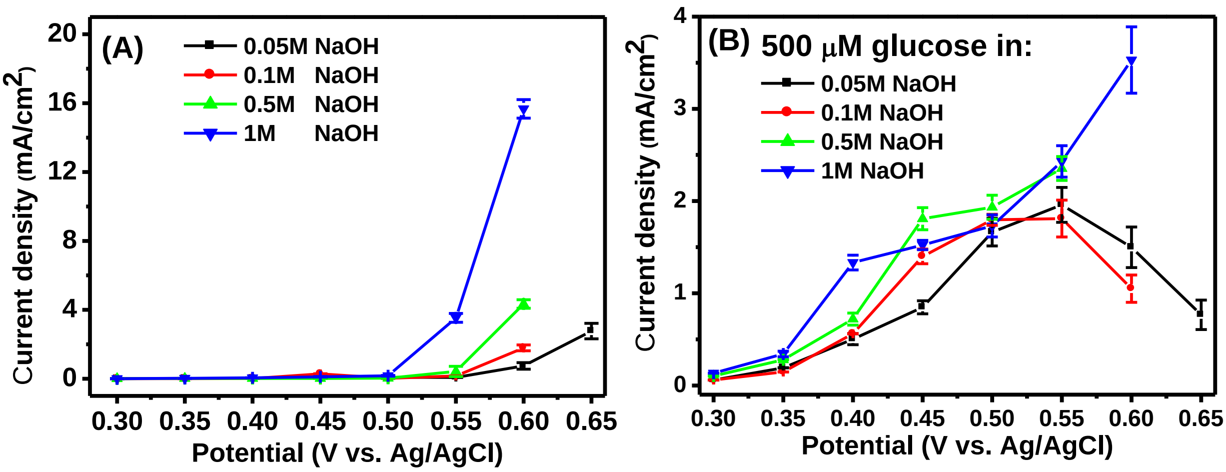

Fig. S8 Plots of the current response of the 150 nm $Ni(OH)_2$-NND electrode versus applied potential in the absence (A) and presence (B) of 500 μM glucose in different concentrations of NaOH. Each response represents the mean ± S.D. of five determinations.