Supporting Information

High performance of NiO nanosheets anchored three-dimensional nitrogen-doped carbon nanotubes as binder-free anode for lithium ion batteries

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\textbf{Fig. S1} Schematic illustration of the synthesis procedure of the N-CNTs/NiO nanosheets on Ni foam.
Fig. S2 (a) High and (b) low magnification SEM images of the N-CNTs on Ni foam.

Fig. S3 HRTEM image of the N-CNTs.

Fig. S4 (a-d) High and low magnification SEM images of the NiO NSs on Ni foam.
Fig. S5 (a-d) High and low magnification SEM images of the NiO NSs on Ni foam.

Fig. S6 XRD pattern of the Ni foam/N-CNTs/NiO NSs.
Fig. S7 XRD pattern of the as-prepared Ni-precursor grown on carbon fiber paper (CFP) to avoid the strong background substrate of Ni foam.

Fig. S8 XPS survey spectrum of the N-CNTs.
Fig. S9 The atomic structures of the graphene and the N-doped graphene with interaction with Ni. (a) graphene, (b) graphite-like nitrogen graphene and (c) and (d) two kinds of pyridine-like nitrogen graphene. The three possible adsorption sites of Ni atoms on graphene are labeled on (a): Hollow site (H), Bridge site (B) and Top site (T).

Fig. S10 Cyclic voltammograms of the Ni foam/N-CNTs electrode over a voltage range of 0.01-3 V (vs Li/Li⁺) at a scan rate of 0.1 mV s⁻¹.
Fig. S11 Cyclic voltammograms of the Ni foam/NiO electrode over a voltage range of 0.01-3 V (vs Li/Li⁺) at a scan rate of 0.1 mV s⁻¹.

Fig. S12 Cycling performances of the actual capacity of NiO ($C_a$) in the Ni foam/N-CNTs/NiO electrode taken the discharge capacity of Ni foam/N-CNTs/NiO ($C_1$) subtracts the discharge capacity of Ni foam/N-CNTs ($C_2$), the discharge capacity of Ni foam/ NiO ($C_3$), and the difference of the $C_a$ and $C_3$ ($C_{a-3}$) at a current density of 0.2 A g⁻¹.
Fig. S13 Rate performances of the actual capacity of NiO (C_α) in the Ni foam/N-CNTs/NiO electrode taken the discharge capacity of Ni foam/N-CNTs/NiO (C_1) subtracts the discharge capacity of Ni foam/N-CNTs (C_2), the discharge capacity of Ni foam/ NiO (C_3), and the difference of the C_α and C_3 (C_{α-3}) at various current densities.

Fig. S14 Rate areal capacity of the Ni foam/N-CNTs/NiO NSs electrode.
**Fig. S15** SEM images of Ni foam/N-CNTs/NiO electrode after 20 cycles at a current density of 0.2 A g⁻¹.

**Fig. S16** Nyquist plots of the Ni foam/NiO and Ni foam/N-CNTs/NiO electrodes at the initial.