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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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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 ($vs \text{ Li/Li}^+$) 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 ($vs \text{ Li/Li}^+$) 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 (C₁) subtracts the discharge capacity of Ni foam/N-CNTs (C₂), the discharge capacity of Ni foam/ NiO (C₃), and the difference of the C_a and C₃ (C_{a-3}) at a current density of 0.2 A g^{-1} .



Fig. S13 Rate 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 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.