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Supporting Information for

Uniqueness of Co_3O_4/Nitrogen-Doped Carbon Nano-spheres Derived from Metal-Organic-Framework: Insight of Superior Lithium Storage Capabilities Beyond Theoretical and Electrochemical Features in High Voltage Battery

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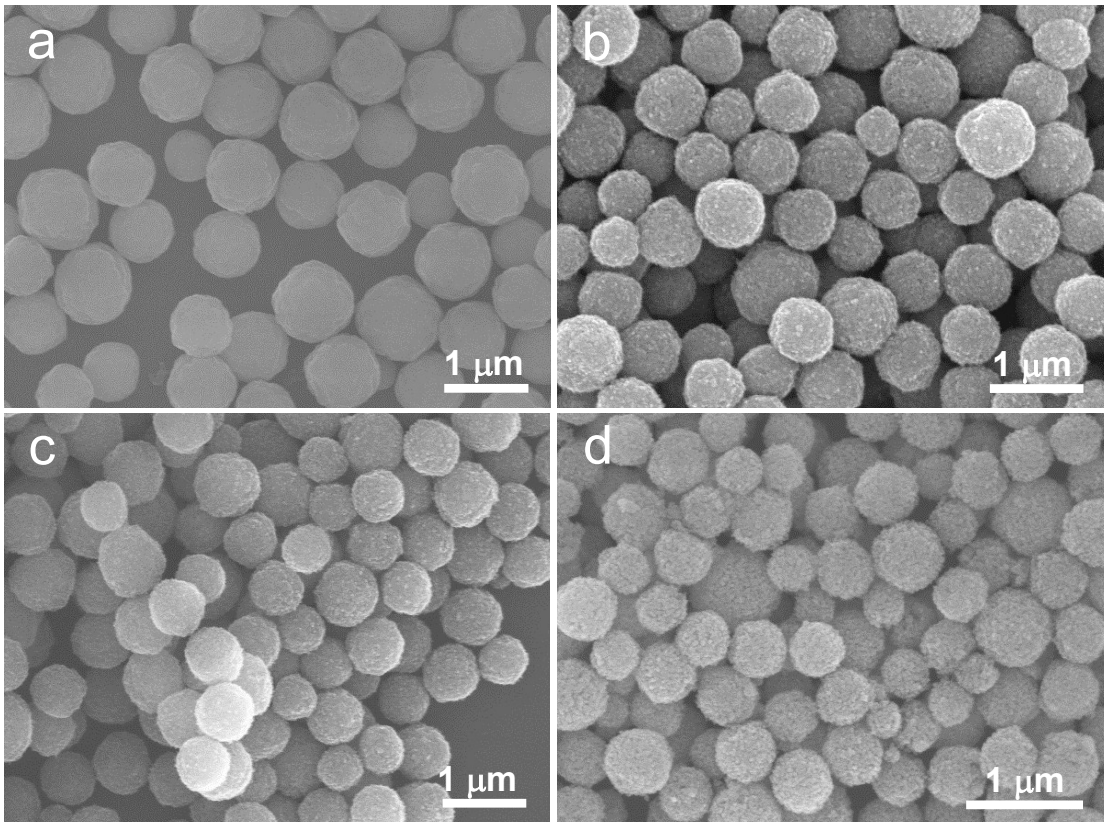

Figure S1 | Morphology and structural variation. SEM images of (a) $Zn_3[Co(CN)_6]_2 \cdot nH_2O$ precursor, (b) Co/N-C intermediate, (c) Co_3O_4/N-C and (d) derivate of Co_3O_4 nano-spheres with low magnification.

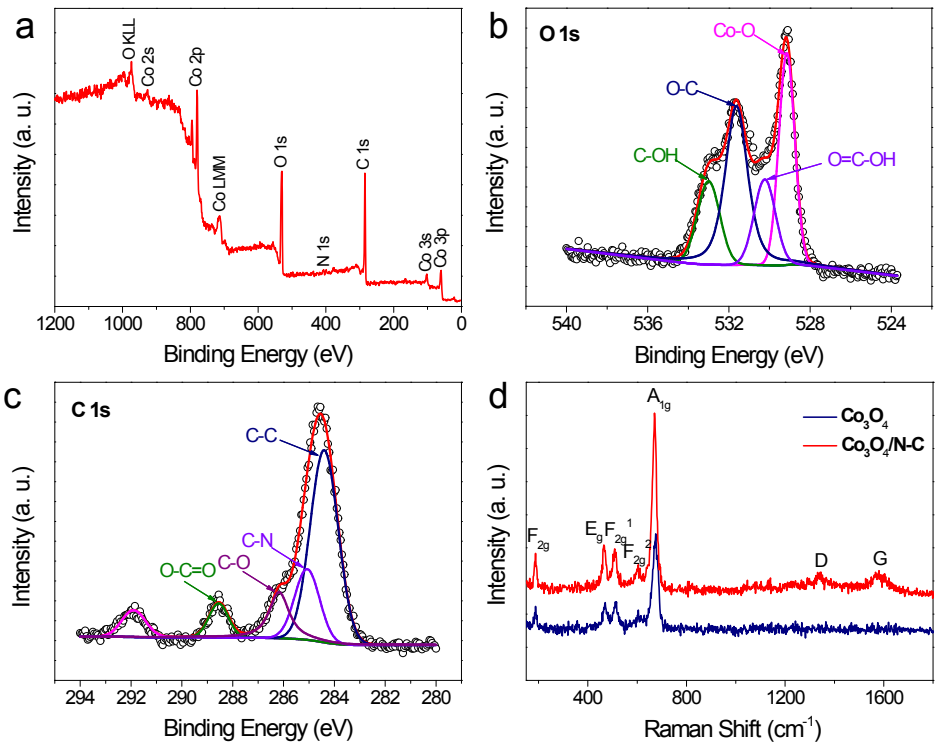

Figure S2 | **Characterizations of composite materials.** (a) XPS survey spectrum of Co_3O_4/N-C. High resolution XPS spectra of (b) O 1s and (c) C 1s of the Co_3O_4/N-C hybrid nanospheres. (d) Raman spectra of Co_3O_4 and Co_3O_4/N-C hybrid nanospheres. The O 1s XPS spectrum comprise three peaks at 532.9 eV (C-OH), 531.6 eV (O-C), 530.2 eV (O=C-OH) and 529.1 eV (Co-O), demonstrating the existence of elemental oxygen. In C 1s spectrum, the prominent peak located at 284.4 eV was assigned to C-C, while the peaks centered at the higher binding energies of 285.1, 286.2 and 288.5 eV were attributed to C-N, C-O, and O-C=O. A small peak at above 291.8 eV can be assigned to p–p* shake-up satellites of sp^2 graphite-like carbon, which is consistence with the results observed in HRTEM. All information confirm that the composite has the chemical compositions of Co_3O_4/N-C.

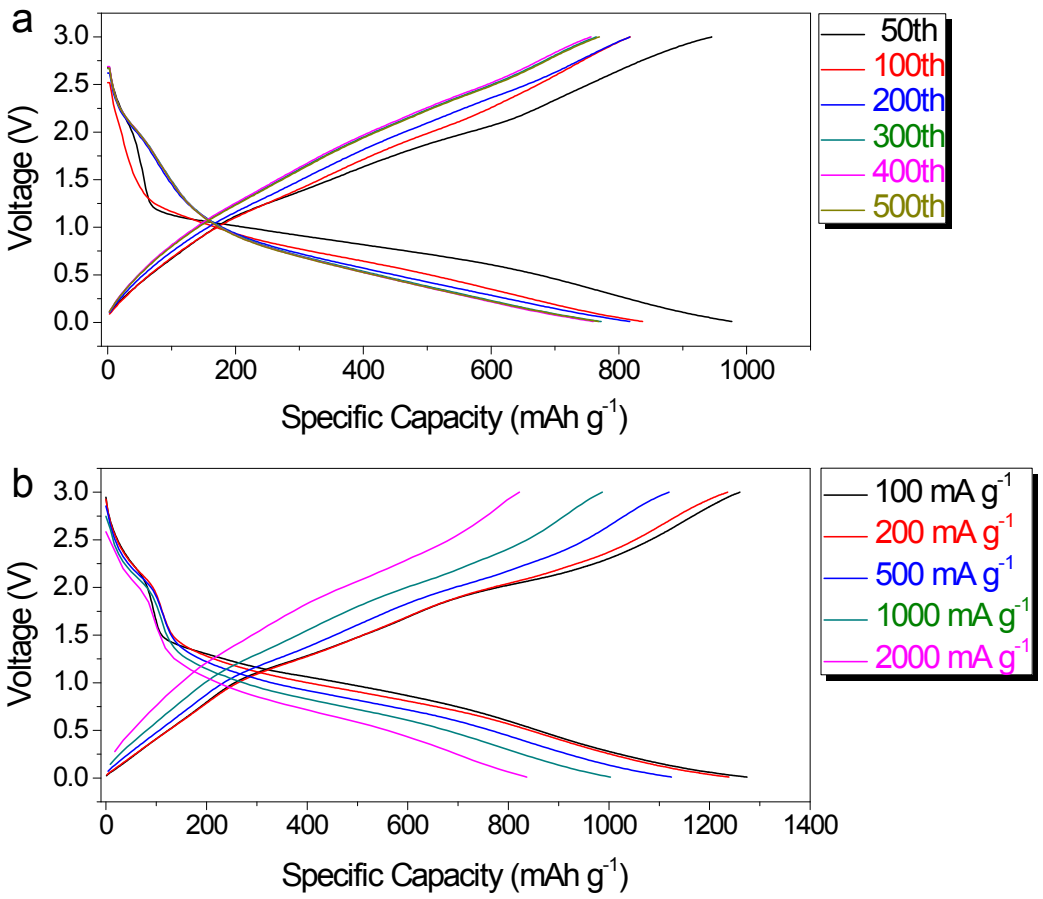

Figure S3 | **Electrochemical performances.** Typical voltage *vs.* capacity profiles of Co_3O_4/N-C in the (a) cycle and (b) rate capability test.

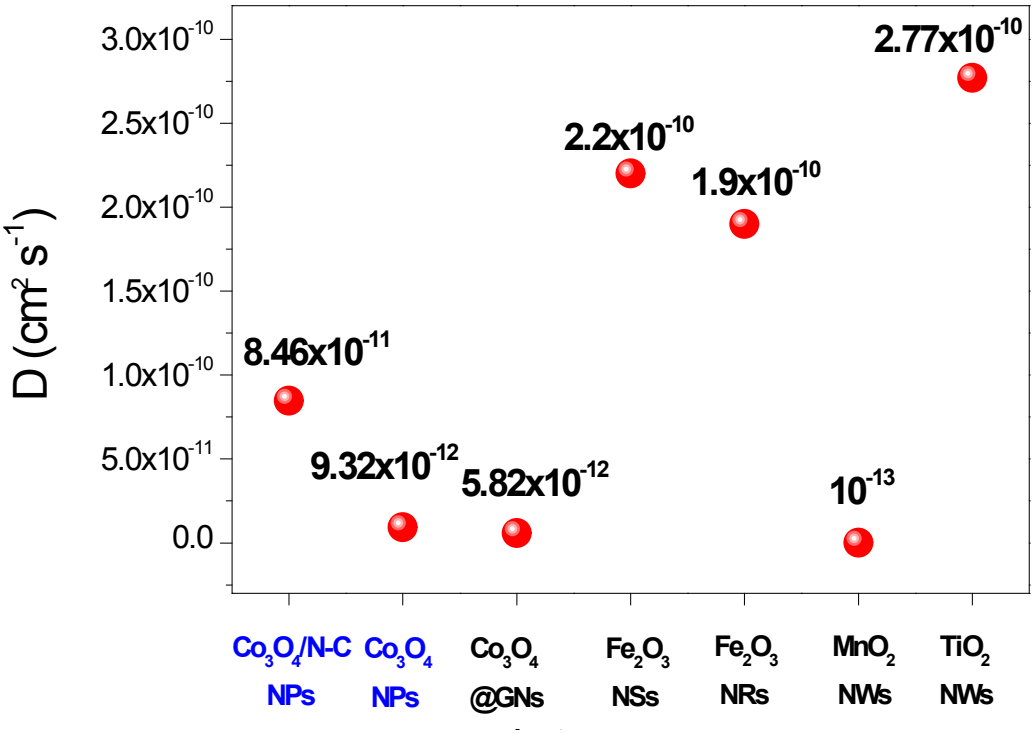

Figure S4 | Lithium diffusion constant. Comparative lithium diffusion coefficients of Co_3O_4/N-C, Co_3O_4 NPs and other kind of transitional metal oxides reported before.

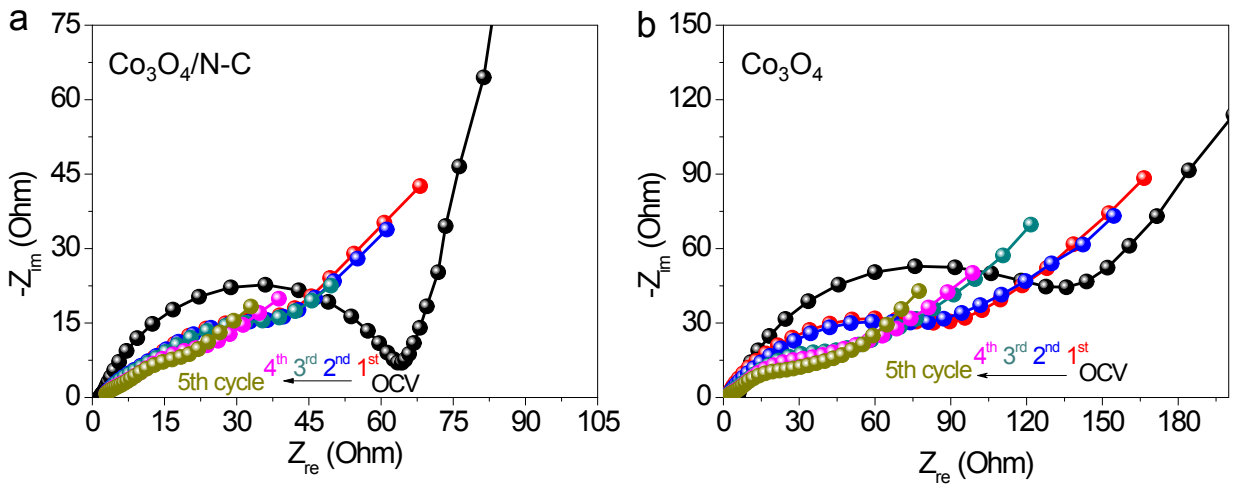

Figure S5 | **Electrochemical impedance spectroscopy.** Nyquist plots of (a) Co_3O_4/N-C and (b) pure Co_3O_4 electrodes.

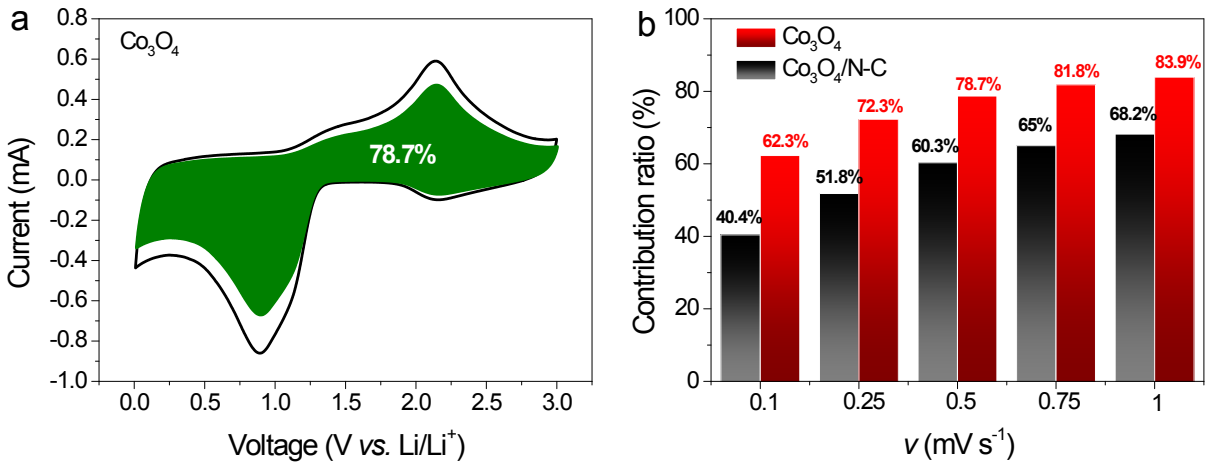

Figure S6 | Electrochemical analysis. (a) Cyclic voltammetry of pure Co_3O_4 with the capacitive contribution at a scan rate of 0.5 mV s^{-1} and (b) Normalized contribution ratio of capacitive capacities of Co_3O_4 and Co_3O_4/N-C at different scan rates.