Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Hierarchical architectures of Co_3O_4 ultrafine nanowires grown on Co_3O_4 nanowires with fascinating electrochemical performance

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Part I: Calculations

The specific capacitance (C) of the electrode was calculated from the discharge curves using the following formula[1]:

$$C = \frac{I \times \Delta t}{m \times \Delta V}$$

where I (A), Δt (s), m (g), and ΔV (V) are the discharge current, discharge time consumed in the potential range of ΔV, mass of the active materials, and the potential windows, respectively.

The energy density (E) and power density (P) are calculated from the discharge curves using the following formula:

$$E = \textbf{Error!} \times C \times \Delta V^2$$

$$P = \frac{E}{\Delta t}$$

1. J. Yan, E. Khoo, A. Sumboja and P. S. Lee. *ACS Nano*, 2010, **4**, 4247.

Part II: Supplementary Figures

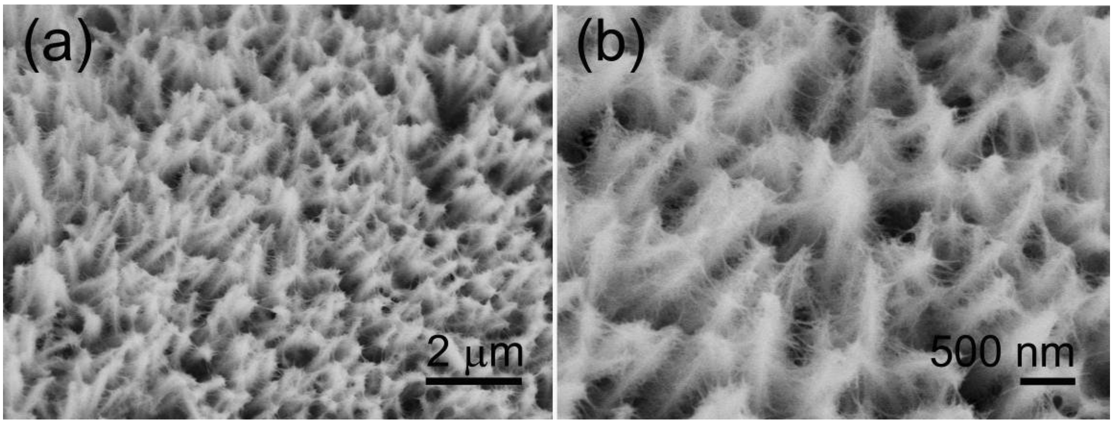

Fig S1 Low- and high- magnification SEM images of the Co-based intermediate.

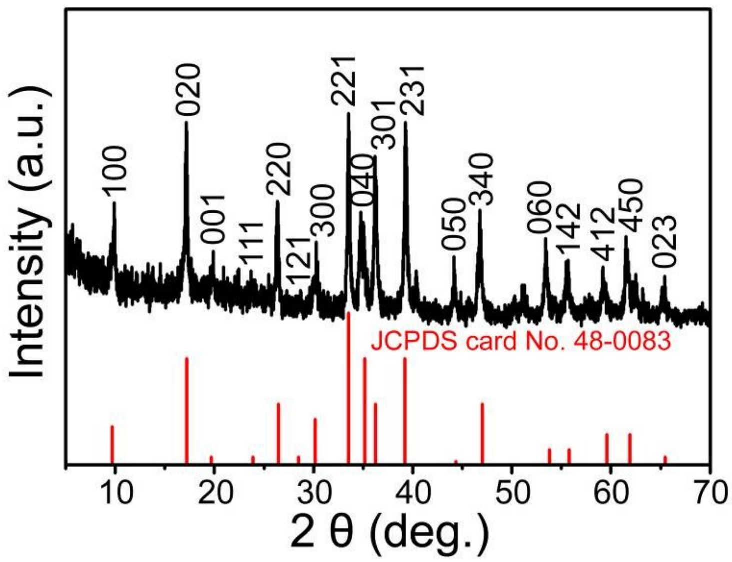

Fig S2 XRD patterns of the as-prepared Co-based intermediate.

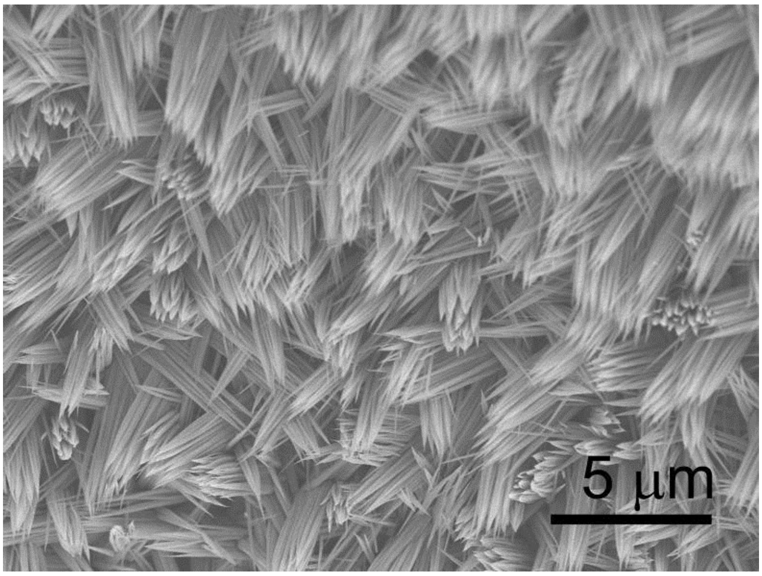

Fig S3 SEM image of the conventional Co_3O_4 nanowires.

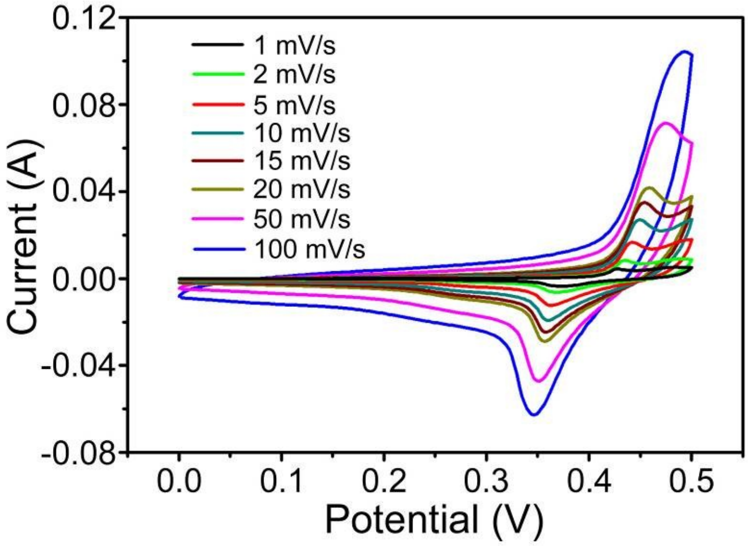

Fig S4 CV curves of the conventional Co_3O_4 nanowires at different scan rates, respectively.

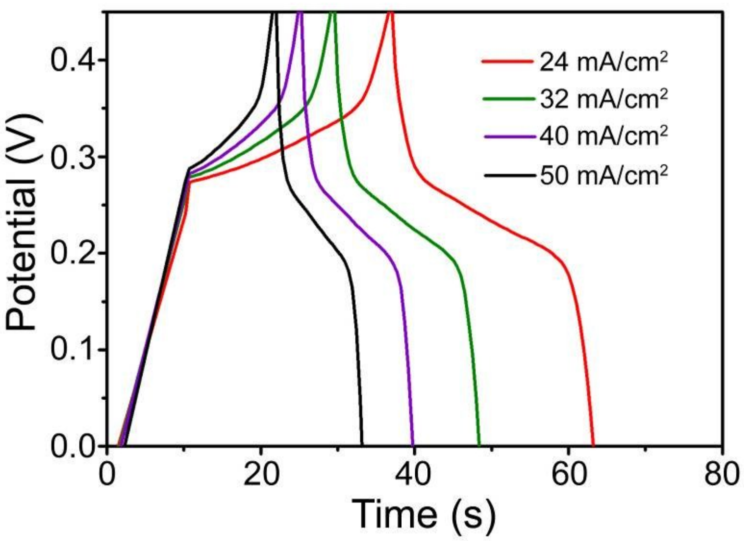

Fig S5 Galvanostatic charge-discharge curves of the Co_3O_4 nanowires@nanowires at different high current densities, respectively.

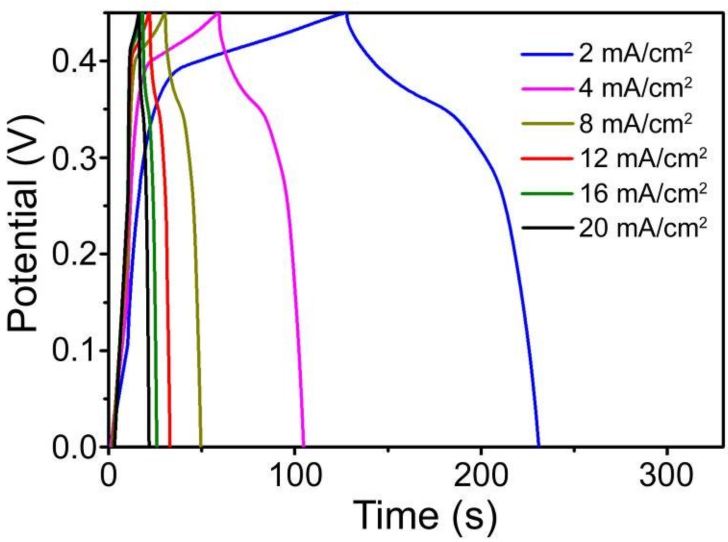

Fig S6 Galvanostatic charge-discharge curves of the conventional Co_3O_4 nanowires at different current densities, respectively.

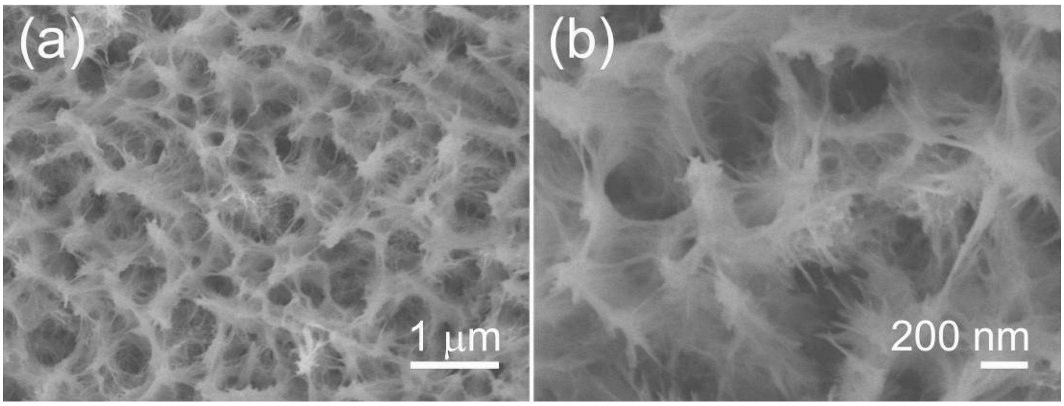

Fig. S7 Different magnification SEM images of the hierarchical Co_3O_4 nanowires@nanowires on Ni foam after 10000 cycle CV test.

Table S1 A comparison of the capacitance for the Co_3O_4 nanowires@ultrafine nanowire electrode material with other reported Co_3O_4 materials based electrodes in previous literatures.

Electrode Materials	Specific Capacitance	Rate Capability	Ref.
Co_3O_4 nanowires@ ultrafine nanowires	1640 F g^{-1} at 2mA cm^{-2} (1640 F g^{-1} at 1.7 A g^{-1})	66% retention from 2 to 50 mA cm^{-2}	This work
Co_3O_4 nanoparticles	519 F g^{-1} at 0.5 mA cm^{-2}	25.8% retention from 0.5 to 10 mA cm^{-2}	18
Dendrite-like Co_3O_4 nanostructures	207.8 F g^{-1} at 0.5 A g^{-1}	36.1% retention from 0.5 to 6 A g^{-1}	19
Mesoporous Co_3O_4 nanocubes	350 F g^{-1} at 0.2 A g^{-1}	45.7% retention from 0.2 to 2 A g^{-1}	20
Hollow Co_3O_4 boxes	278 F g^{-1} at 0.5 A g^{-1}	63.3% retention from 0.5 to 5 A g^{-1}	37
Co_3O_4 nanowires	1217.4 F g^{-1} at 0.7 A g^{-1}	57.5% retention from 0.7 to 20 A g^{-1}	38
Flower-like Co_3O_4 microspheres	541.9 F g^{-1} at 1 A g^{-1}	54% retention from 0.7 to 20 A g^{-1}	39
Nanonet-like Co_3O_4	1084 F g^{-1} at 5 mA cm^{-2}	62.1% retention from 5 to 100 mA cm^{-2}	40
Co_3O_4@MnO_2 nanoflakes	675.9 F g^{-1} at 1 A g^{-1}	26.8% retention from 1 to 10 A g^{-1}	41
Co_3O_4@MnO_2 nanoconch arrays	1183.6 F g^{-1} at 1 A g^{-1}	51.6% retention from 1 to 10 A g^{-1}	42
Co_3O_4 nanowire@MnO_2 ultrathin nanosheet	480 F g^{-1} at 2.67 A g^{-1}	55.6% retention from 2.67 to 29.8 A g^{-1}	43
Hybrid NiO/Co_3O_4 architectures	193 F g^{-1} at 3 A g^{-1}	60.1% retention from 3 to 8 A g^{-1}	44
ZnO@Co_3O_4 core/shell heterostructures	857.7 F g^{-1} at 2 mA cm^{-2}	63.4% retention from 2 to 20 mA cm^{-2}	45
Co_3O_4/RGO composites	518.8 F g^{-1} at 0.5 A g^{-1}	47.6% retention from 0.5 to 10 A g^{-1}	46
Co_3O_4/Carbon composites	400 F g^{-1} at 0.5 A g^{-1}	37.5% retention from 0.5 to 5 A g^{-1}	47
Co_3O_4 nanoplates/ grapheme nanosheets	703.4 F g^{-1} at 0.625 A g^{-1}	37.5% retention from 0.625 to 12.5 A g^{-1}	48