Supplementary Information

C@Fe_3O_4 nanoparticles anchored on carbon nanotubes with enhanced reversible lithium storage

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Experimental Section

Synthesis of porous CNT@Fe_3O_4@C nanocomposites

70 mg of sulfonated polymer nanotubes (SPNTs) [1,2] were dispersed in 30 mL of ethylene glycol by ultrasonic, 35 mg of dopamine hydrochloride (DHC) and 0.7 g of $Fe(NO_3)_3 \cdot 9H_2O$ were successively added, and then stirred for 1 h at room temperature. Subsequently, the mixture was transferred to a microwave reactor, setting system parameters, including reaction temperature (180 ^oC), power (80 W), running time (5 min) and reaction time (30 min, 60 min, and 90 min, respectively). After cooling down naturally, these samples were washed with distilled water and collected by centrifuge, and then throughly dried at 80 ^oC. Ultimately, the precursors were calcined in nitrogen atmosphere (700 °C / 2 h / 5 $^oC\ min^{-1}$), resulting the achievement of CNT@Fe_3O_4@C, which were labeled as W180-30, W180-60, and W180-90 with different reaction time, respectively.

Material characterization

Material compositions of W180 series were characterized by X-ray diffraction (XRD; Bruker D8/Cu Kα radiation). Morphology analysis was conducted by utilizing Hitachi's field-emission scanning electron microscopy (SEM, Hitachi-S-4800) and transmission electron microscopy (TEM, Hitachi-2600) and high resolution transmission electron microscope (HRTEM, JEOL JEM-2010F). Thermogravimetric analysis (TGA) was conducted by the Netzsch STA 449C from room temperature to 800 ^oC with a heating rate of 10 $^oC\ min^{-1}$. Brunauer-Emmett-Teller (BET) specific surface area and pore structure analysis (DFT method) of the products were measured by nitrogen adsorption/desorption with an Autosorb-iQ Pressure Sorption Analyzer (Quantachrome Instruments USA) at 77 K. The preparation of the working electrodes follows the previous procedure. [3] Cyclic voltammetry curves were accounted on a CHI-660C workstation with a sweep rate of 0.1 mV s^{-1}. Galvanostatic charge and discharge processes were conducted on a Land (CT2001A China) at 0.01-3.00 V

(versus Li^+/Li). EIS behaviors were gained within the frequency scope of 100 kHz to 10 mHz.

Table S1. Comparison of preparation and electrochemical performances in various Fe_3O_4@C-based materials.

Composites	Synthesis condition	Current density (mA g^{-1})	Capacity level (mAh g^{-1})	Tested condition (V)	Ref.
Fe_3O_4@C/CNT	Stiring at 75 °C for 5 h+ hydrothermal at 180 °C for 6 h/450 °C calcination in N_2 for 4 h	1200	282	0.01-3.0	[4]
GS@Fe_3O_4@C	Solvothermal at 210 °C for 24 h/450 °C calcination in N_2 for 4 h	1600	483.2	0.01-3.0	[5]
Fe_3O_4@C/G	Solvothermal at 180 °C for 10 h/500 °C calcination in Ar for 1 h	1600	250	0.01-3.0	[6]
N–C@Fe_3O_4@N–C	Stiring at 80 °C for 30 min/500 °C calcination in Ar for 3 h	2000	470	0.01-3.0	[7]
Fe_3O_4@C-rGO	Solvothermal at 180 °C for 24 h/650 °C calcination in Ar for 2 h	1658	~410	0.01-3.0	[8]
SnO_2-Fe_3O_4@C	Solvothermal at 190 °C for 9 h/500 °C calcination in Ar for 2h	2000	133	0.01-3.0	[9]
MnO_2@Fe_3O_4@C	Solvothermal at 120 °C for 12 h/550 °C calcination in N_2 for 2.5 h	2000	450	0.01-3.0	[10]
C-N@Fe_3O_4@C-N-20	Ultrasound-assisted in-situ polymerization of pyrrole/600 °C calcination in N_2 for 2 h	2000	437	0.01-3.0	[11]
MnO-doped Fe_3O_4@C	Solvothermal at 180 °C for 12 h/450 °C calcination in N_2 for 2 h	800	430	0.01-3.0	[12]
CNT@Fe_3O_4@C	Microwave-assisted 180 °C reaction for 60 min/700 °C calcination in N_2 for 2 h	2000	490	0.01-3.0	This work

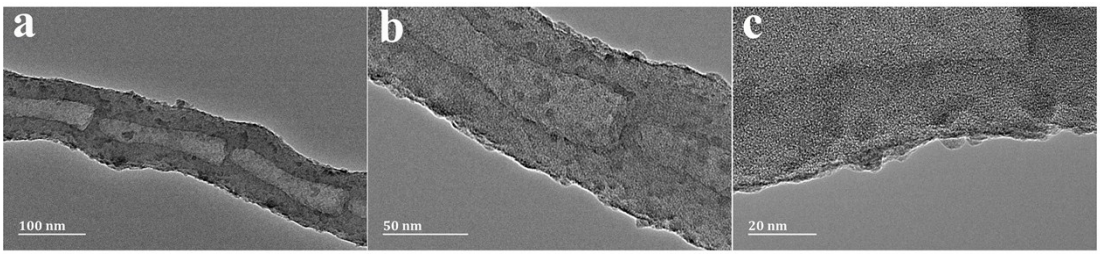

Figure S1. TEM images of SPNTs@180-60 at different resolutions.

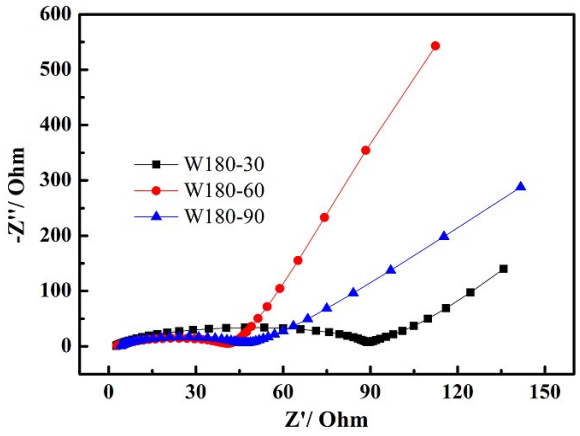

Figure S2. Nyquist plots of W180-30, W180-60, and W180-90.

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