Supporting Information

Sn Nanoparticles@Nitrogen Doped Carbon Nanofiber Composites as High-Performance Anode for Sodium-Ion Batteries

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Keywords: Sn nanoparticles, nitrogen doped carbon nanofibers, electrospinning, sodium ion battery anode material

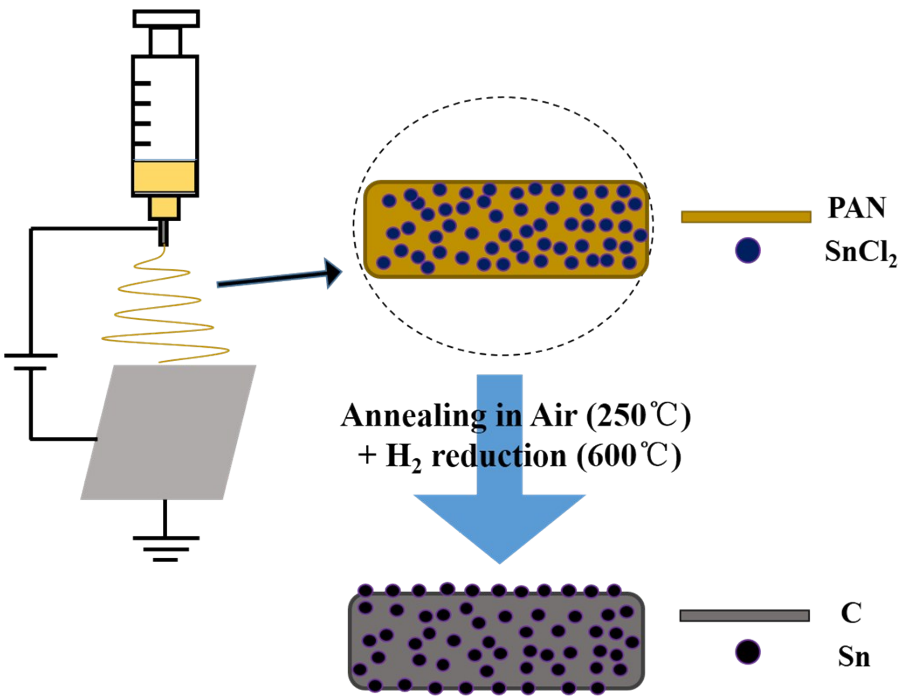

Figure S1. Schematic illustration of the preparation process for the Sn@NCNFs.

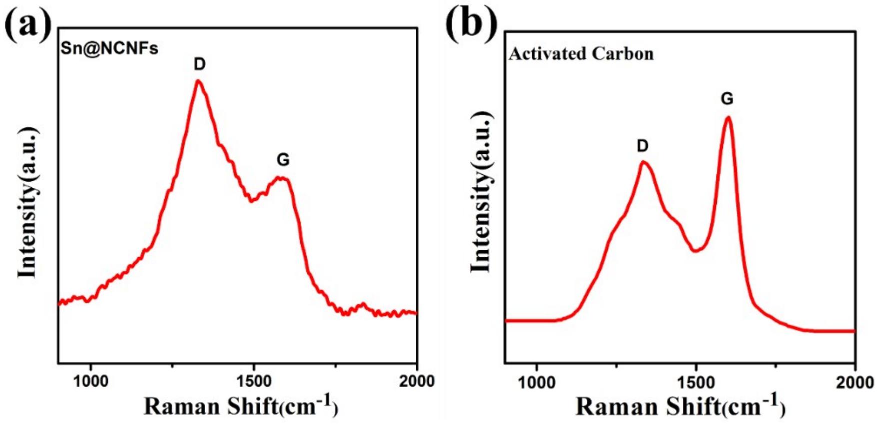

Figure S2. Raman spectra of (a) Sn@NCNFs and (b) activated carbon

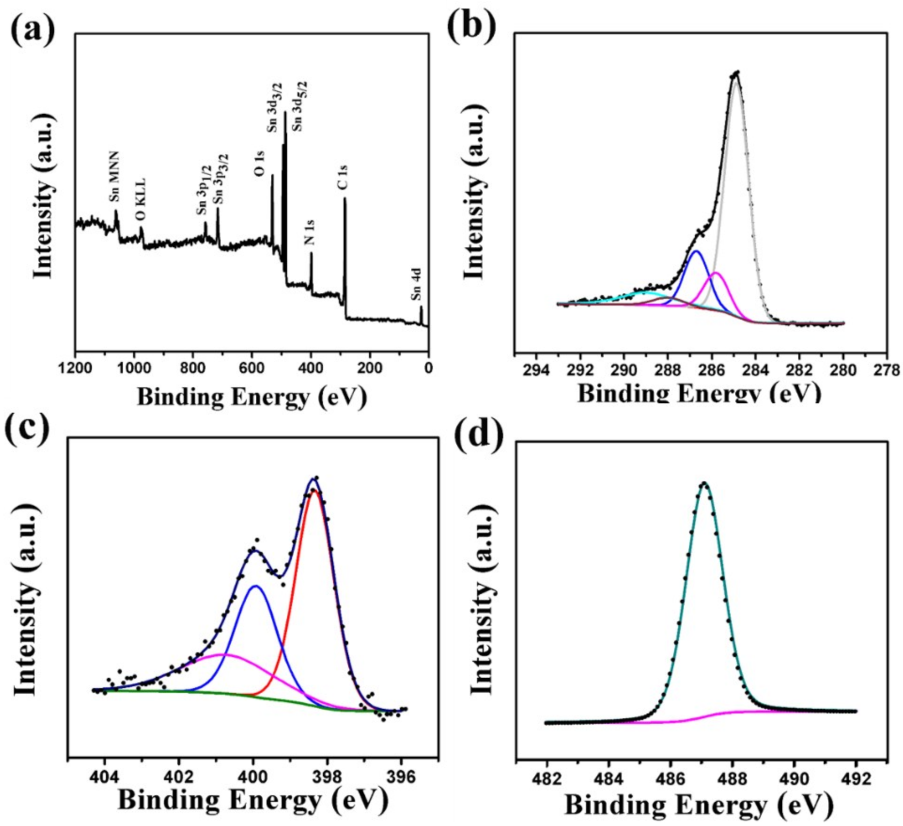

Figure S3. XPS general spectrum of Sn@NCNFs composite (a) and the corresponding high resolution spectra of C 1s (b), N 1s (c) and Sn 3d (d).

Figure S3b shows the C 1s spectrum and the fitting peaks: C–C in aromatic rings at 284.9 eV, C=N at 285.8 eV, C–O at 286.7 eV, C=O at 288.1 eV, and O=C–O at 289.1 eV. Figure S3c shows two N 1s peaks, which can be fitted by three component peaks at 398.3, 399.9 and 400.8 eV, which are assigned to pyridinic, nitrile, and quaternary nitrogen, respectively. Figure S3d shows the components ascribed to Sn^{4+} at 487.1 eV. No metallic state of Sn was observed because of the oxidation of Sn on the surface of the sample. [1]

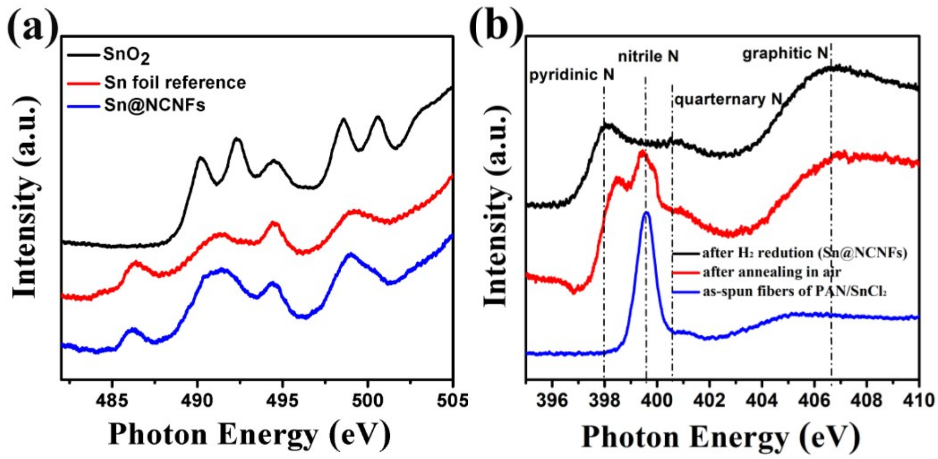

Figure S4. XANES spectra of Sn $M_{4,5}$-edge in Sn@NCNFs composite and the reference samples (a) and N K- edge in different product obtained in various synthetic stages (b).

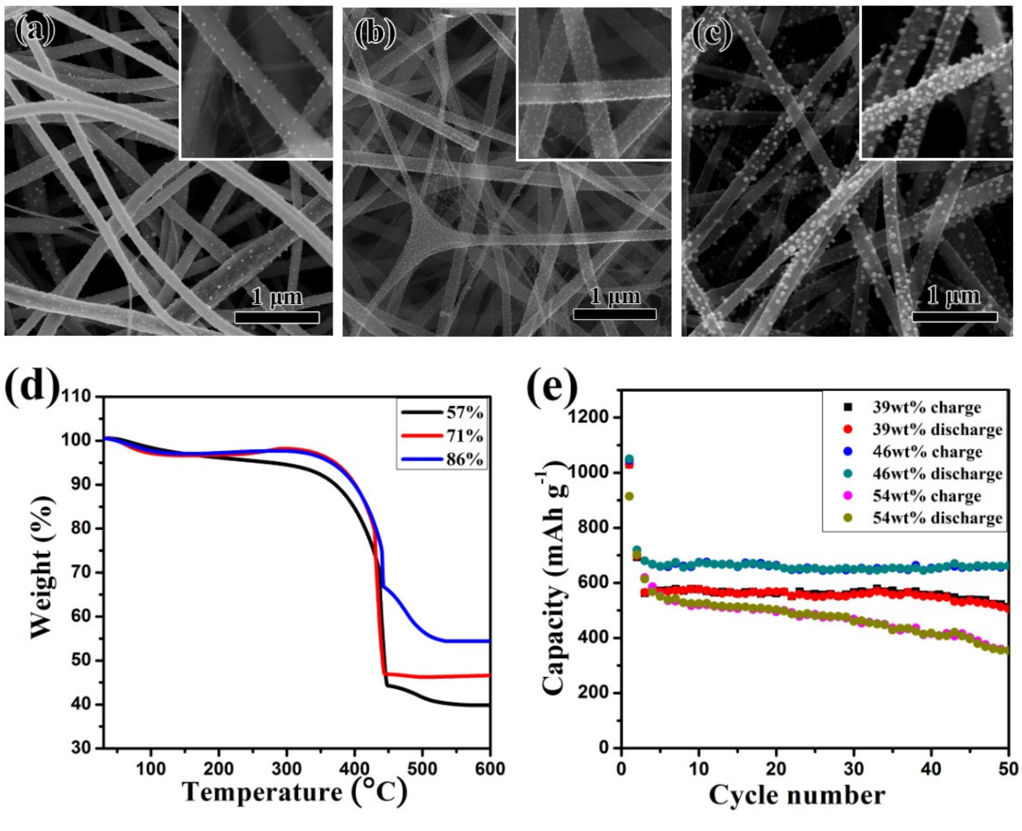

Figure S5. SEM images, Thermogravimetric analysis and Cycling performance of Sn@NCNFs with different Sn content. (a-c) SEM images of Sn@NCNFs with mass fraction (m_{SnCl2}/m_{PAN}) of (a) 57%, (b) 71% and (c) 86%. (d) Thermogravimetric analysis of Sn@NCNFs composites with different mass fraction of 57%, 71% and 86% in air, showing the content of Sn in these three samples were 39 wt.%, 46 wt.% and 54 wt.%, respectively. (e) Cycling performance of Sn@NCNFs with the Sn content of 39wt.%, 46wt.% and 54wt.%, respectively.

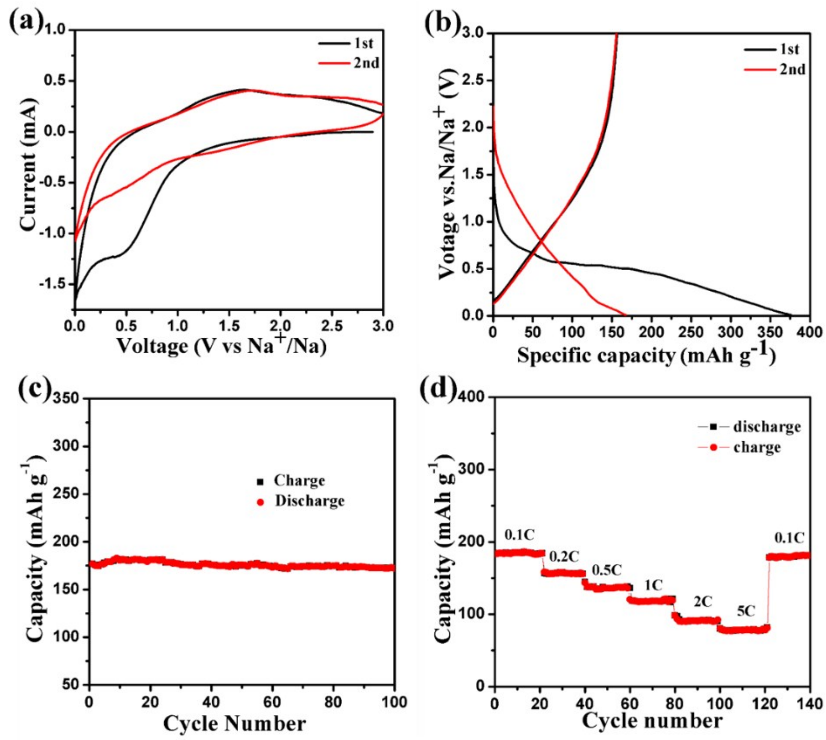

Figure S6. Electrochemical performance of pure NCNFs electrode for SIBs: (a) CV curves of the initial two cycles from 3.0 V to 0 V vs. Na^+/Na at a scan rate of 0.1 mV s^{-1}; (b) the initial two discharge-charge profiles between 0 V and 3.0 V vs. Na^+/Na at a current rate of 0.1 C (84.7 mA g^{-1}); (c) cycling performance at a rate of 0.1 C; (d) rate capability at various current rates from 0.1 C to 5 C and back to 0.1 C.

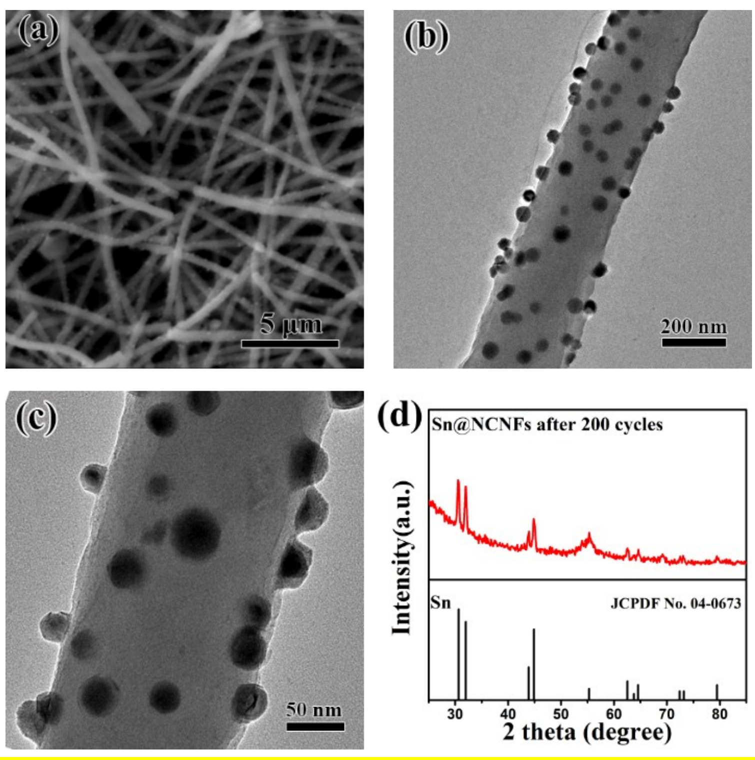

Figure S7. SEM image (a), TEM images (c, d) and XRD pattern (d) of Sn@NCNFs after 200 cycles at 0.1C

Table S1. Summary of cycling performance for Sn@NCNFs anodes in SIBs.

Sample	Current dentist (mA g^{-1})	Cycle number (cycles)	Specific capacity (mA h g^{-1})	Reference
Porous C/Sn	20	15	200	2
C/Sn/Ni/TMV	50	150	105	3
Sn@Wood fiber	84	400	145	4
Al_2O_3/Sn@CNFs	84.7	40	650	5
$Sn_{0.9}Cu_{0.1}$	169	100	420	6
Sn-polyacrylate	50	25	500	7
Sn/graphite composite	50	20	350	8
Sn@NCNFs	84.7	200	610	This work
	847	1000	400	

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