Supporting Information

Highly Integrated All-manganese Battery with Supported Oxide Nanoparticles on Cathode and Anode by Super-aligned Carbon Nanotubes

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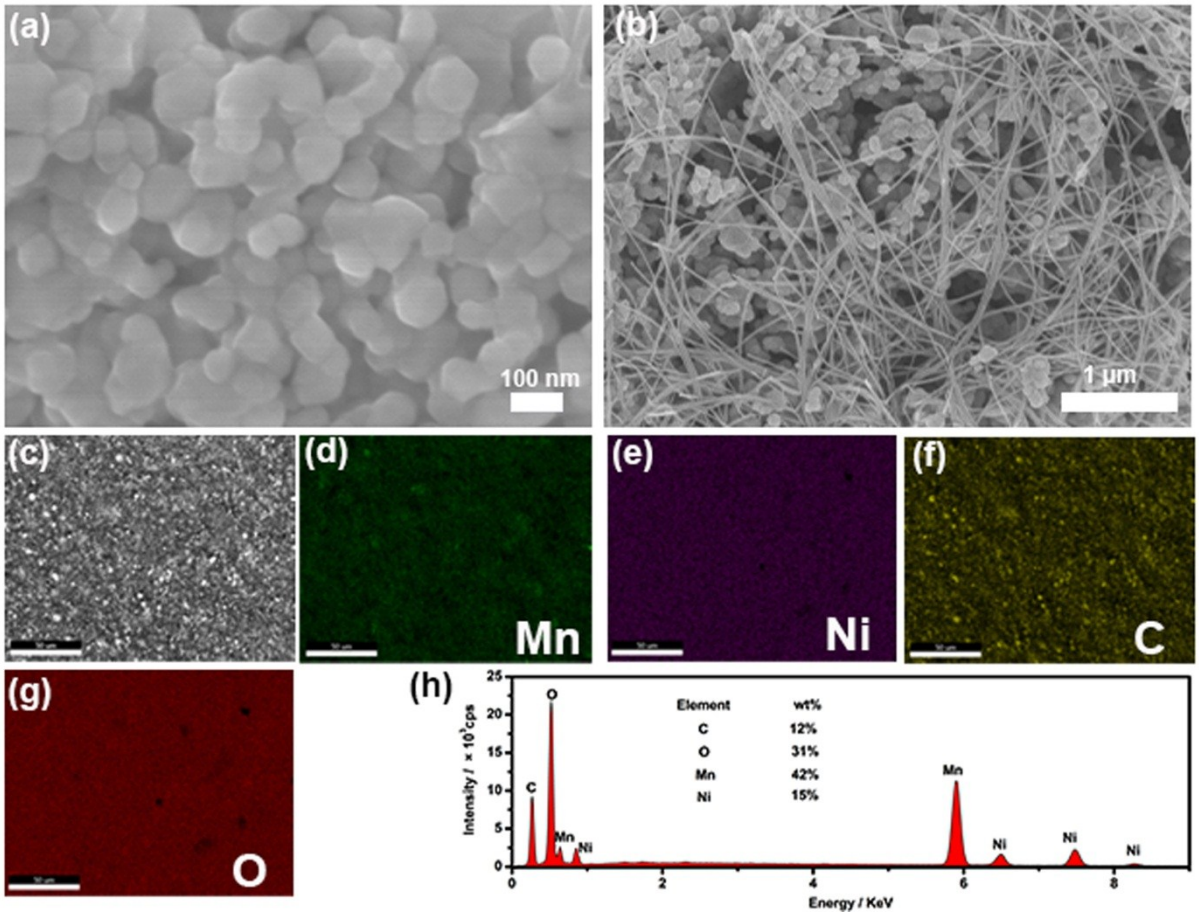

Fig. S1. (a) SEM image of LMN nanoparticles; (b) The top-view SEM image of LMN/SACNT; (c) SEM image of LMN/SACNT and corresponding element mappings of (d) Mn, (e)Ni, (f) C, and (g) O; (h) EDS profile and element contents.

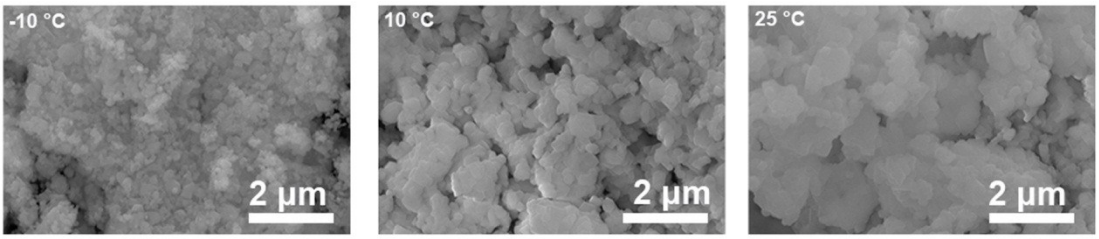

Fig. S2. SEM images of LMN from the precursor synthesized at -10°C, 10 °C and 25 °C.

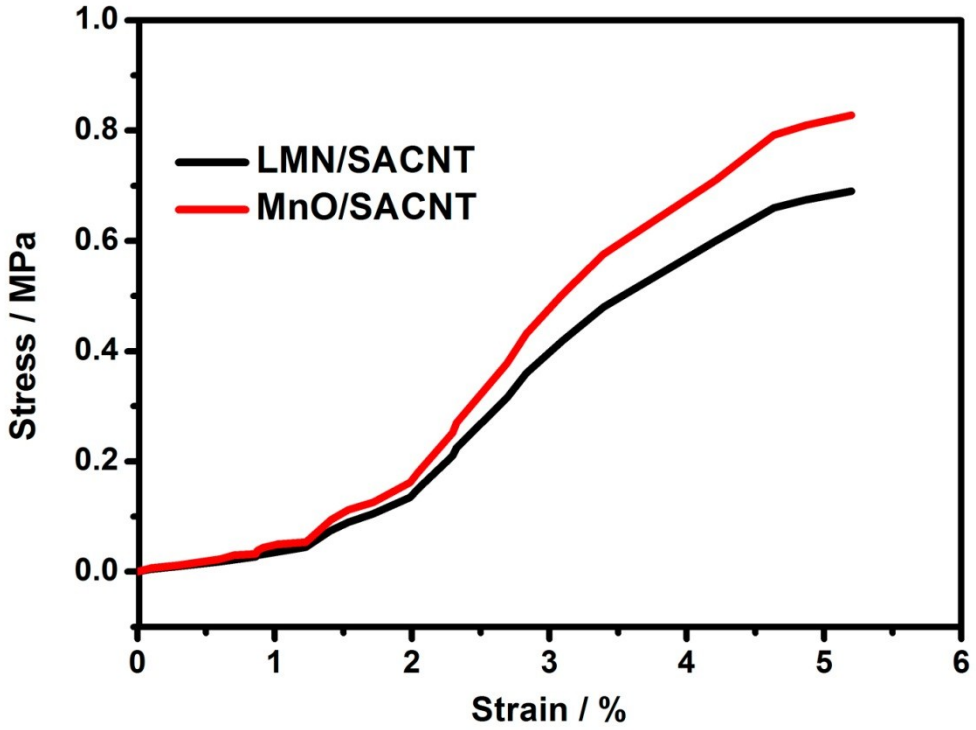

Fig. S3. Stress-strain curves of LMN/SACNT and MnO/SACNT electrodes.

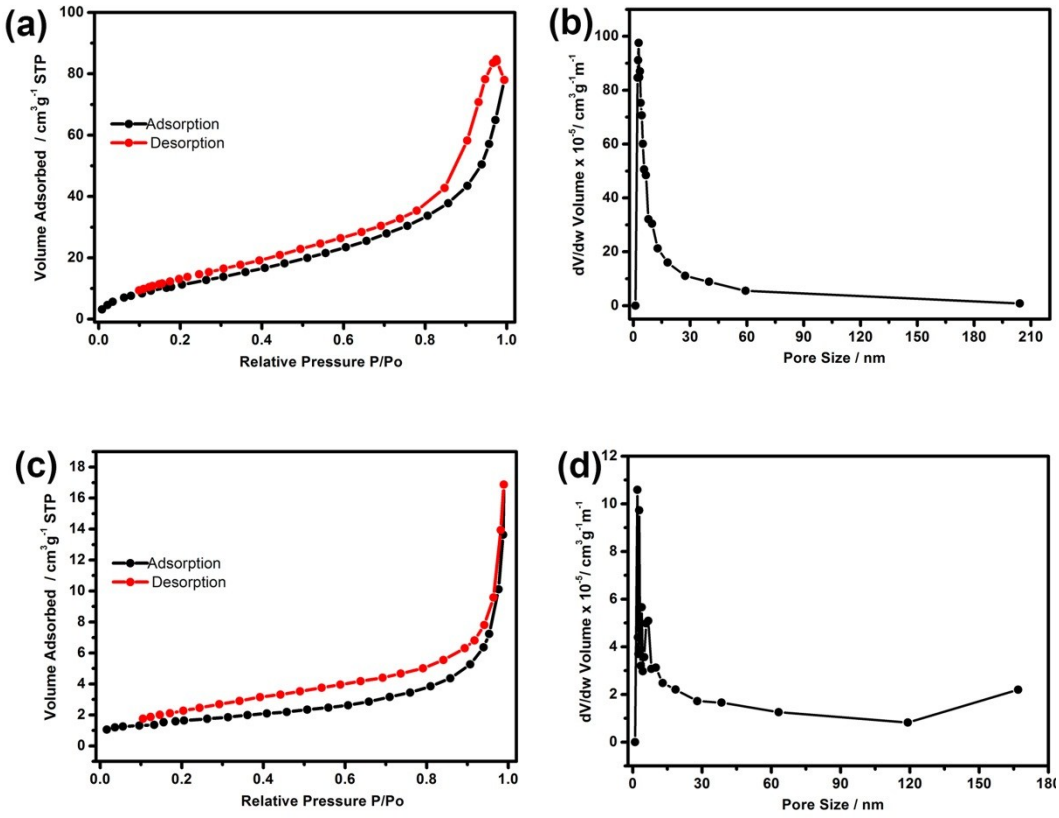

Fig. S4. (a, c) Nitrogen adsorption and desorption isotherms and (b, d) pore distribution curves of LMN/SACNT (a, b) and LMN (c, d).

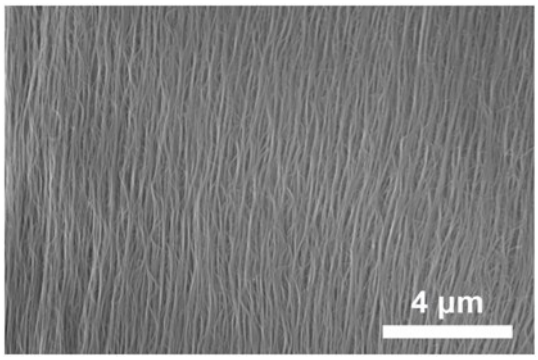

Fig. S5. SEM image of SACNT, indicating the orderly arranging of CNTs in long range.

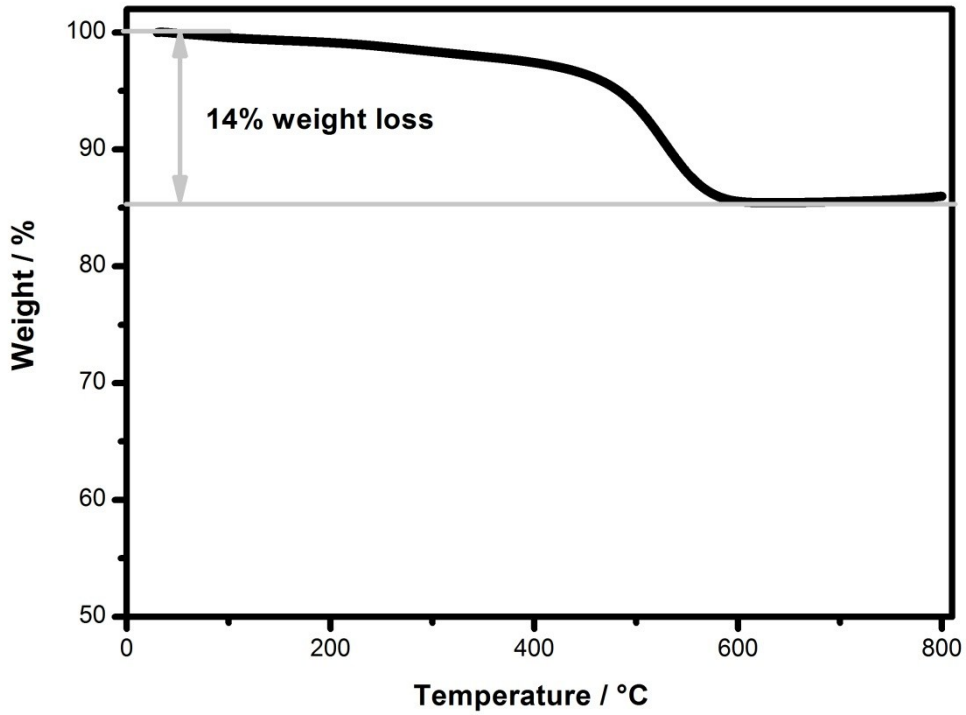

Fig. S6. TGA curve of LMN/SACNT.

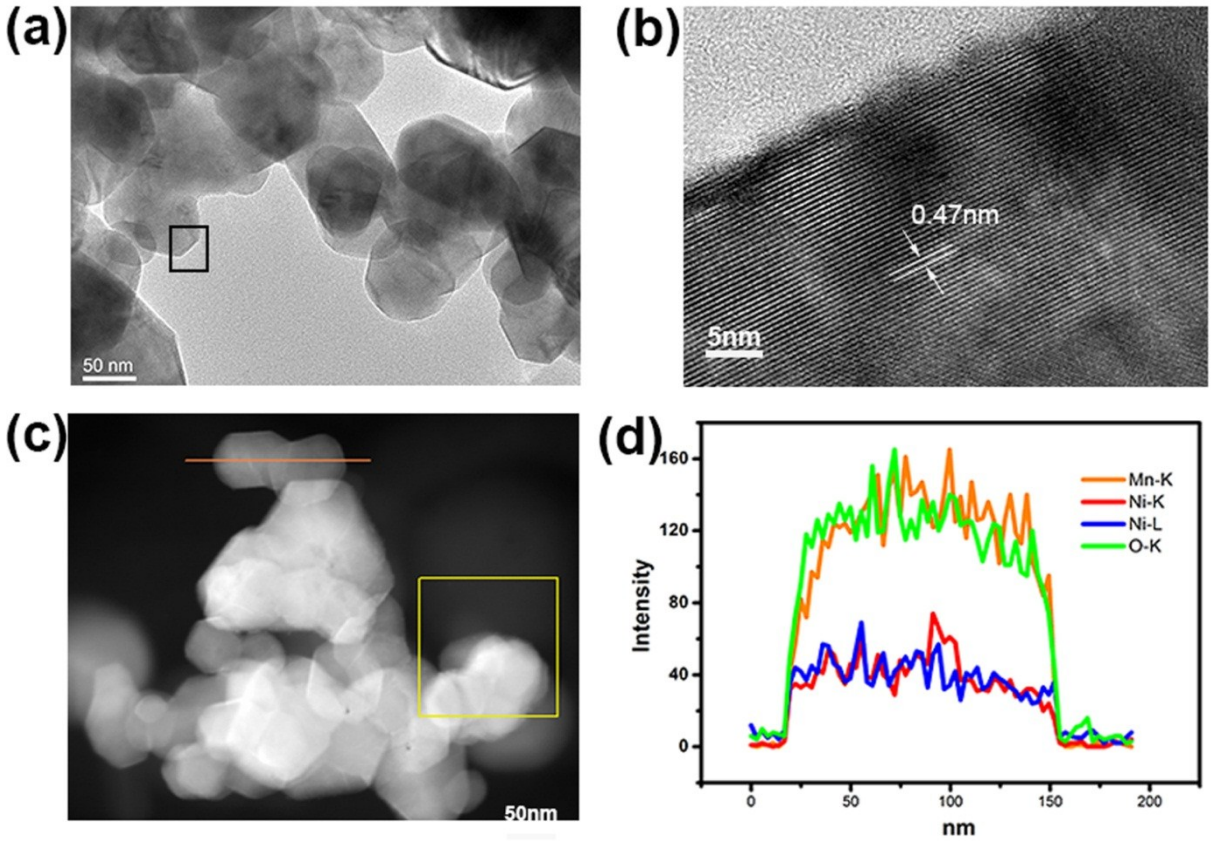

Fig. S7. (a) TEM, (b) HRTEM and (c) HAADF STEM images of LMN nanoparticles; (d) Line scan EDS profile in (c).

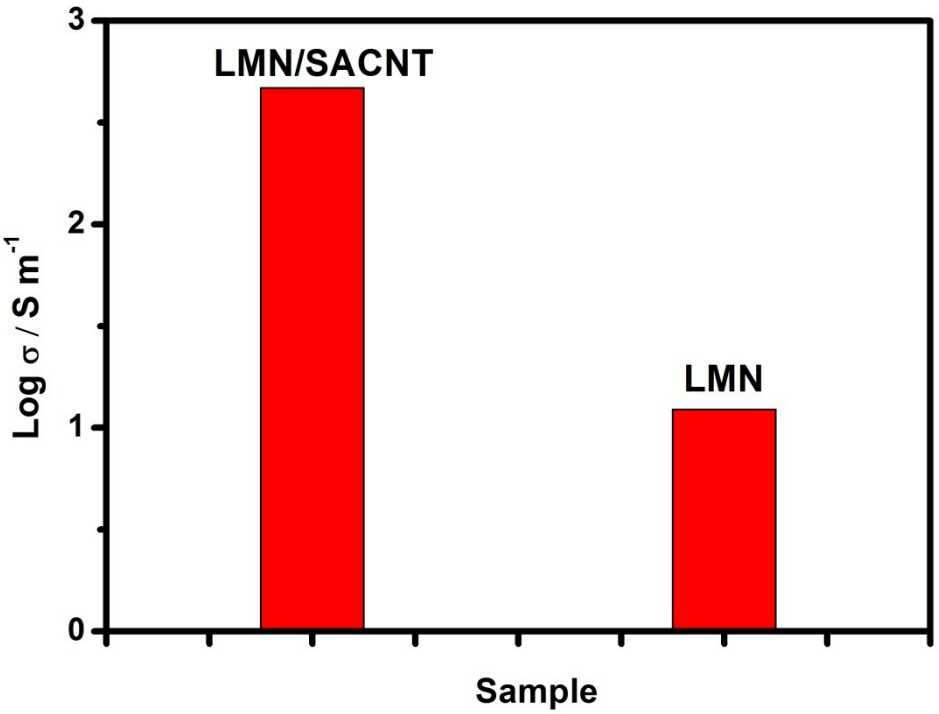

Fig. S8. Electrical conductivity of LMN/SACNT and LMN.

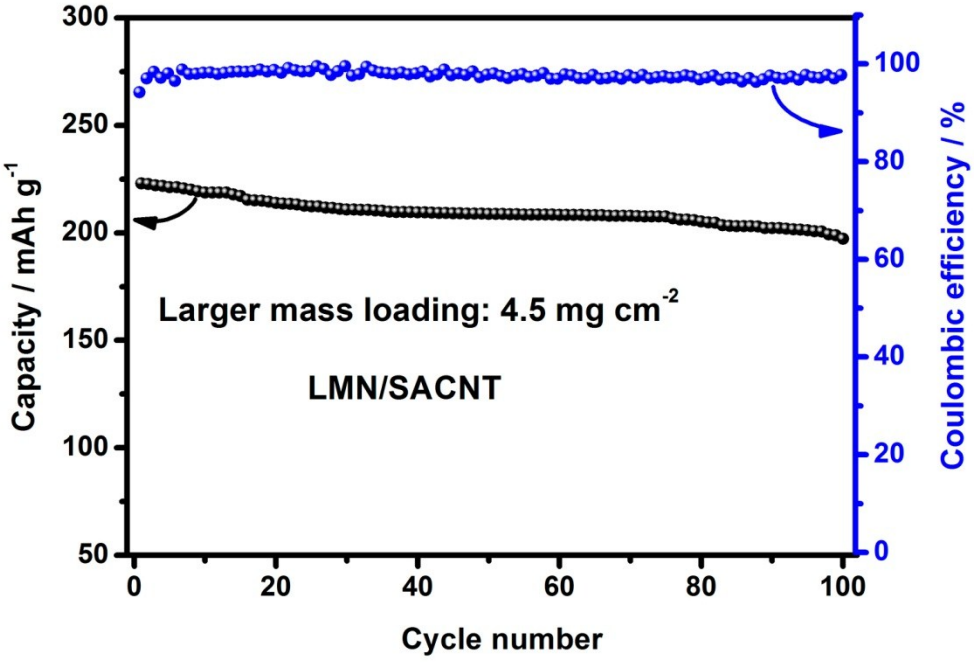

Fig. S9. Cycling performance and corresponding Coulombic efficiency of LMN/SACNT electrode with a mass loading of 4.5 mg cm^{-2} at 0.3C. Before cycling, an initial activation was performed at 0.1 C for 5 cycles.

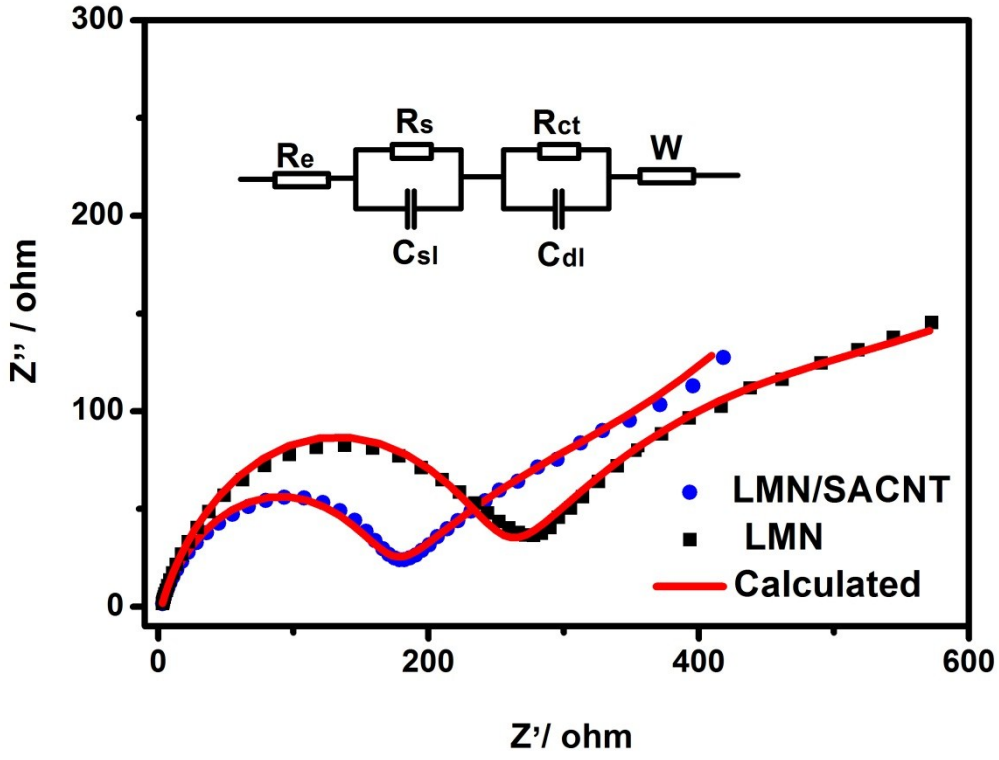

Fig. S10. Electrochemical impedance spectra of tLMN/SACNT and LMN electrodes after 200 cycles at 0.3C.

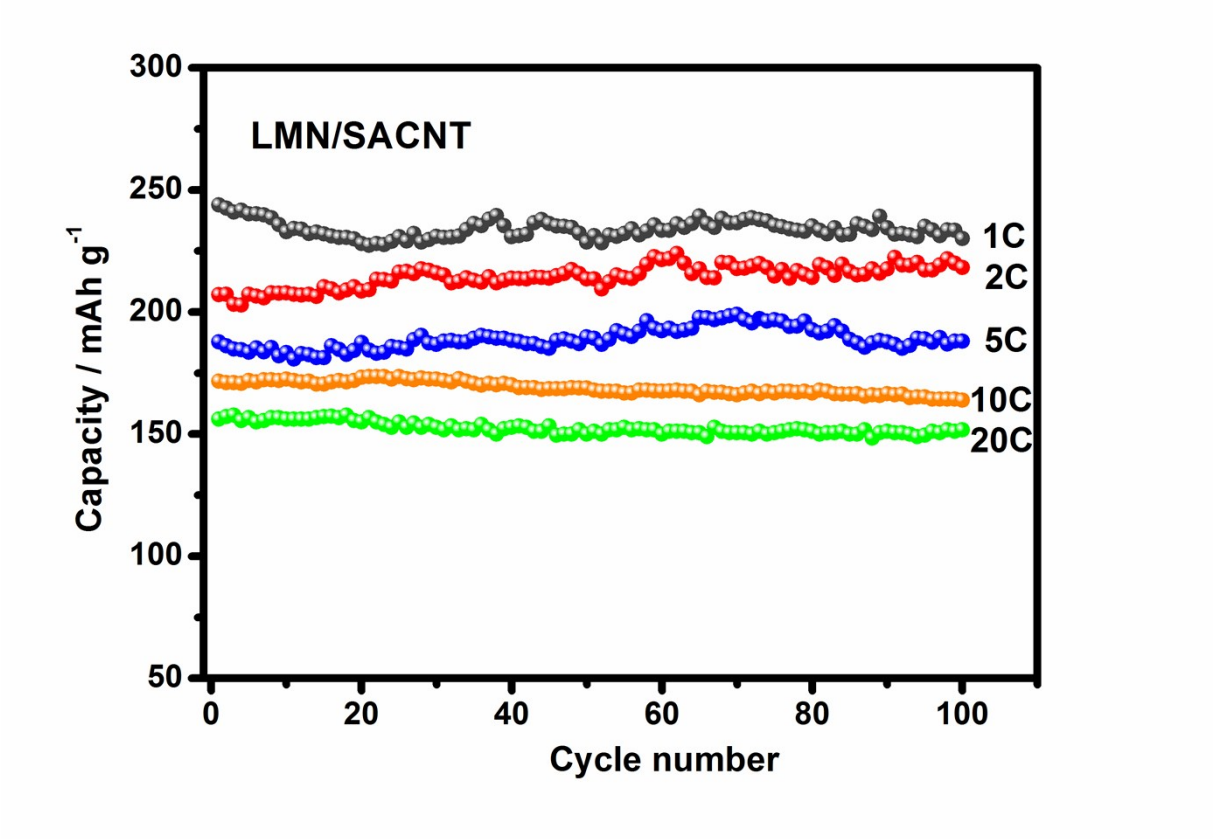

Fig. S11. Cycling performance of LMN/SACNT electrode at various rates (after activation at 0.1 C for 5 cycles) between 2.0-4.8 V.

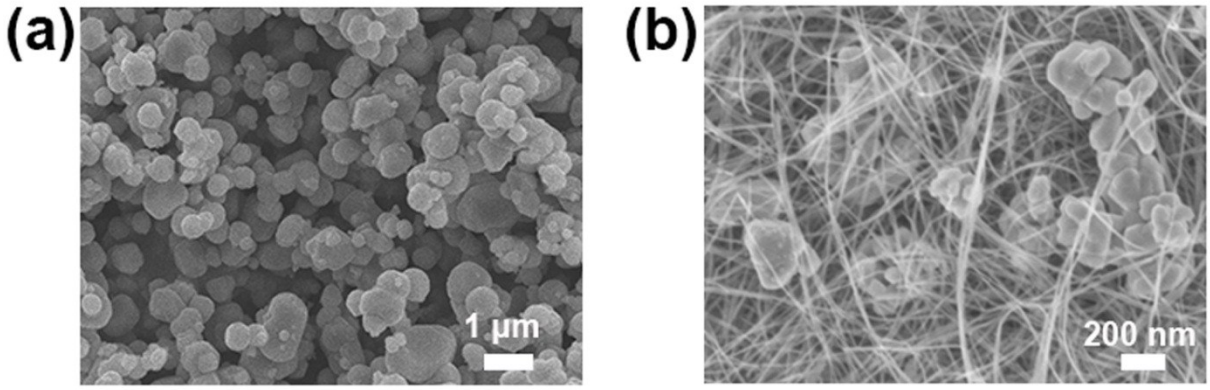

Fig. S12. SEM images of (a) MnO and (b) MnO/SACNT.

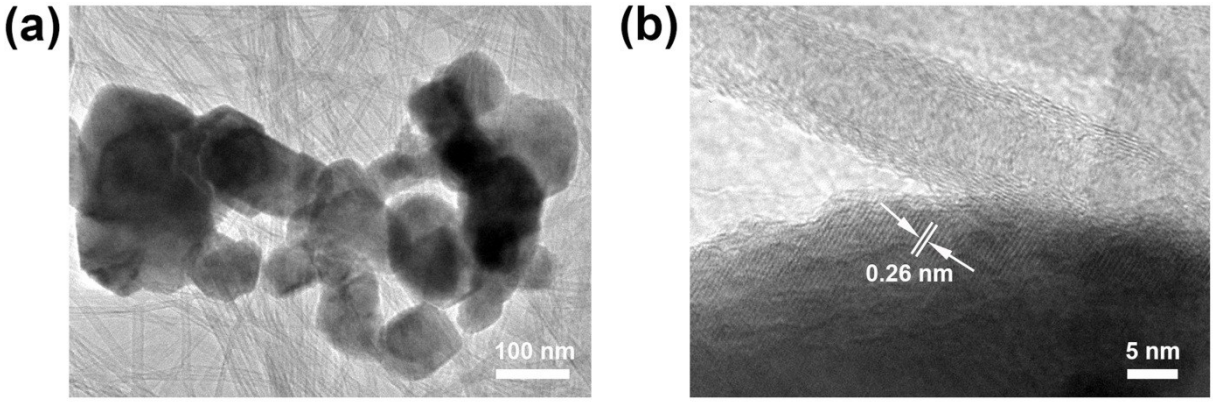

Fig. S13. (a) TEM and (b) HRTEM images of MnO/SACNT.

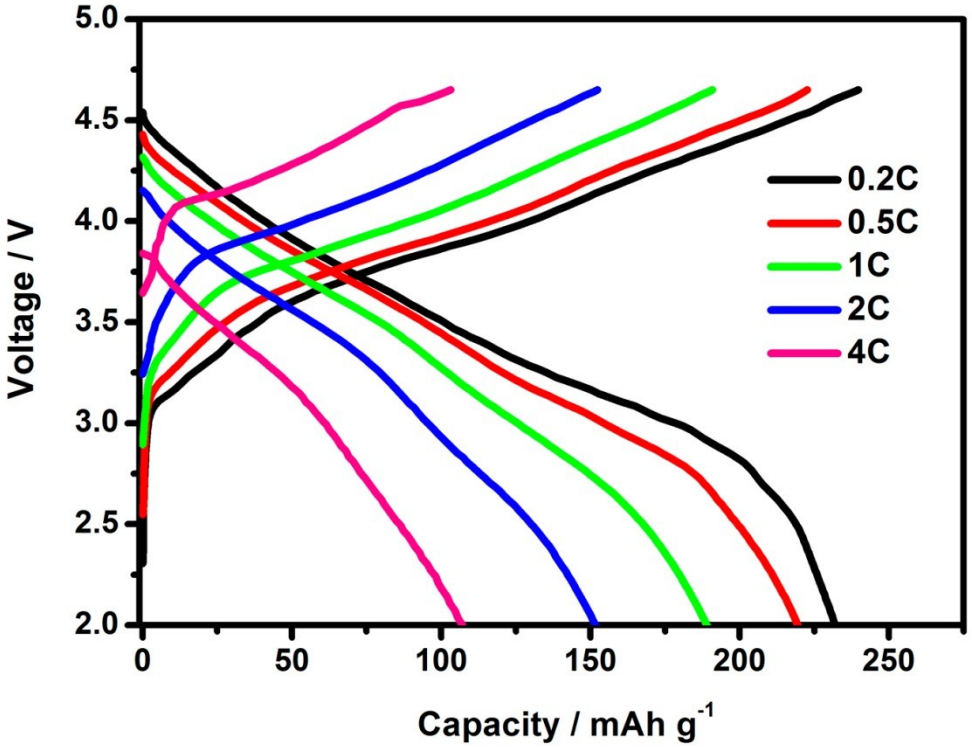

Fig. S14. Typical charge/discharge profiles of LMN/SACNT‖MnO/SACNT full cell when performed with rate capability test in Fig. 5c.

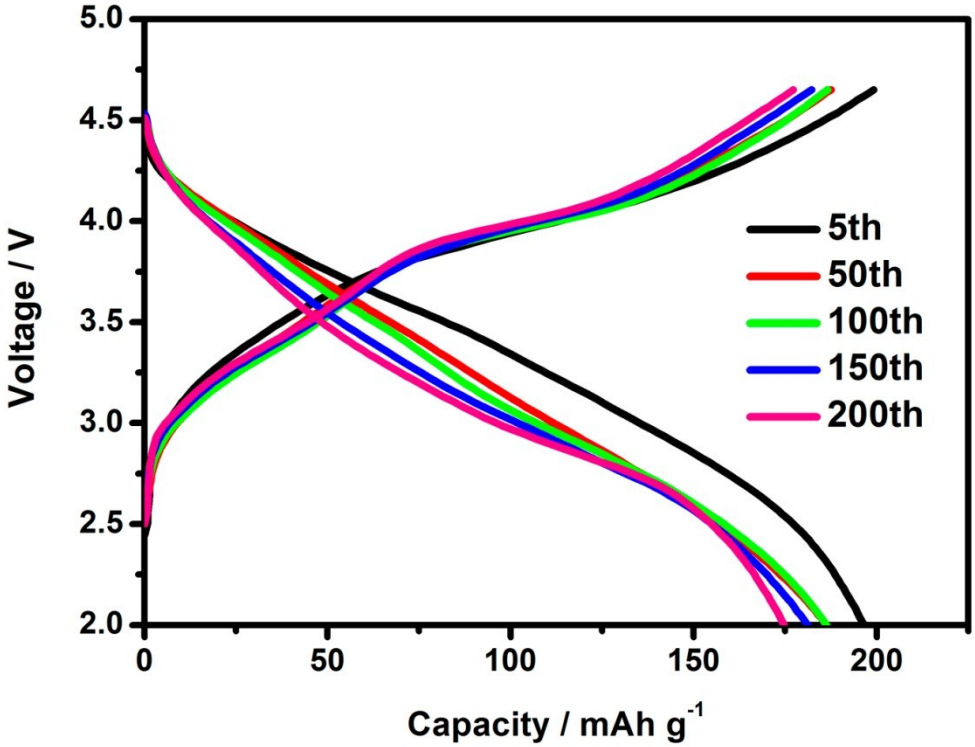

Fig. S15. Typical charge/discharge profiles of LMN/SACNT‖MnO/SACNT full cell when performed with cyclic stability test in Fig. 5d

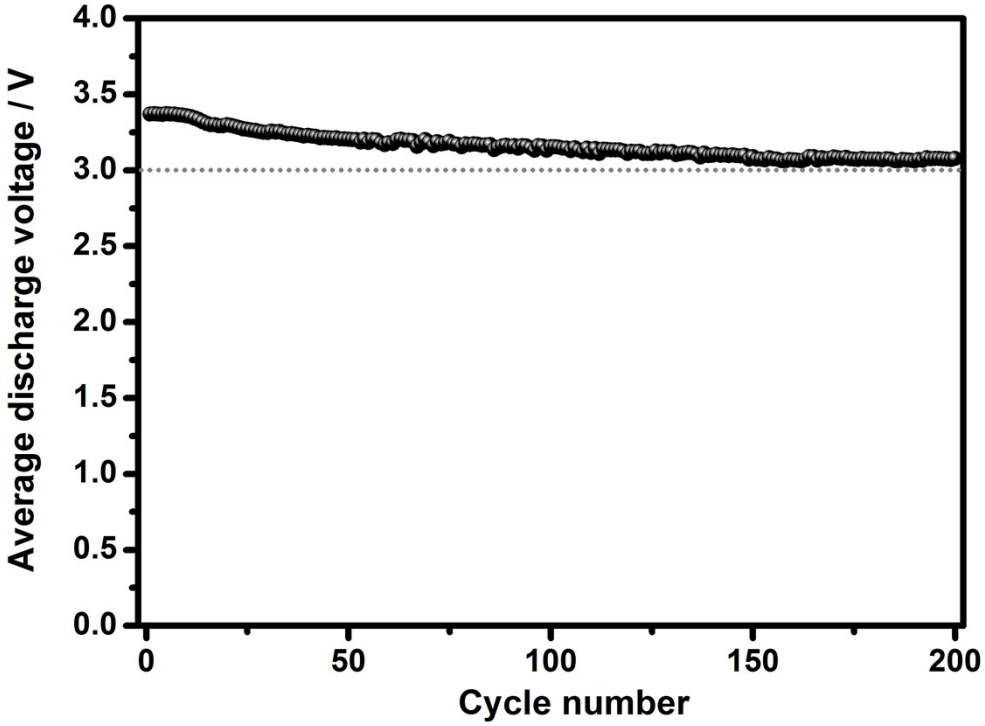

Fig. S16. Evolution of average discharge voltage of LMN/SACNT‖MnO/SACNT full cell with cycling at 1 C

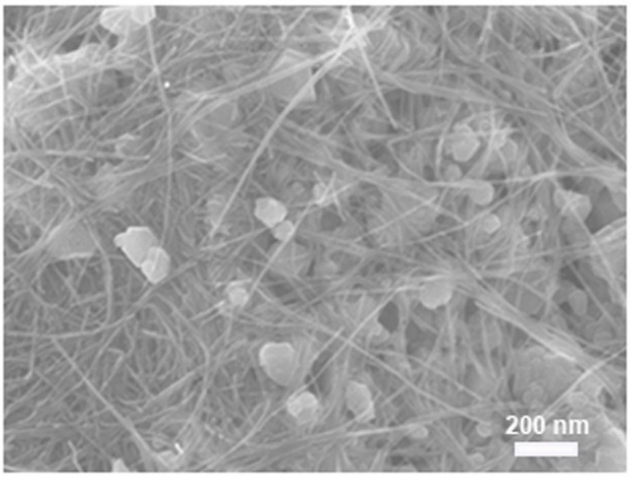

Fig. S17. SEM image of LMN/SACNT electrodde from the cycled LMN/SACNT‖MnO/SACNT full cell at 1 C for 200 cycles.

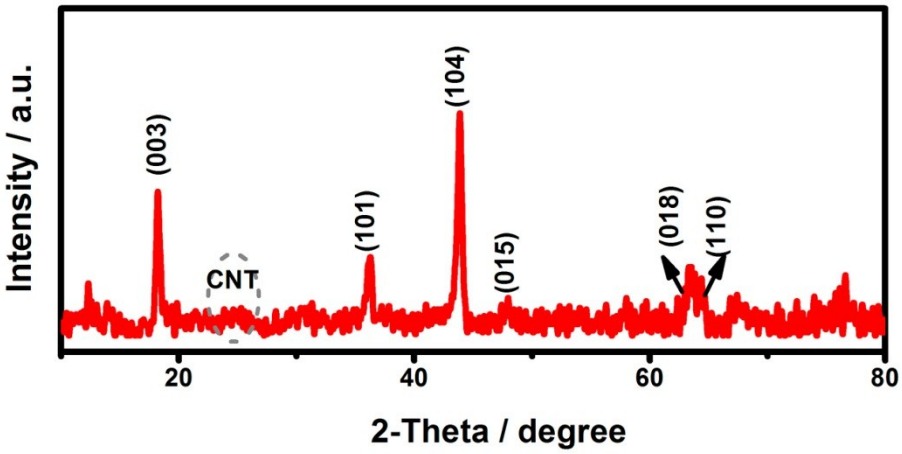

Fig. S18. XRD pattern of LMN/SACNT electrode from the cycled LMN/SACNT‖MnO/SACNT full cell at 1 C for 200 cycles.

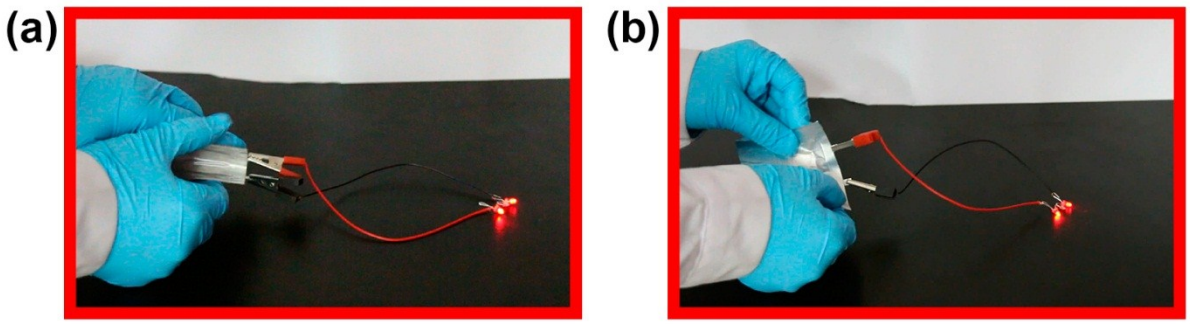

Fig. S19. LMN/SACNT‖MnO/SACNT pouch cell that power two LEDs under bending conditions.

Table S1. Fitting parameters for EIS of two samples.

Samples	R_e / Ω	R_s / Ω	R_{ct} / Ω	R_{total} / Ω
LMN/SACNT	2.11	165	200	367.11
LMN	2.21	248	355	605.21

Table S2. Performance comparisons of our full cell with those reported in literature.

Sample	Current density / mA g^{-1}	Voltage window / V	Capacity / mAh g^{-1}	Energy density / Wh kg^{-1}	Ref.
rGO/Mn_3O_4‖$LiMn_2O_4$	100	2.0-4.1	100		[1]
MnO_x/CNT‖$LiMn_2O_4$/CNT	150	2.4-3.7	~97		[2]
Mn_2O_3‖$LiMn_2O_4$	100	1.5-4.2	~99		[3]
MnO@C‖$LiMn_2O_4$	25.16	2.4-4.2		397 (Based on the weight of cathode active material)	[4]
MnO_x/C‖$LiMn_2O_4$	29.6	2.0-4.1	~100	350 (Based on the weight of cathode active material)	[5]
MnO‖$LiNi_{0.5}Mn_{1.5}O_{4-\delta}$	14.8	2.3-4.6		285.5 (Based on the weight of cathode active material)	[6]
LMN/SACNT‖MnO/SACNT	200	2.0-4.65	253	411 (Based on the total weight of cathode and anode electrodes, separator and electrolyte)	This work

Reference:

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