Electronic Supplementary Material (ESI) for Dalton Transactions.


# Supporting Information

## Polymerization Inspired Synthesis of MnO@Carbon Nanowires with Long Cycling Stability for Lithium Ion Battery Anode: Growth Mechanism and Electrochemical Performance

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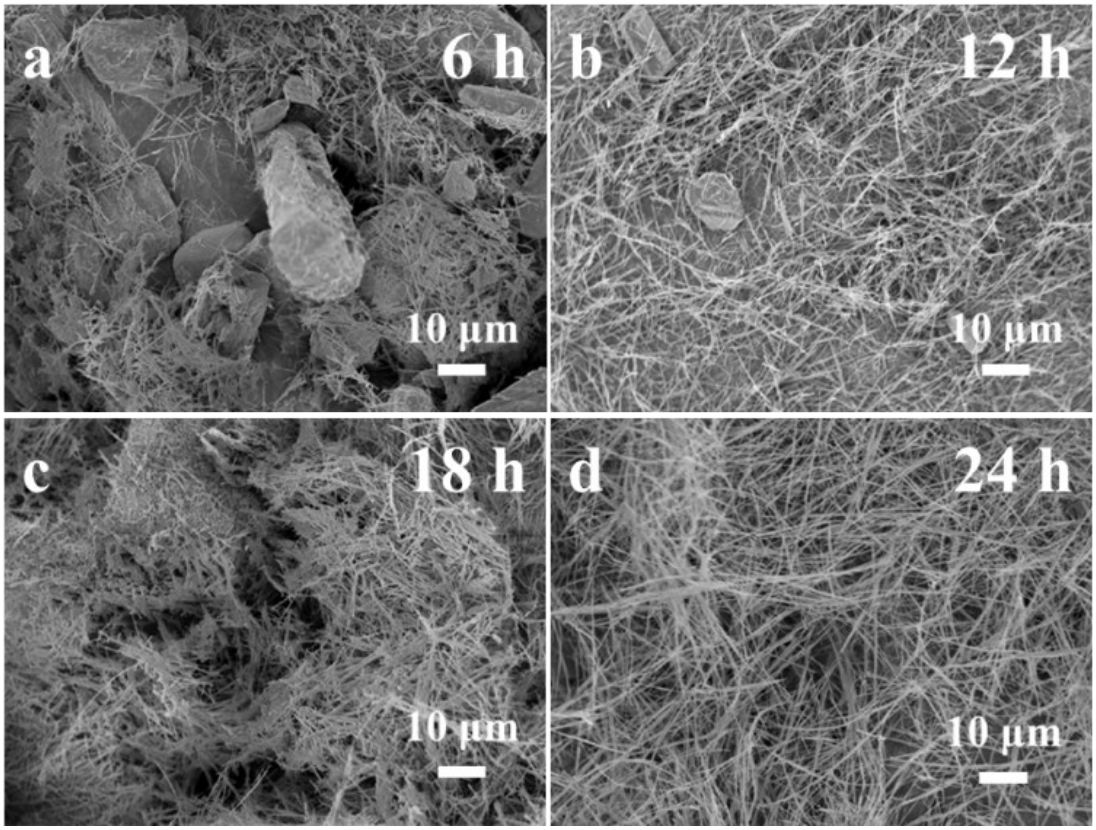


**Fig S1.** SEM images of [Mn-NTA] with the ratio of $MnCl_2$ to NTA were 2:1 (a) 6 h, (b) 12 h, (c) 18 h and (d) 24 h.

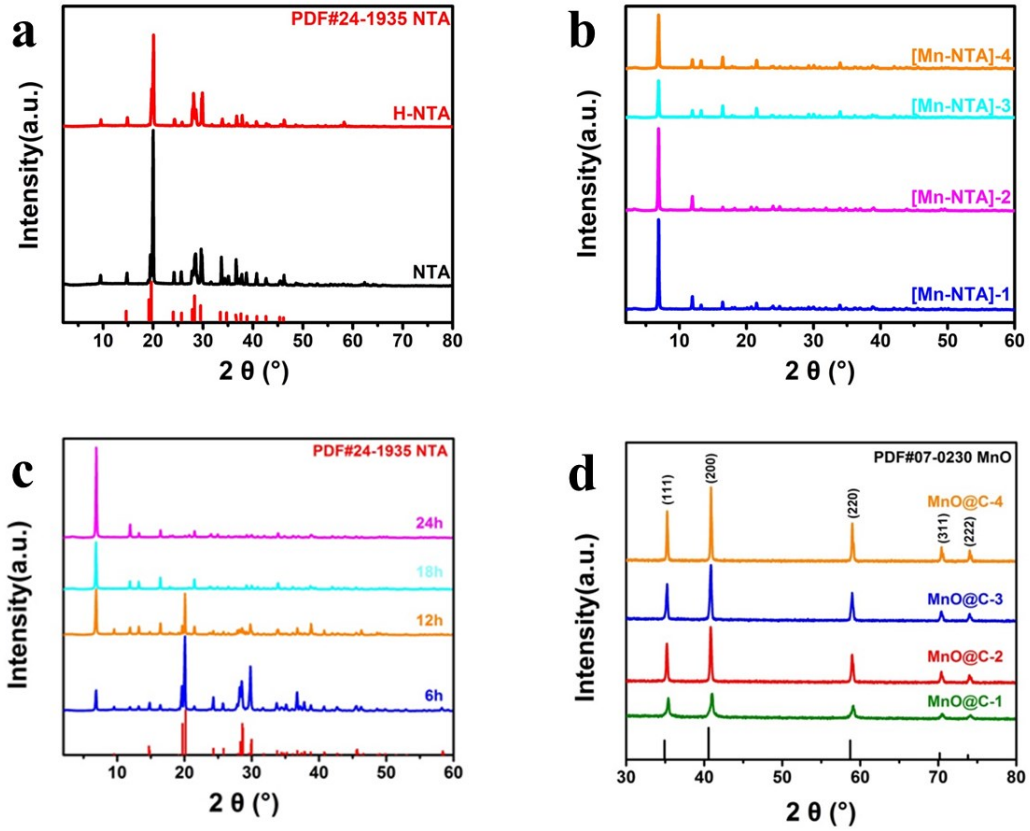


**Fig. S2.** (a) XRD pattern of [Mn-NTA] nanowires with different hydrothermal reaction time at 2:1 Mn to NTA ratio. (b) XRD pattern of [Mn-NTA] nanowires with different $MnCl_2$ to NTA ratio. (c) XRD pattern of H-NTA and NTA. (d) XRD patterns of MnO@C with the different ratios of $MnCl_2$ to NTA.

**Table S1.** The length distribution of the nanowires produced by $MnCl_2$ and NTA with different molar ratio

| $MnCl_2$:NTA | Sample | Length/μm |
|---|---|---|
| 1:1 | [Mn-NTA]-1 | 60~80 |
| 2:1 | [Mn-NTA]-2 | ≥100 |
| 3:1 | [Mn-NTA]-3 | 30~50 |
| 4:1 | [Mn-NTA]-4 | ⩽30 |

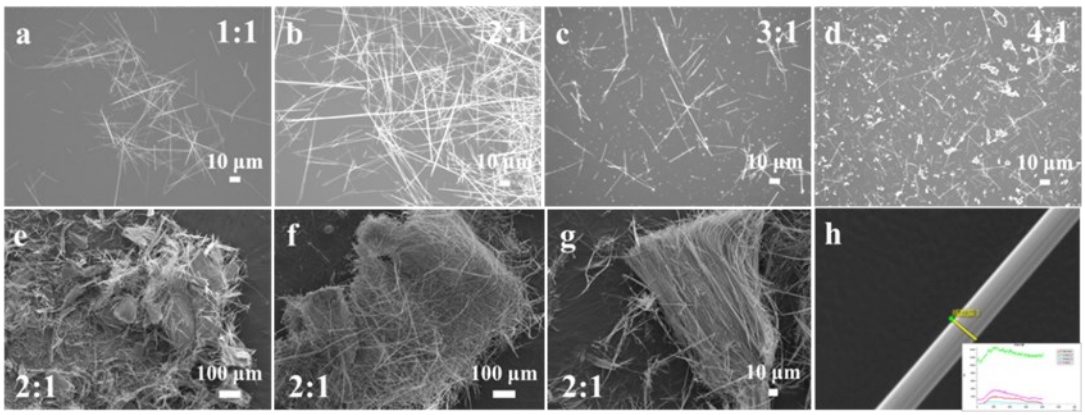


**Fig S3.** SEM images of [Mn-NTA] nanowires with Mn to NTA ratio (a) 1:1, (b) 2:1, (c) 3:1 and (d) 4:1. (e), (f), (g) and (h) low-resolution SEM of [Mn-NTA]-

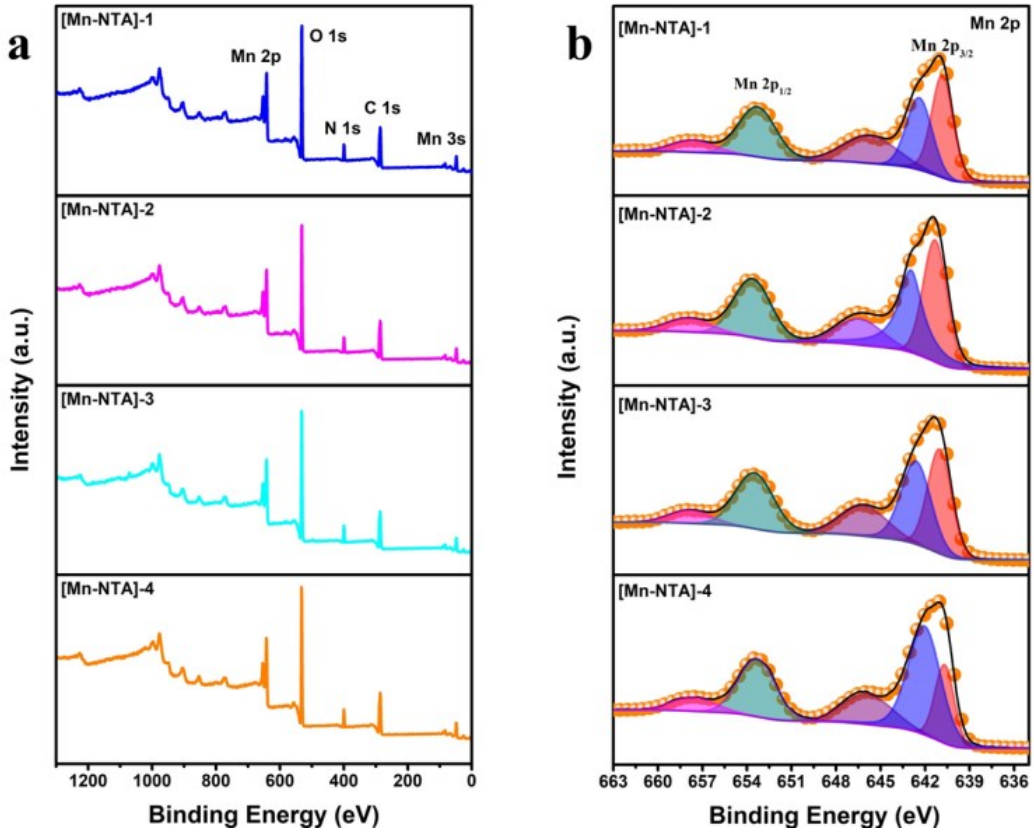


**Fig S4.** (a) The full XPS spectra of [Mn-NTA] nanowires. (b) High-resolution XPS spectra Mn 2p of [Mn-NTA] nanowires.[Zou, 2020 #202]

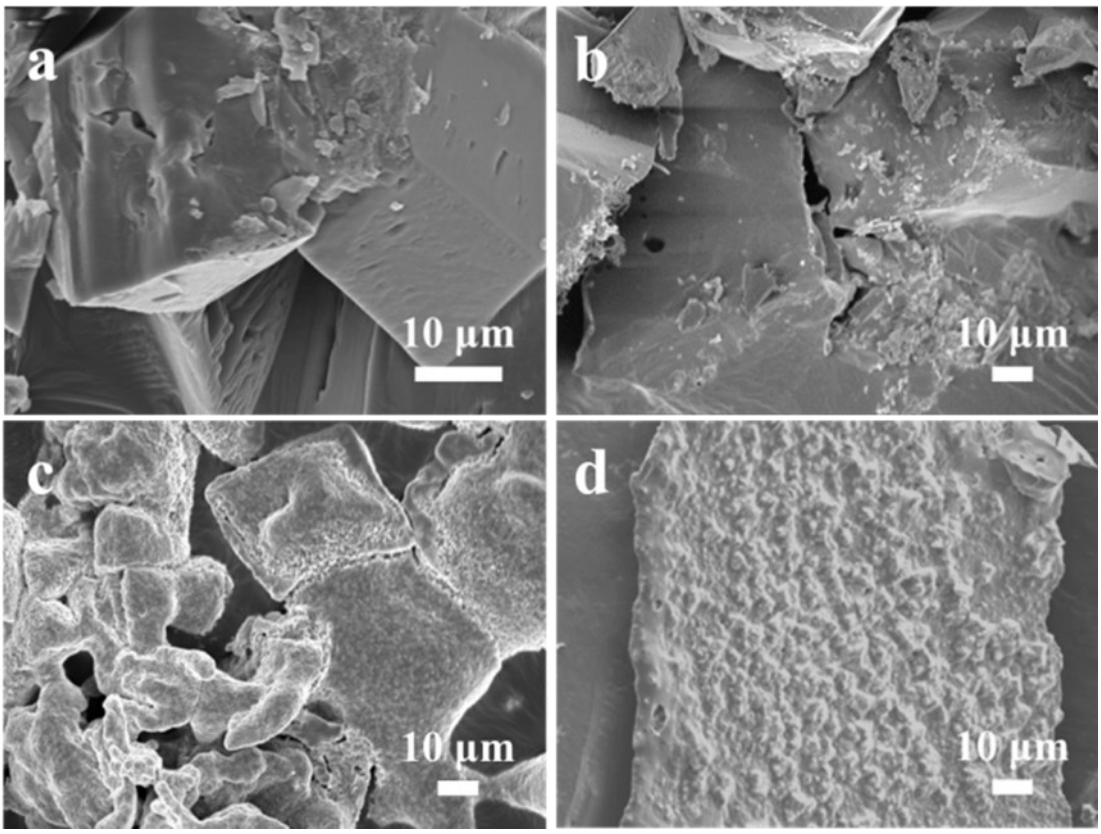


**Fig. S5.** SEM images of (a) raw material of NTA, (b) hydrothermal ammonium of NTA, (c) raw material of $MnCl_2$, (d) hydrothermal ammonium of Mn

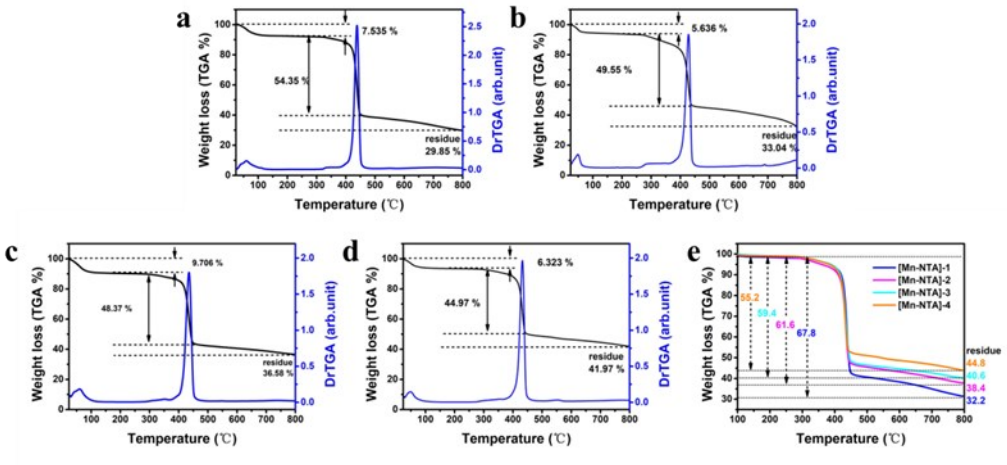


**Fig S6.** TGA patterns of (a) [Mn-NTA]-1, (b) [Mn-NTA]-2, (c) [Mn-NTA]-3 and (d) [Mn-NTA]-4. (e) TGA pattern of [Mn-NTA] nanowires with moisture removal.

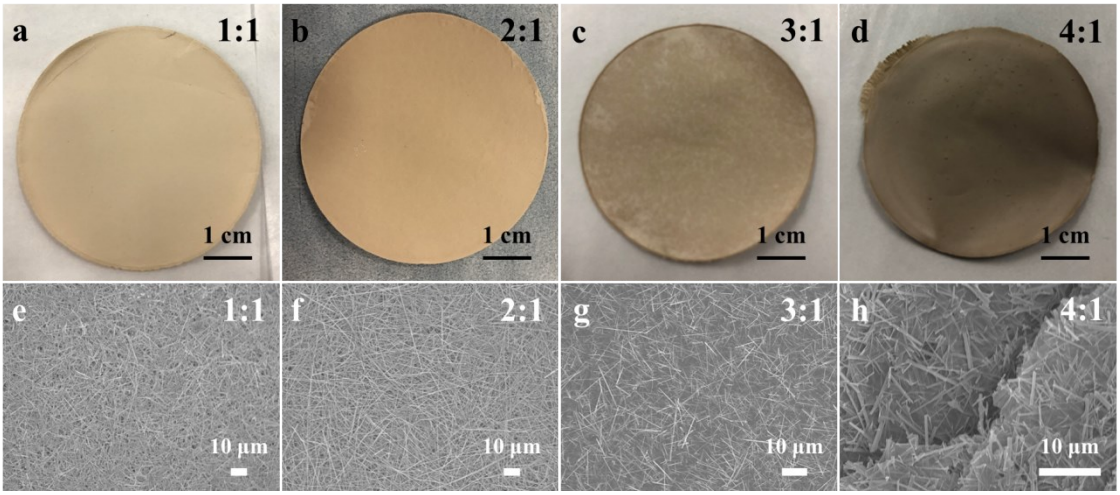


**Fig S7.** Digital photos of [Mn-NTA]/ GO paper prepared at the different ratio of $MnCl_2$ to NTA with the same reaction time of 24 h (a) 1:1, (b) 2:1, (c) 3:1, (d) 4:1. SEM images of MnO@C/rGO electrodes prepared at the different ratio of $MnCl_2$ to NTA with the same reaction time of 24 h (e) 1:1, (f) 2:1, (g) 3:1, (h) 4:1.

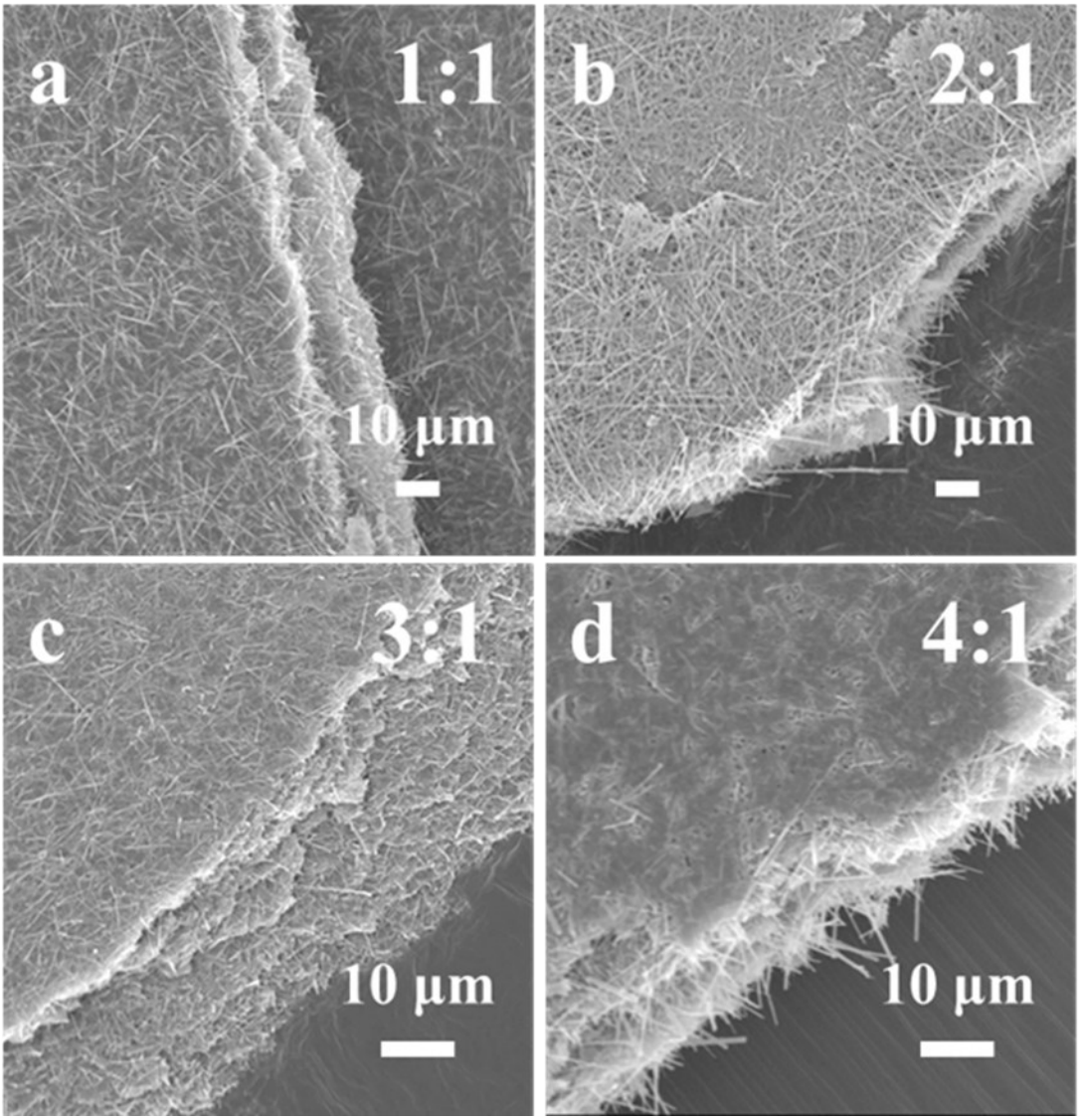


**Fig S8.** Cross section SEM images of free-standing MnO@C/rGO electrodes prepared at the different ratio of $MnCl_2$ to NTA with the same reaction time of 24 h (a) 1:1, (b) 2:1, (c) 3:1, (d) 4:1.

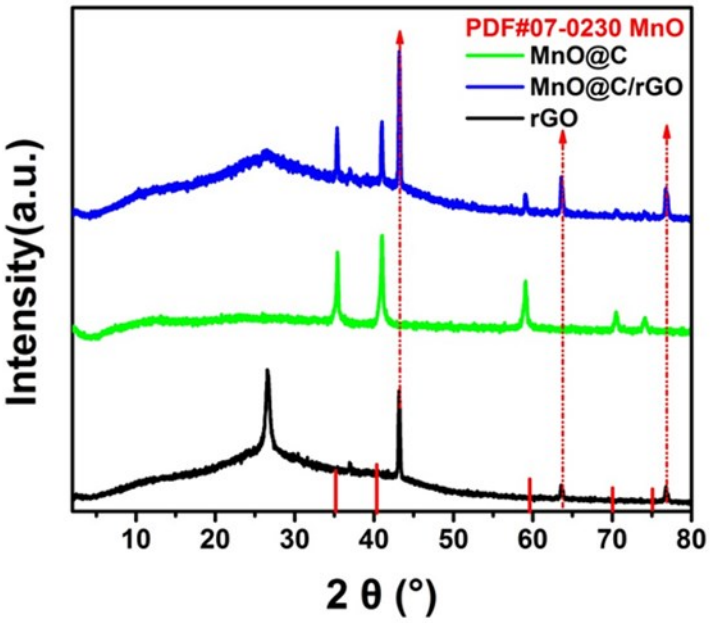


**Fig S9.** XRD pattern of rGO, MnO@C and MnO@C/rGO

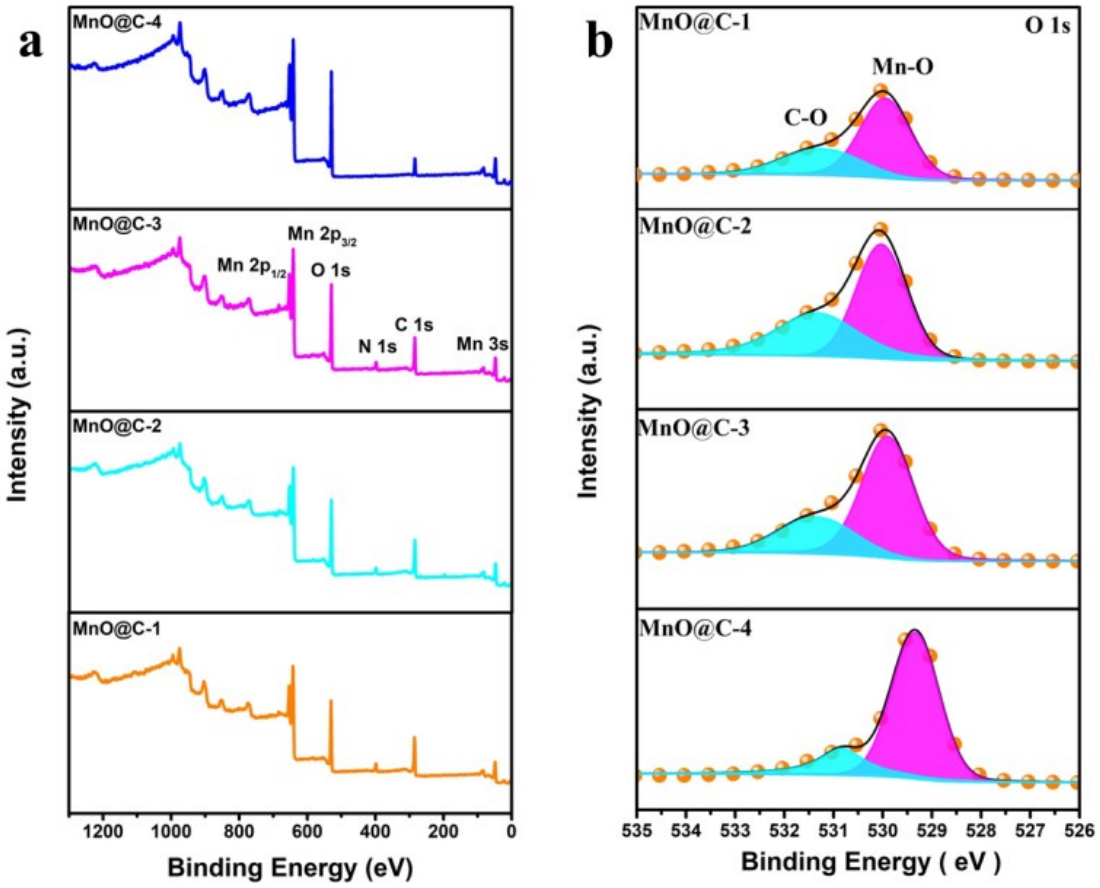


**Fig S10**. (a) The full XPS spectra of MnO@C. (b) High-resolution XPS spectra O 1s of MnO@C

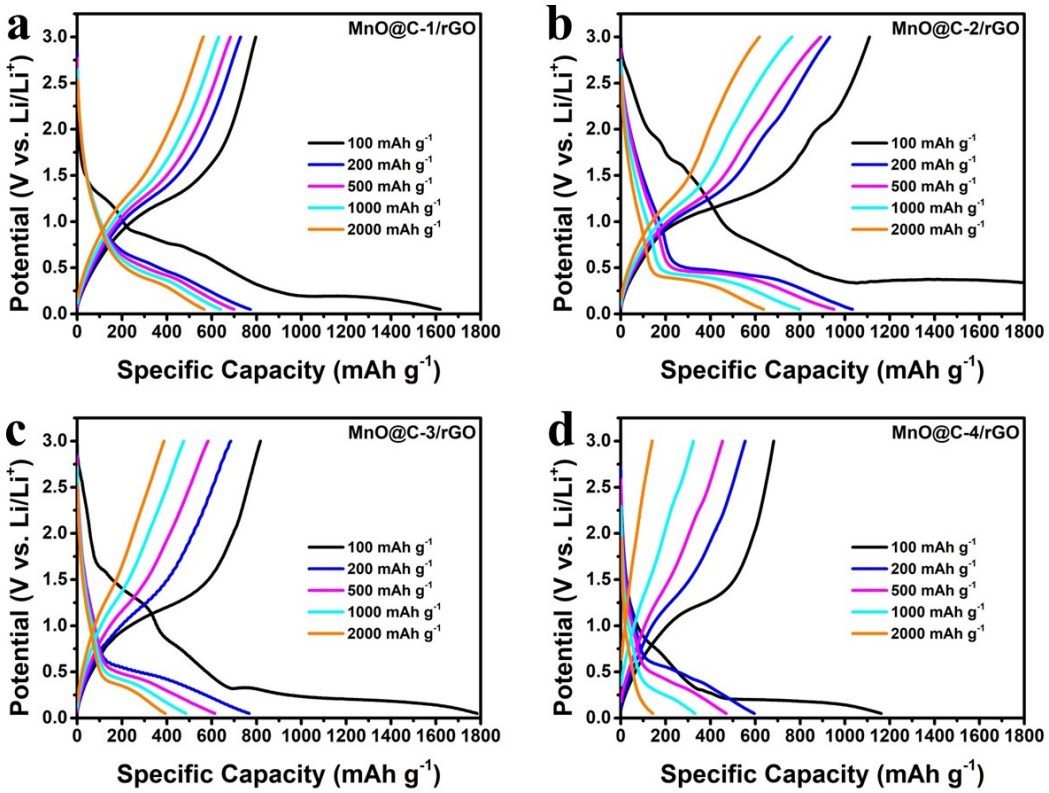


**Fig S11.** Galvanostatic discharging/charging voltage profiles of (a) MnO@C-1/rGO, (b) MnO@C-2/rGO, (c) MnO@C-3/rGO, (d) MnO@C-4/rGO.

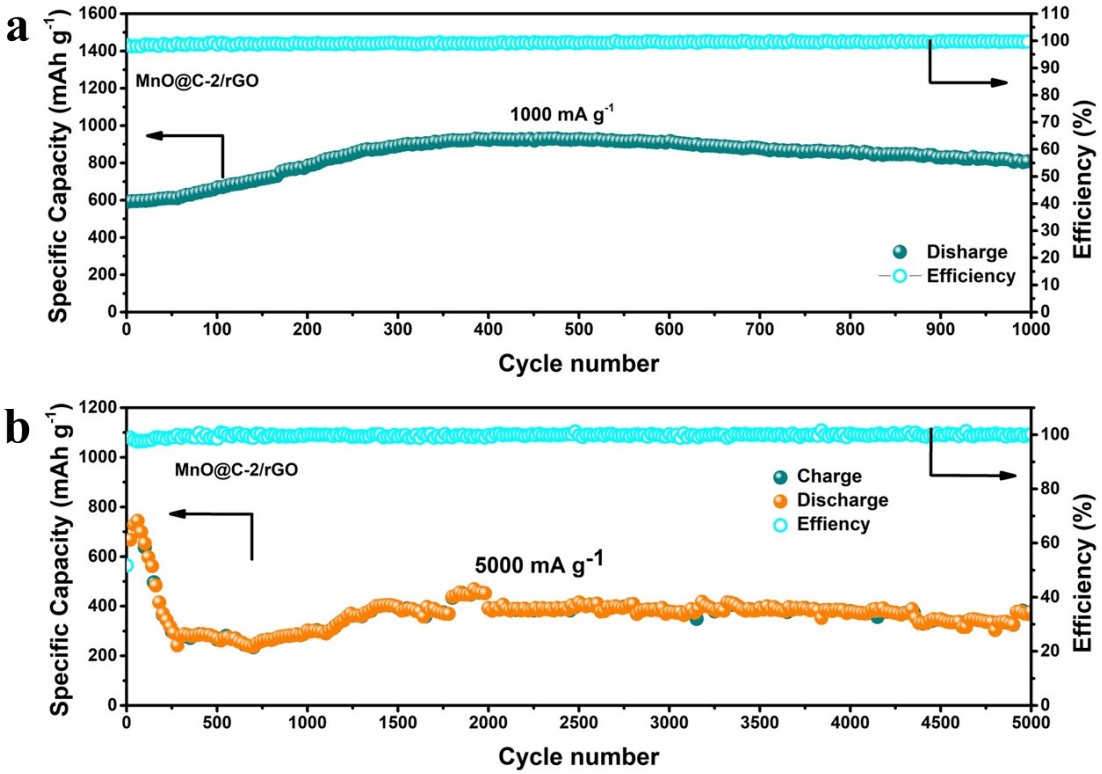


**Fig S12.** Cycling performances of MnO@C-2/rGO (a) 1000 mAh $g^{-1}$ and (b) 5000 mAh $g^{-1}$.

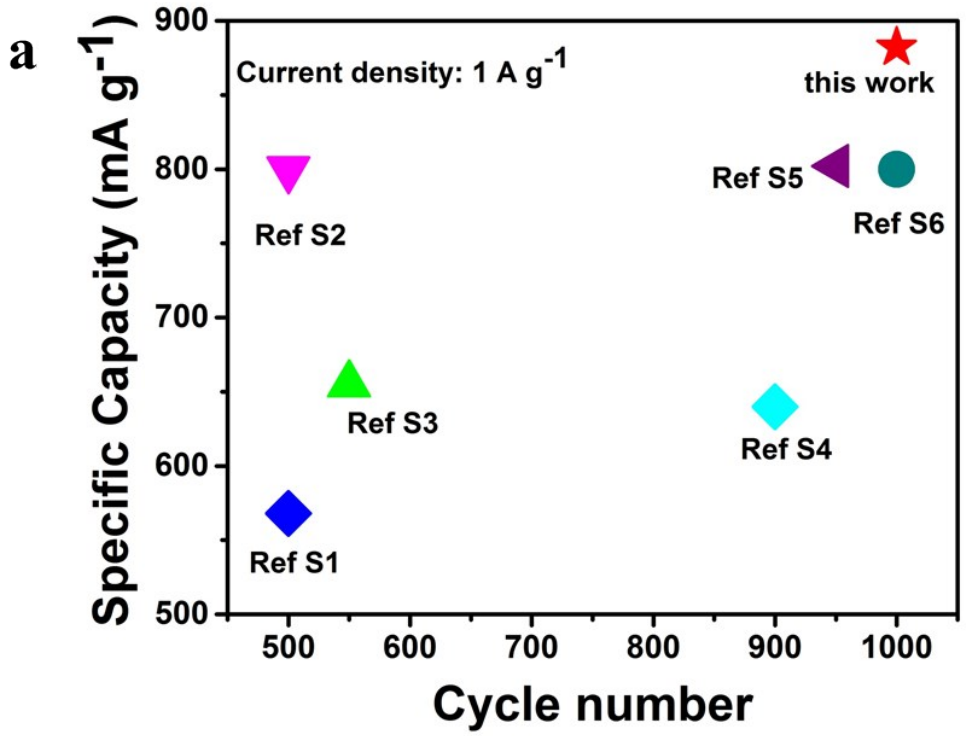


**Fig S13.** The performance comparison of MnO@C-2/rGO with other high performance anodes used in lithium-ion batteries.

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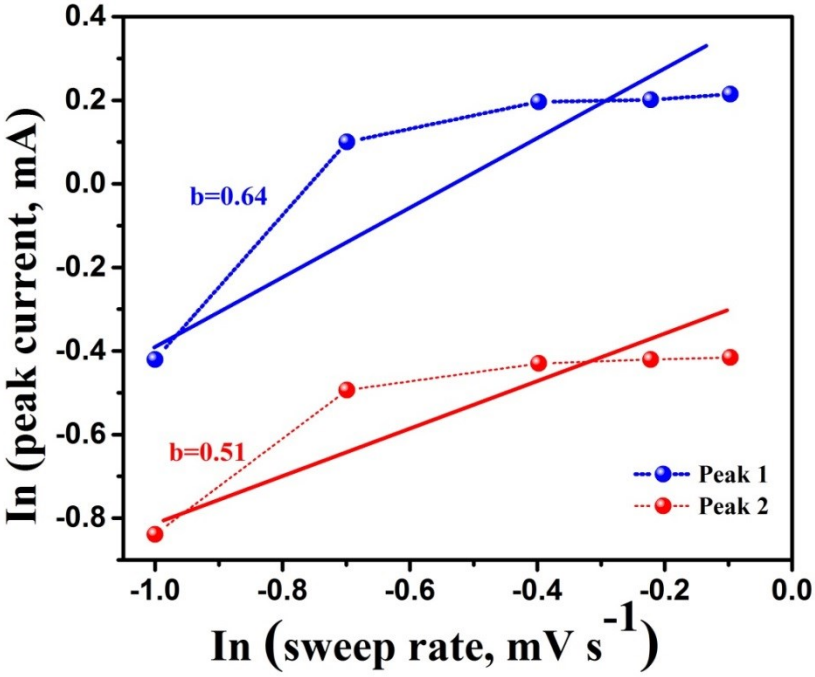


**Fig S14. The *b*-value from plot of log *i* versus log *v* for anodic specific current peaks (of the sample MnO@C-1/rGO).**

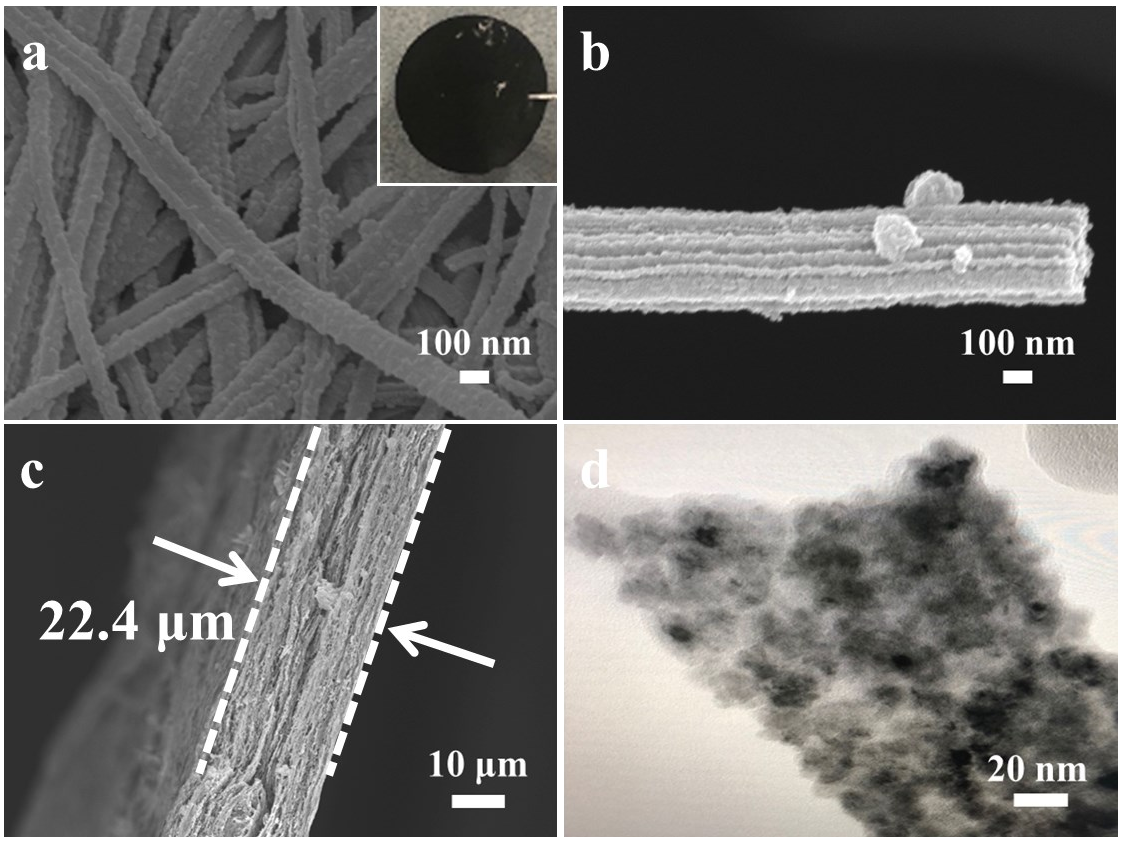


**Fig S15.** (a) High-resolution SEM image and digital photo of cycled MnO@C-2/rGO electrode. (b) High-resolution SEM image of single cycled MnO@C-2 nanowire. (c) Cross section SEM images of cycled MnO@C-2/rGO electrode. (d) TEM image of cycled MnO@C-2 nanowire

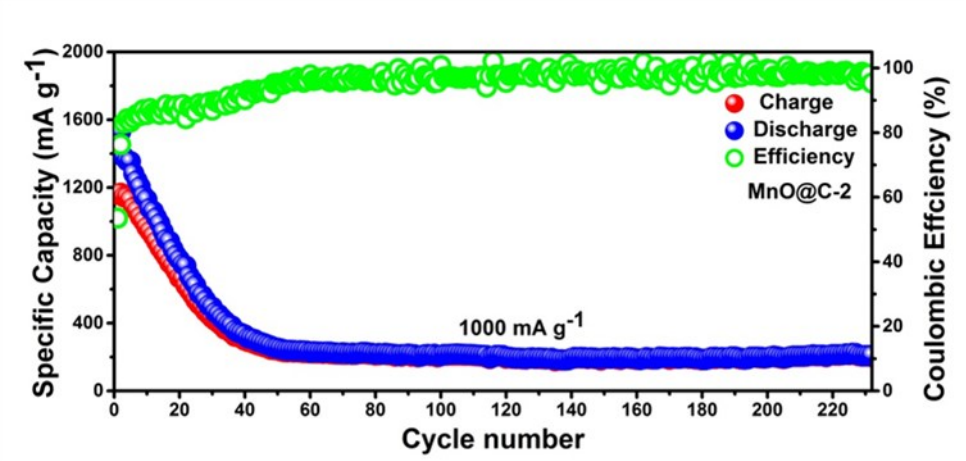


**Fig S16.** Cycling performances of MnO@C-2 at 1000 mAh $g^{-1}$.

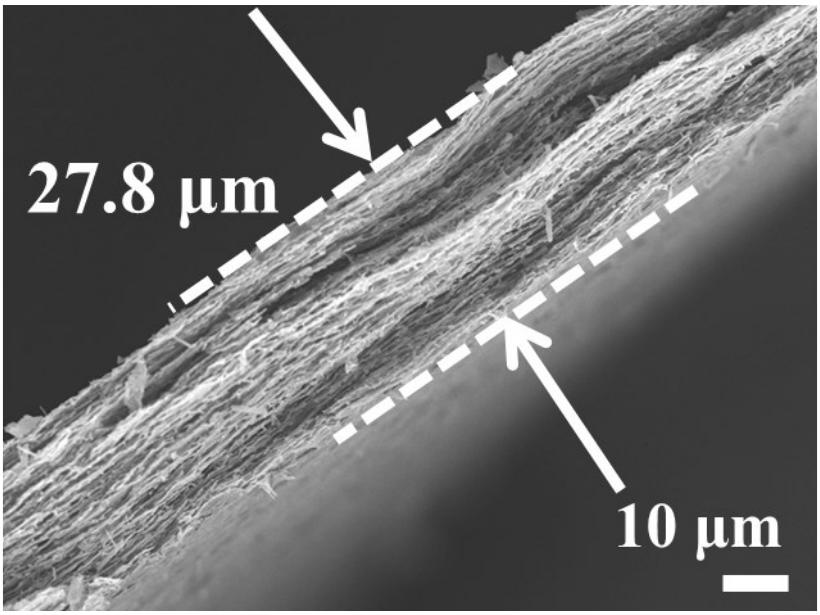


**Fig S17.** Cross section SEM images of fresh MnO@C-2/rGO electrode.