Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information for

Topotactic Conversion-Derived $Li_4Ti_5O_{12}$-Rutile TiO_2 Hybrid Nanowire Array for High-Performance Lithium Ion Full Cell

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Figures:

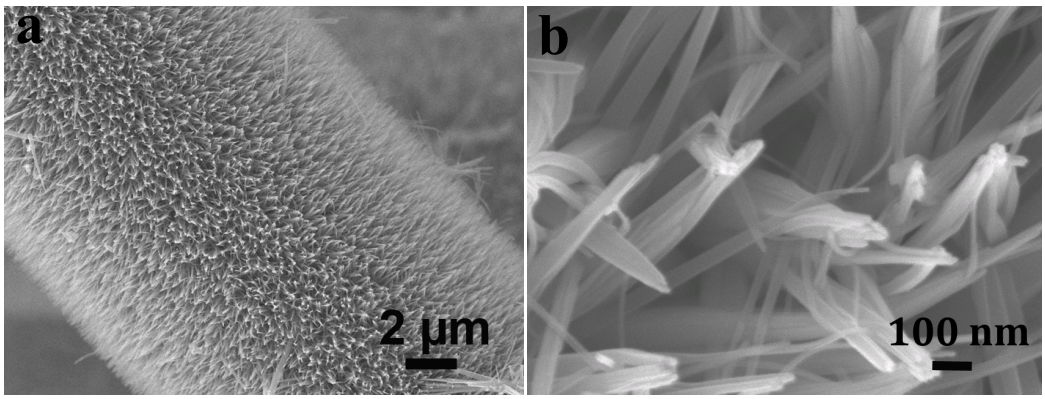

Fig. S1. SEM images of pristine RTO nanowire array at different resolutions, showing the smooth surface of nanowires.

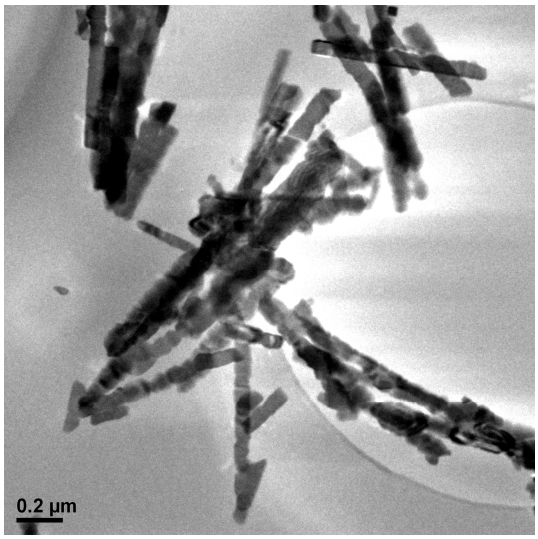

Fig. S2. TEM image of the optimized LTO-RTO hybrid nanowires. The particulate-shaped LTO on RTO nanowire surface can be clearly seen.

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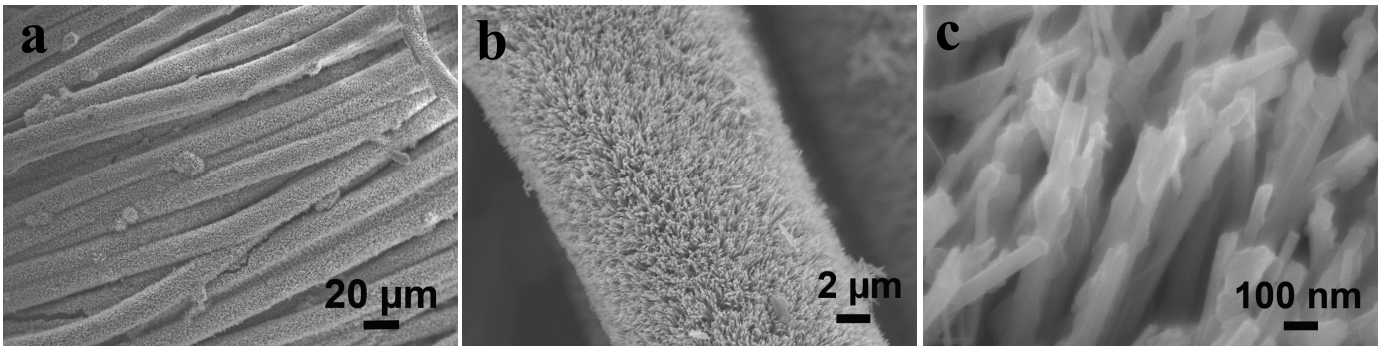


Fig. S3. SEM images of the 3:1 LTO-RTO sample after 400 cycles at various resolutions.

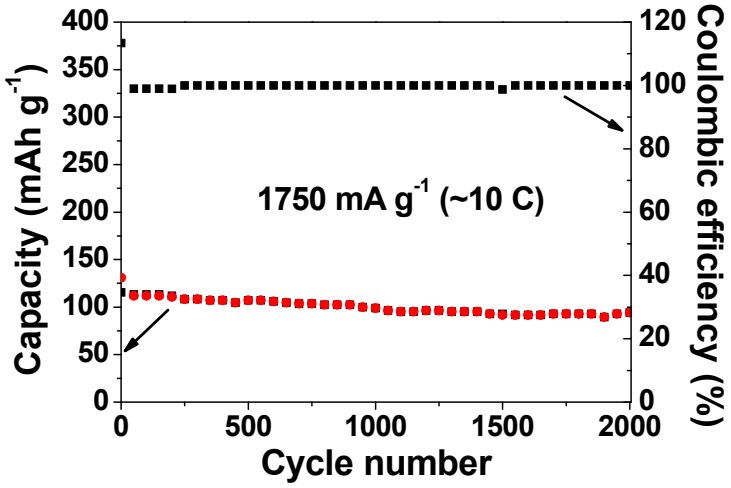


Fig. S4. Cycling performance of the full cell at constant current of 1750 mA g^{-1}.

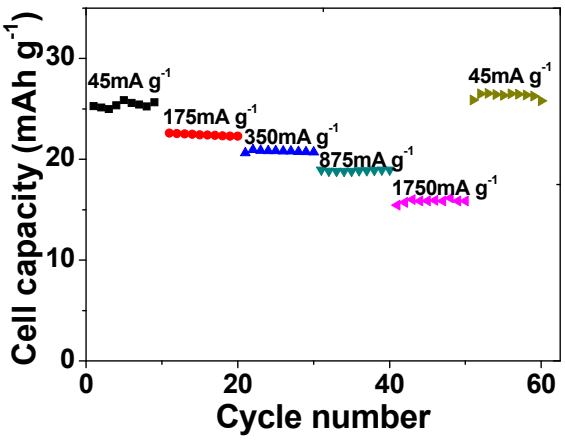


Fig. S5. Cell capacities at progressively increased current densities. The mass of the full cell was calculated by adding those of the total active materials, total current collectors and separator.

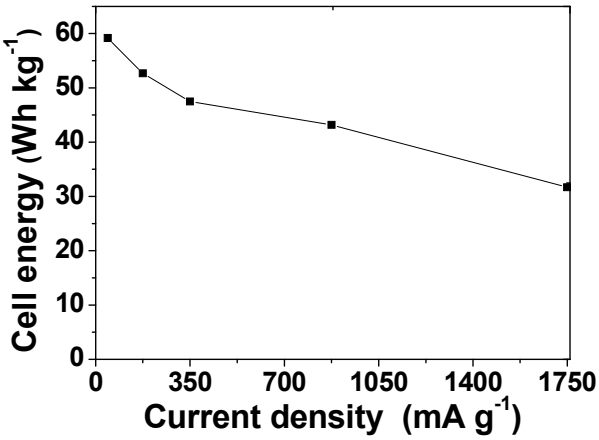
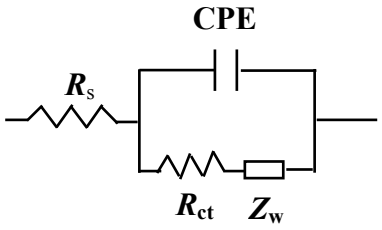


Fig. S6. Cell discharge energy density at various current densities.

Tables:

Table S1. The parameter values of typical elements based on the following equivalent circuit.



Parameter \ Sample	Pristine RTO	1:1 LTO-RTO	3:1 LTO-RTO	5:1 LTO-RTO
R_s (Ω)	3.97	3.07	0.85	2.84
R_{ct} (Ω)	156.6	176.6	414.1	653.3

Table S2. Charge and discharge capacity comparison of different samples at 350 mA g^{-1}.

	Charge capacity (mAh g^{-1})			Discharge capacity (mAh g^{-1})		
Sample (LTO:RTO) \ Cycle number	1	100	200	1	100	200
0:1	198.7	73.9	41.7	156.1	73.1	40.6
1:1	170.5	95.8	67.3	136.9	100.8	67.3
3:1	165	136.8	113.8	161.5	135.5	109.1
5:1	99.4	85.2	94.	142.1	84.7	91.9

Table S3. Coulombic efficiency in the first cycle of different samples at 350 mA g^{-1}.

Sample(LTO:RTO)	0:1	1:1	3:1	5:1
Coulombic efficiency	78.5%	80.0%	97.5%	98.0%

Table S4. Comparison of the electrochemical performance of different LTO-based electrodes. Note that the capacity values of reported LTO electrodes were collected from the rate capacity figures.

Morphology	Carbon involved?	Capacity at different current density				Cycle number
		175 mA g^{-1}	350 mA g^{-1}	875 mA g^{-1}	1750 mA g^{-1}	
Porous microsphere[58]	Carbon coating	165	Not available	135	105	100 (at 175 mA g^{-1})
Porous microsphere[22]	Carbon coating	165	Not available	160	159	Not available
Nanoparticles in mesoporous carbon[18]	Carbon coating	144	135	125	115	500 (at 1750 mA g^{-1})
Hollow sphere[60]	Carbon black	175	150	128	115	200 (at 350 mA g^{-1})
Nanoparticles in mesoporous carbon[59]	Carbon coating	145	140	130	121.3	1000 (at 3500 mA g^{-1})
LTO nanowire[40]	No (but hydrogenated)	165	Not available	160	150	100 (at 875 mA g^{-1})
LTO nanowire[40]	No	150	Not available	125	105	100 (at 875 mA g^{-1})
LTO-RTO nanowire array (our work)	No	181	165	137	122	400 (at 1750 mA g^{-1}); >2000 (at 1750 mA g^{-1}) for full cell

Table S5. Initial cell energy efficiency at various current densities.

Current density (mA g^{-1})	45	175	350	875	1750
Energy efficiency (%)	98.7	97.5	94.7	91.4	78.1