Supporting Information

Lithium Titanate Epitaxial Coating on Spinel Lithium Manganese Oxide Surface for Improving the Performance of Lithium Storage Capability

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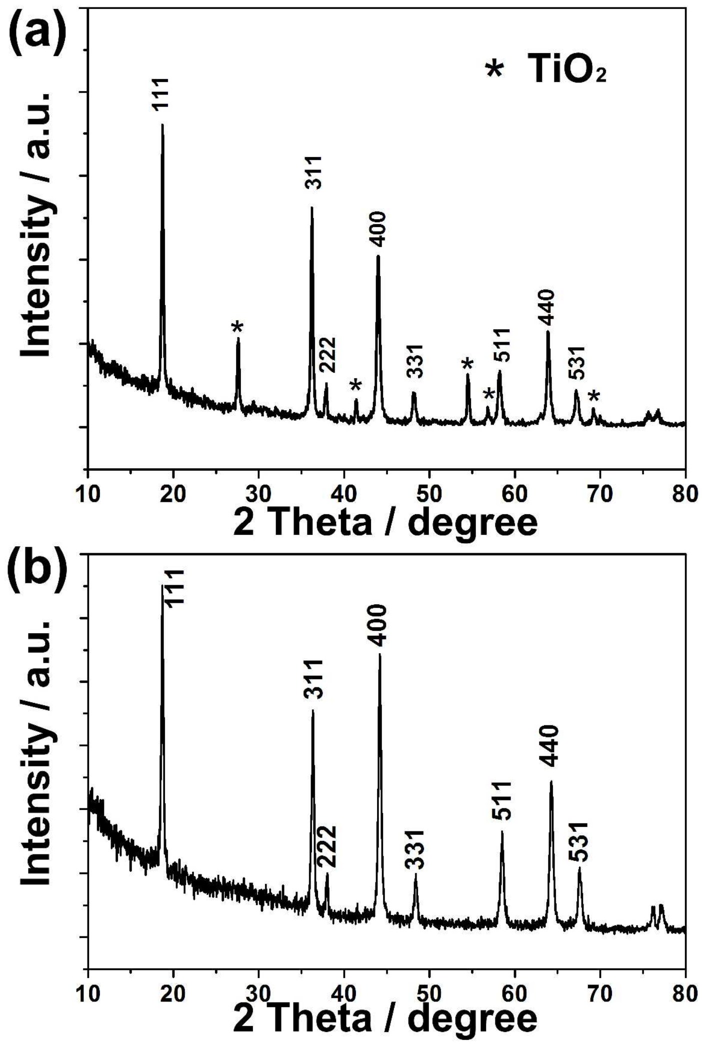

Figure S1. The XRD patterns of 10 wt% coated LMO@TiO_2 (a) and LMO@LTO (b).

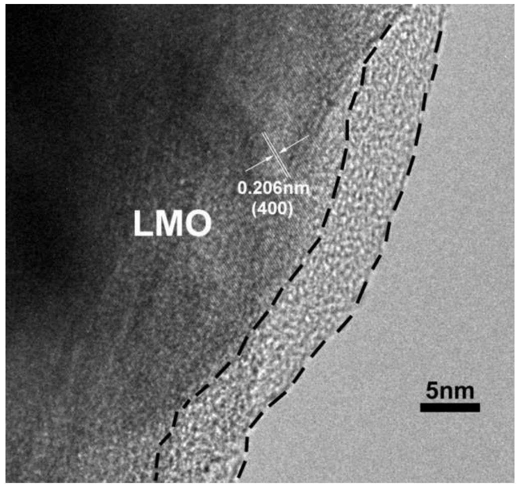

Figure S2. The HR-TEM image of precursor of LMO@TiO_2 and EC-LMO@LTO before annealing.

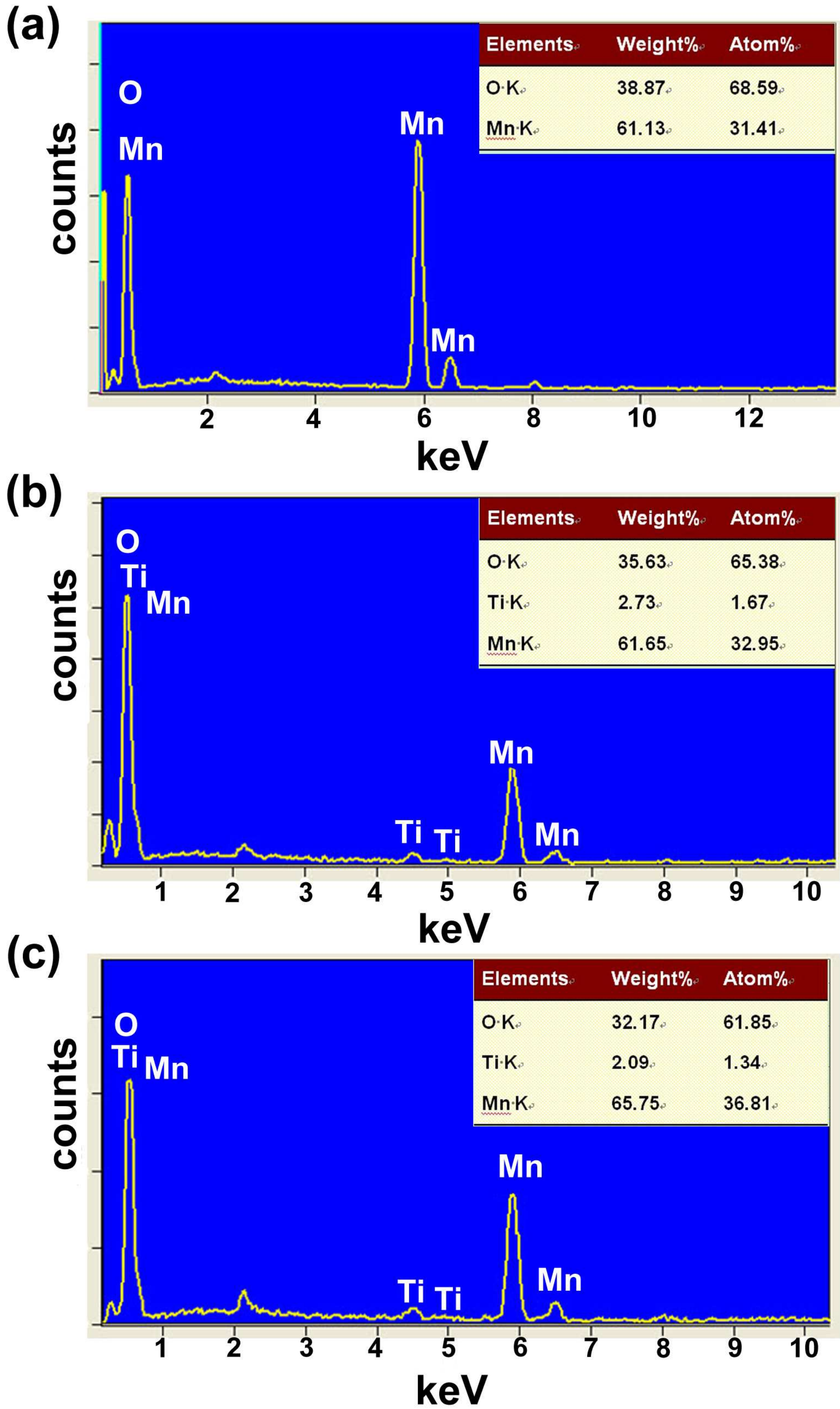

Figure S3. EDX results of uncoated LMO (a), LMO@TiO_2 (b) and EC-LMO@LTO (c).

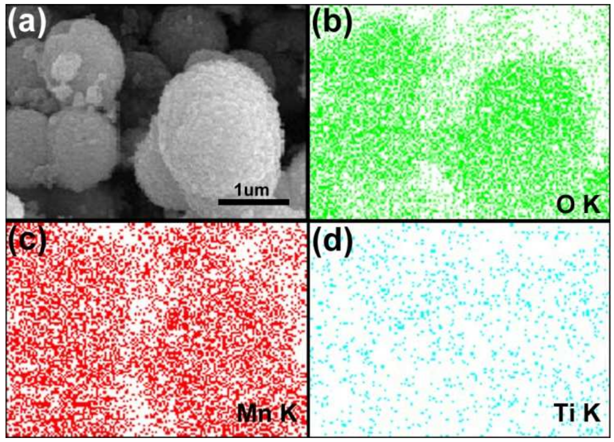

Figure S4. SEM image of EC-LMO@LTO (a) and corresponding element maps: O K (green) (b), Mn K (red) (c), Ti K (blue) (d).

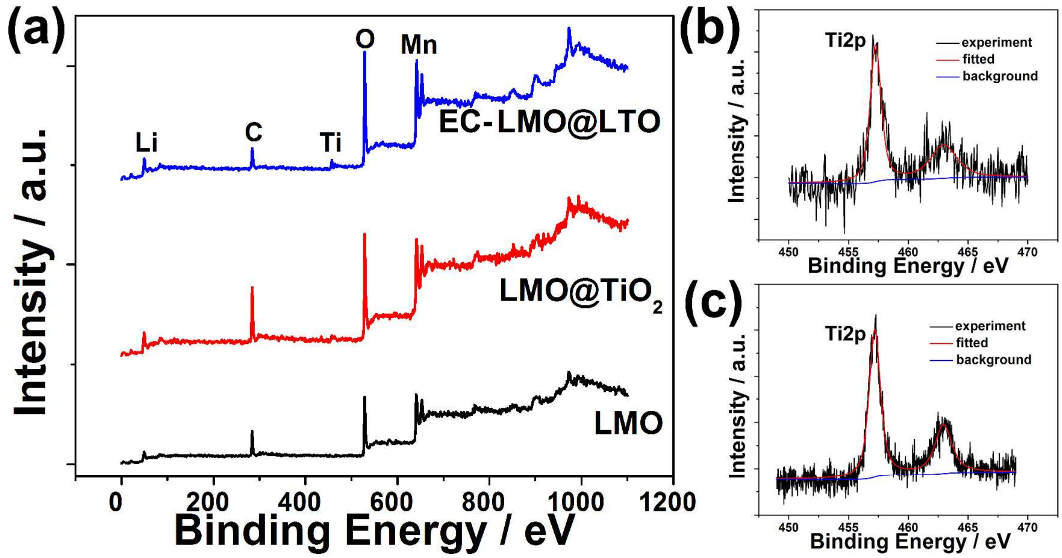

Figure S5. (a) The XPS patterns of LMO, LMO@TiO_2 and EC-LMO@LTO. The high resolution XPS spectra of the Ti2p region present in LMO@TiO_2 (b) and EC-LMO@LTO (c).

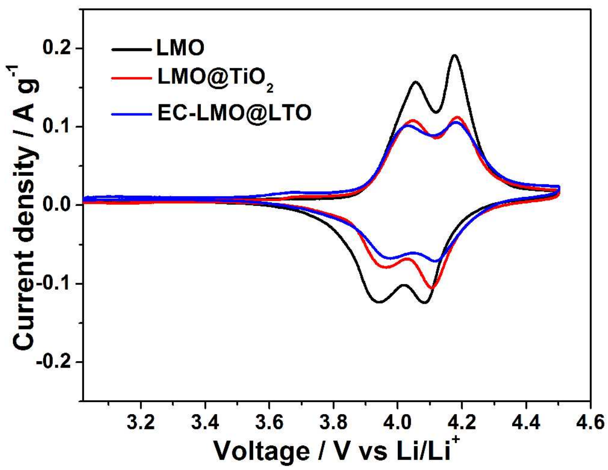

Figure S6. The CV curves of LMO, LMO@TiO_2 and EC-LMO@LTO at the first cycle between 3 and 4.5 V. Scan rate: 0.1 mV s^{-1}

Table S1. Summary of the CV results for LMO, LMO@TiO_2 and EC-LMO@LTO cathodes.[a]

Sample	Potential Values / V					
	Epa1	Epc1	ΔE1	Epa2	Epc2	ΔE2
LMO	4.055	3.944	0.111	4.175	4.084	0.091
LMO@TiO_2	4.047	3.965	0.082	4.184	4.107	0.077
EC-LMO@LTO	4.032	3.977	0.055	4.175	4.115	0.060

[a] Epa: anodic peak potential, Epc: cathodic peak potential, ΔE: the separation between Epa and Epc. The subscript numbers 1 and 2 denote the redox couple at lower and higher potential, respectively.

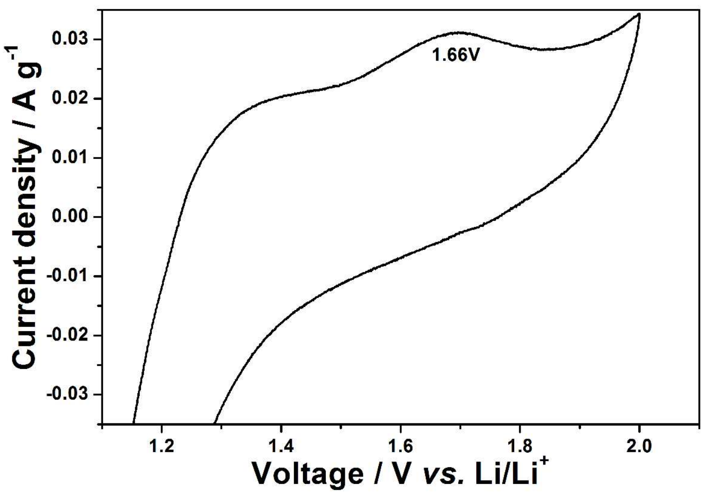

Figure S7. The CV curve of EC-LMO@LTO between 1 and 2 V. Scan rate: 1 mV s^{-1}

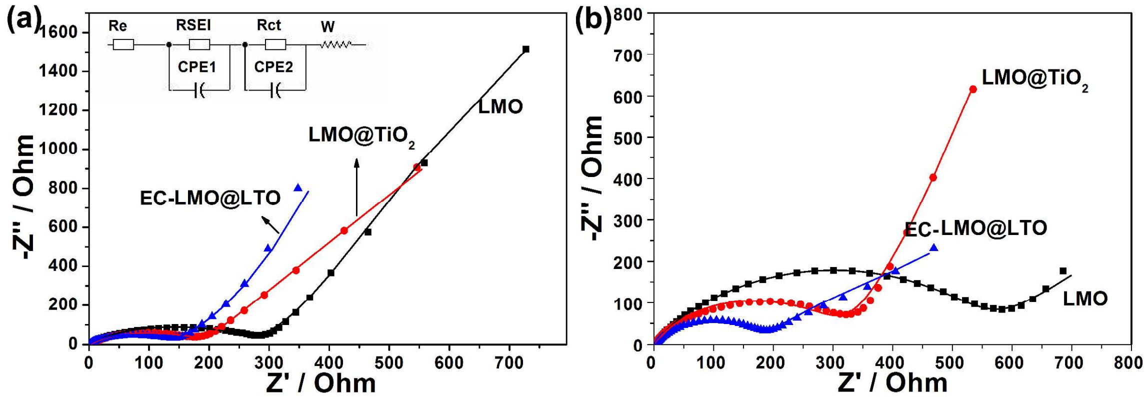

Figure S8. Nyquist plots of LMO, LMO@TiO_2 and EC-LMO@LTO cathodes at fresh state (a) and after 100^{th} charge/discharge cycles at 1 C (b) over the frequency range between 100 kHz and 0.1 Hz and applying an AC signal of 5 mV. The symbols are the experimental data, whereas the continuous lines are fitted ones.

For all the cathodes, the intercept at the Z' axis in the high frequency region is due to the combined impedance of the electrolyte and cell components (Re).[1] The semicircles in the high-middle frequency region are the contribution of two semicircles (high and intermediate frequency), which are attributed to the solid electrolyte interface (SEI) resistance (RSEI) corresponding to form a passive surface film on the surface of the cathode materials and the charge-transfer resistance (Rct) in the electrode–electrolyte interfaces.[2] The inclined lines in the lower frequency region reveal the Li^+-ion diffusion process in the electrode materials, the Warburg impedance (W).[1]

Table S2. The fitted combined impedance (resistance) of the electrolyte and cell components (Re), solid electrolyte interface (SEI) resistance (RSEI) and the charge-transfer resistance (Rct) for the Nyquist plots of LMO, LMO@TiO_2 and EC-LMO@LTO before and after 100^{th} cycling at 1C rate.

Sample	LMO	LMO@TiO_2	EC-LMO@LTO
Re /Ω	1.86	2.06	2.34
Re (100^{th}) /Ω	3.68	3.45	2.89
RSEI /Ω	28.5	18.5	11.81
RSEI (100^{th}) /Ω	38.55	25.2	14.5
Rct /Ω	260.5	168.9	122.4
Rct (100^{th}) /Ω	500.4	275.7	178.1

Table S3. Calculated Li^+ ion diffusion coefficient (D) in as-prepared materials from EIS results (18.6 Hz <ω<0.1 Hz) before cycling.

Sample	LMO	LMO@TiO_2	EC-LMO@LTO
D(cm^2 s^{-1})	1.318E-13	1.837E-13	5.299E-13

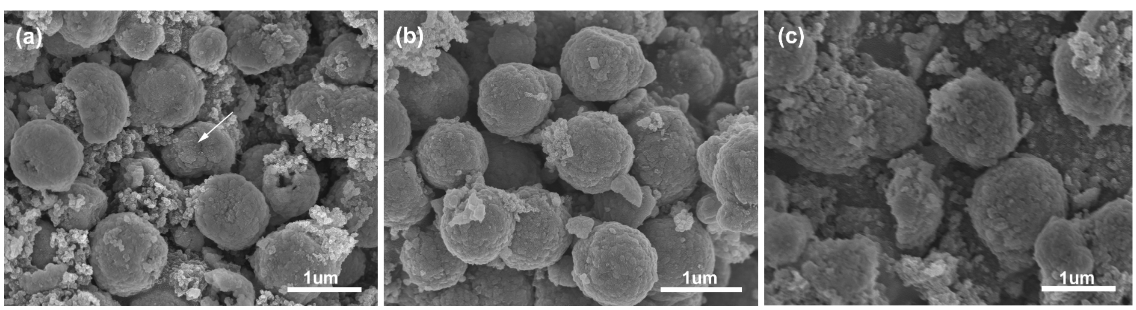

Figure S9. The morphology of LMO (a), LMO@TiO_2 (b) and EC-LMO@LTO (c) after 100 charge and discharge cycles at 1 C at 25 °C.

(1) Shi, S.J.; Tu, J.P.; Tang, Y.Y.; Liu, X.Y.; Zhang, Y.Q.; Wang, X.L.; Gu, C.D. Enhanced Cycling Stability of Li[$Li_{0.2}Mn_{0.54}Ni_{0.13}Co_{0.13}$]$O_2$ by Surface Modification of MgO with Melting Impregnation Method. *Electrochim. Acta* **2013**, *88*, 671–679.

(2) Zhao, S.; Bai, Y.; Chang, Q.J.; Yangm Y.Q.; Zhang W.F. Surface Modification of Spinel $LiMn_2O_4$ with FeF_3 for Lithium Ion Batteries. *Electrochim. Acta* **2013**, *108*, 727–735.