Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Supplementary information for

Rate Dependent Structural Transition and Cycling Stability of a Lithium-Rich Layered Oxide Material

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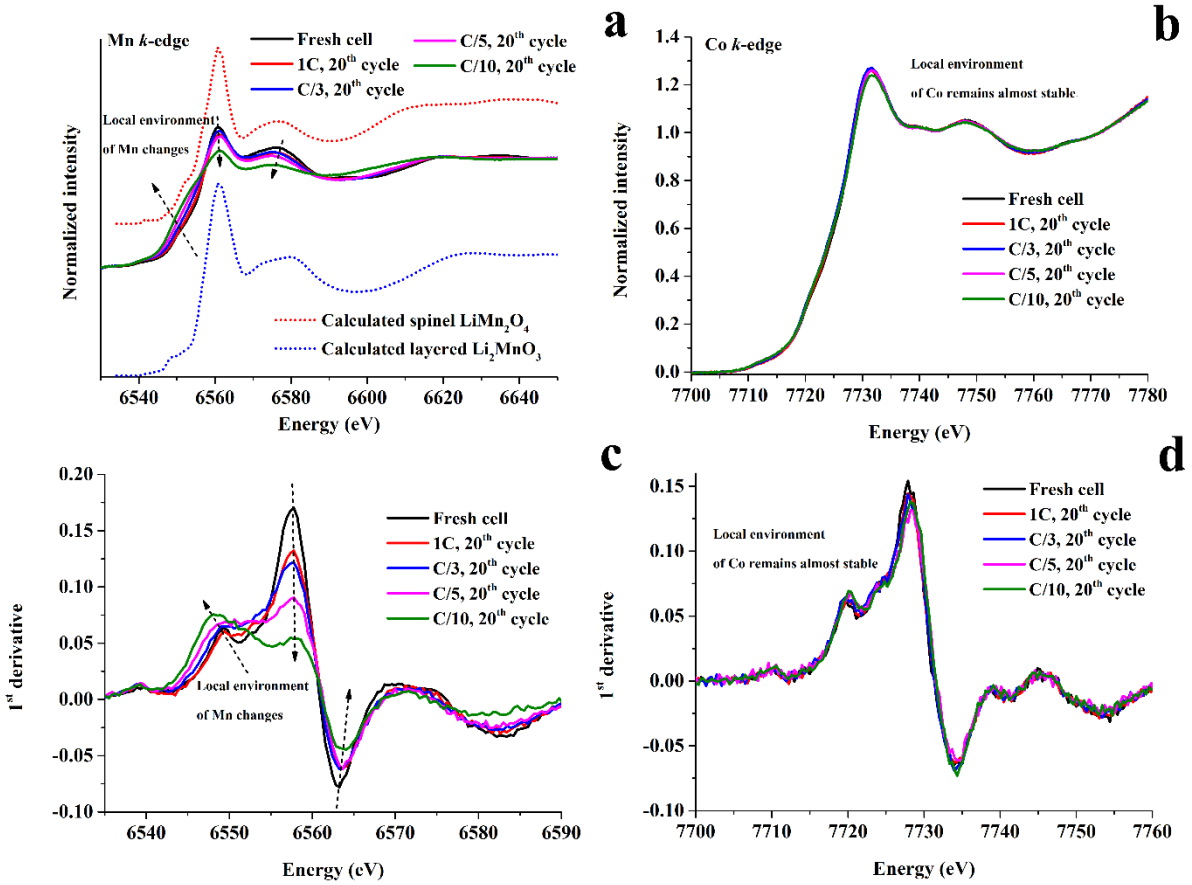

Fig. S1 Mn (a) and Co (b) *K*-edge XANES spectra of the fresh cell and the cells under various current rates after cycling for 20 cycles. The 1st derivative Mn (c) and Co (d) *K*-edge spectra of the cycled cathode materials.

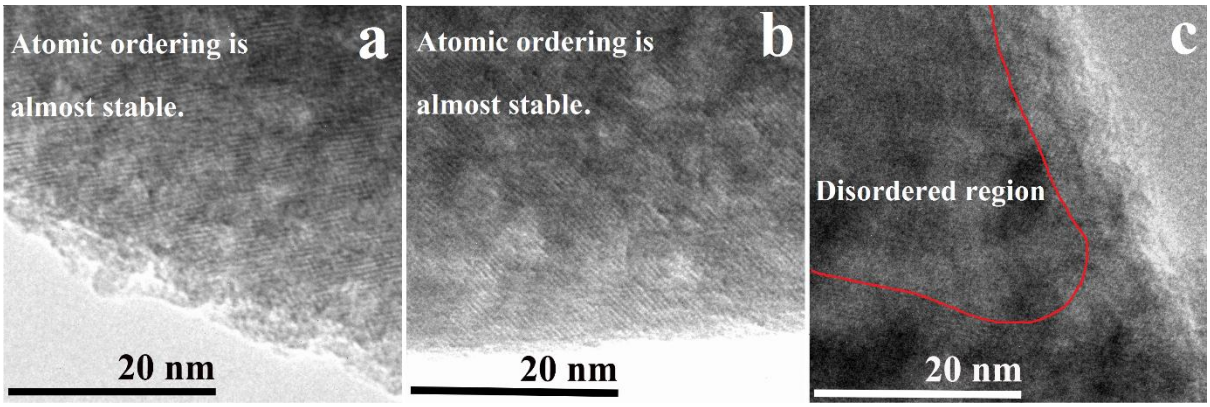

Fig. S2 HRTEM images of $0.5Li_2MnO_3 \cdot 0.5LiCoO_2$ cycled with 1C (a), C/3 (b), and C/10 (c) after 30 cycles.

The TEM image qualities of the pristine (Fig. 4(b)) and cycled cathode (Fig. S2) materials are different. This is because the TEM image of the pristine cathode material was obtained from a JEOL

(JEM-2010 TEM) using an accelerating voltage of 200 kV and exposure time of 500 ms while those of the cycled cathode materials were obtained with a FEI (TECNAI G2 20) TEM using an accelerating voltage of 200 kV and exposure time of 300 ms. This provided a TEM image with a lower quality than the TEM image obtained from the JEOL (JEM-2010 TEM).

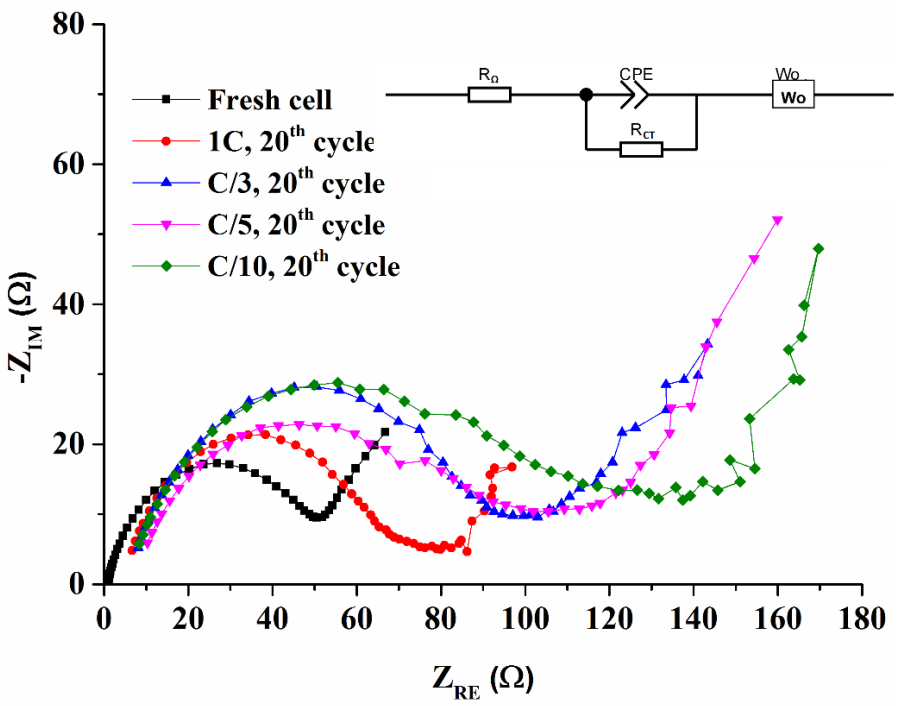

Fig. S3 Nyquist plots of the fresh cell and the cells under different current rates after cycling for 30 cycles (The inset presents an equivalent circuit). R_{Ω}, R_{CT}, CPE, and W_0 denote the ohmic resistance that occurred from interaction between the electrode and electrolyte, the charge-transfer resistance, constant phase element, and Warburg resistance corresponding to lithium ion diffusion, respectively.

Table. S1 Comparison of calculated resistances obtained from fitting parameters using the equivalent circuit model illustrated in Fig. S3 of the fresh cell and the cells cycled at different current rates after 30 cycles.

Samples	R_{Ω} (Ω)	R_{CT} (Ω)
Fresh cell	0.3	47.2
Cell cycled at 1C	2.1	70.5
Cell cycled at C/3	4.2	90.0
Cell cycled at C/5	4.4	92.9
Cell cycled at C/10	5.1	111.6