Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Boosting Cycling Stability of Ni-rich Layer Oxide Cathode by Dry Coating of Ultrastable $Li_3V_2(PO_4)_3$ Nanoparticles

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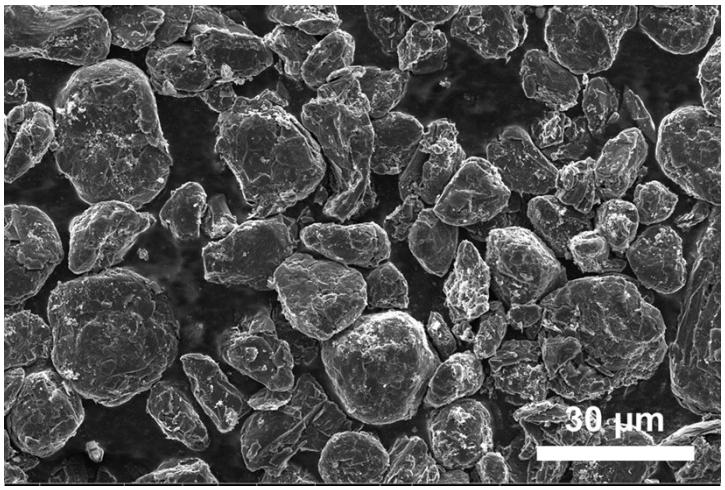

Figure S1. SEM image of the graphite (MTI corporation) used in full cell fabrication.

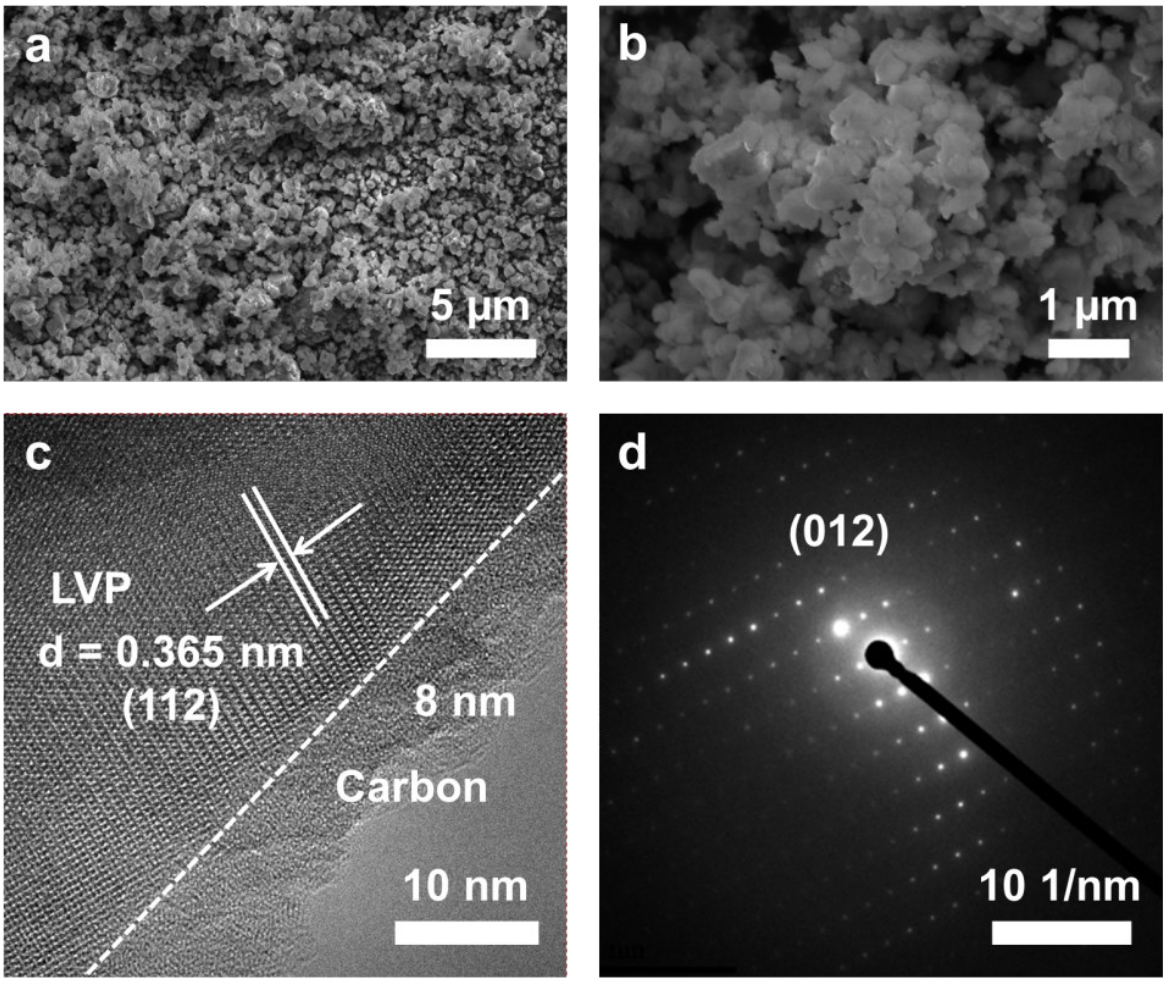

Figure S2. (a, b) SEM images of the LVP-C nanoparticles; (c) HR-TEM image of the LVP-C nanoparticles; (d) the relevant SEAD pattern of the LVP-C nanoparticles.

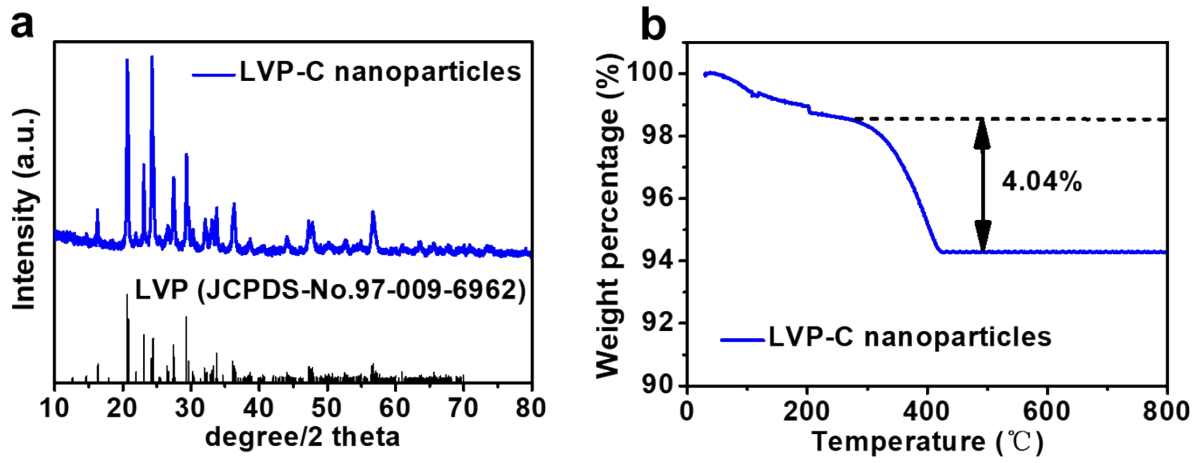

Figure S3. (a) XRD pattern of the synthesized LVP-C nanoparticles; (b) TGA curve of the LVP-C nanoparticles.

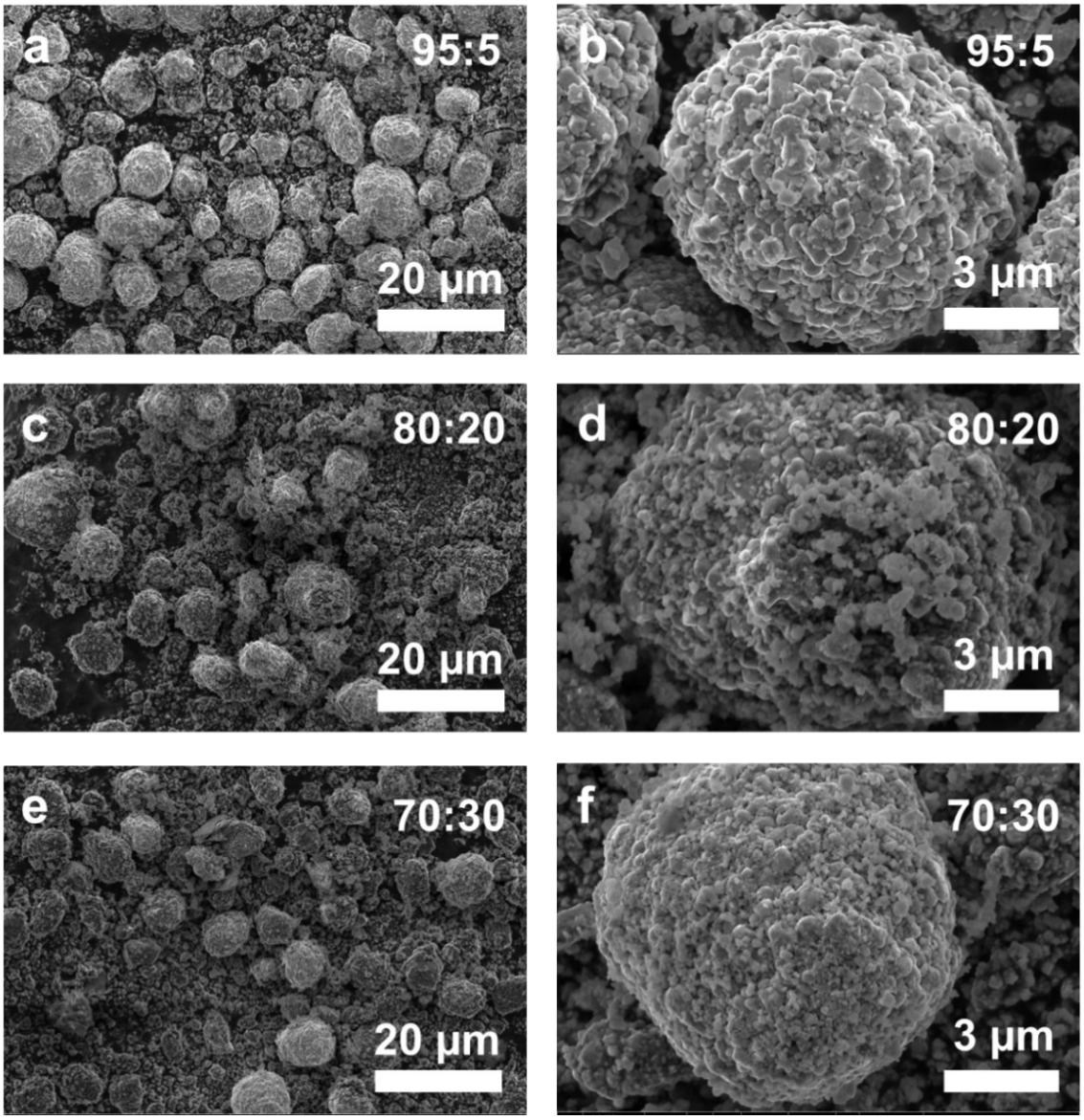

Figure S4. SEM images of NCM622/LVP-C composites with different LVP contents: (a, b) 95:5; (c, d) 80:20; (e, f) 70:30.

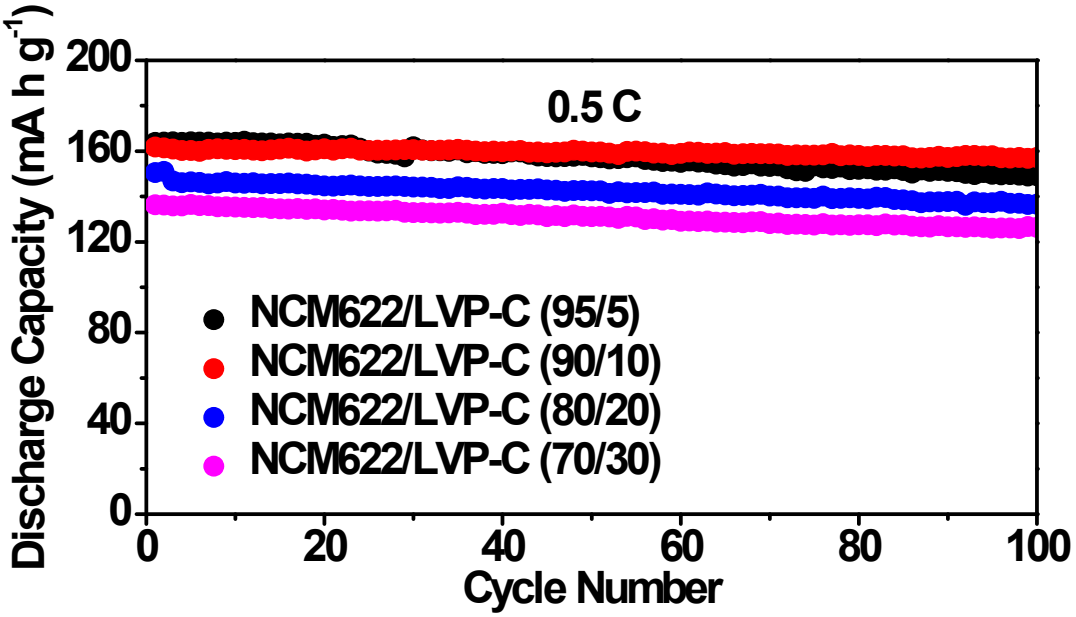

Figure S5. Cycling performance of NCM622/LVP-C composites with different contents of LVP-C at a current density of 0.5 C (*e.g.*, 90:10 refers to the weight ratio between NCM622 and LVP-C).

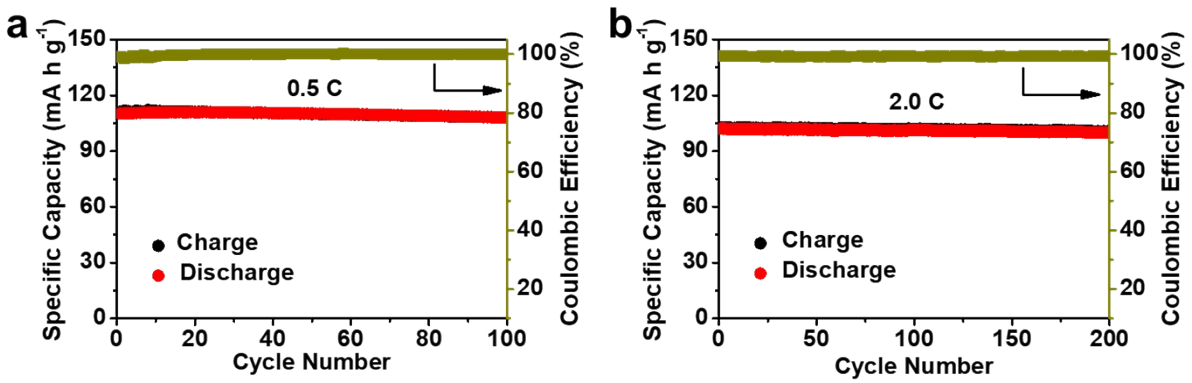

Figure S6. Cycling performance of LVP-C electrode at rate of (a) 0.5 C and (b) 2.0 C.

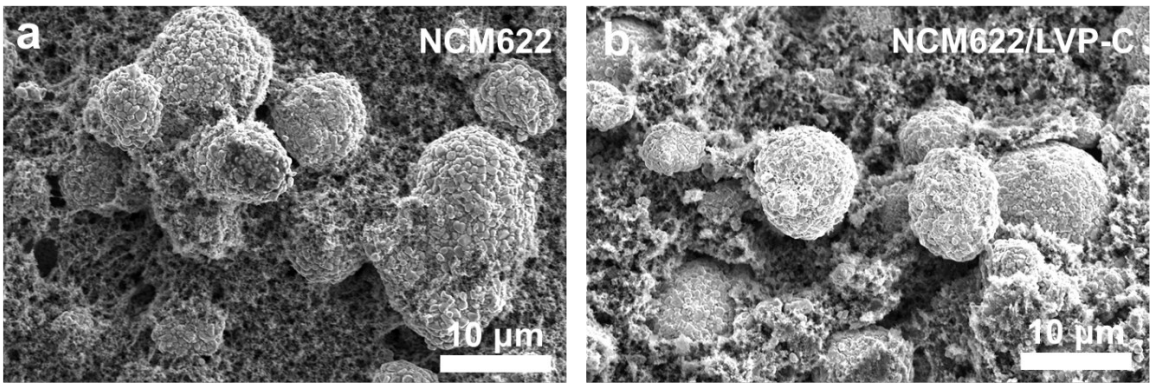

Figure S7. SEM images of (a) NCM622 and (b) NCM622/LVP-C electrodes after 50 cycles at 0.5C.

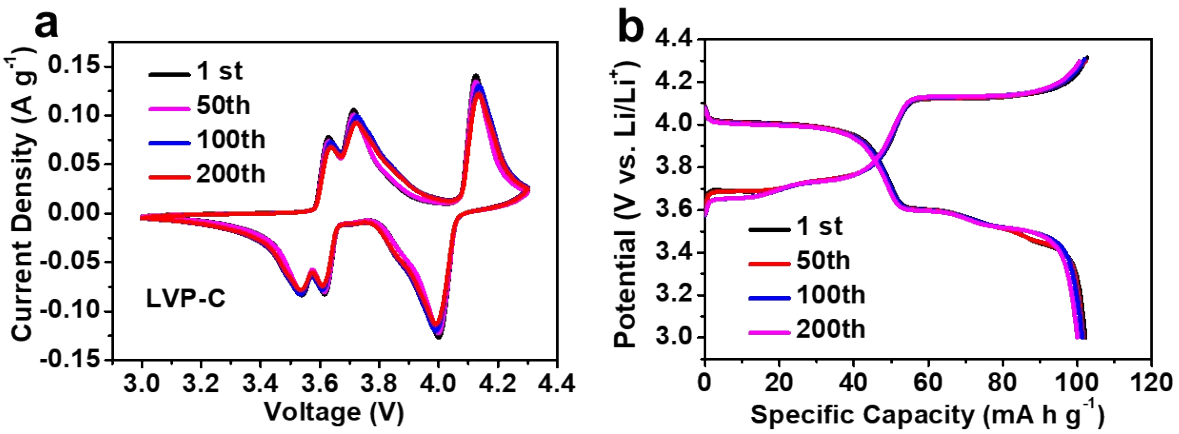

Figure S8. (a) The CV curves of LVP-C electrode after different cycles at a scan rate of 0.1 mV s^{-1} between 3.0-4.3V; (b) The charge and discharge curves of LVP-C electrode after different cycles.

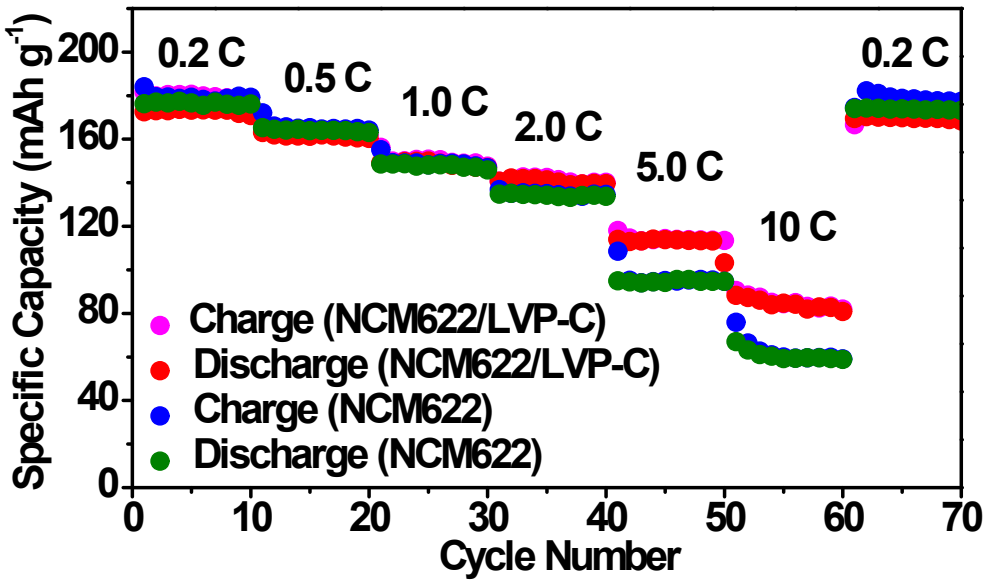

Figure S9. Comparison of the rate performance of NCM622/LVP-C and NCM622 electrode.

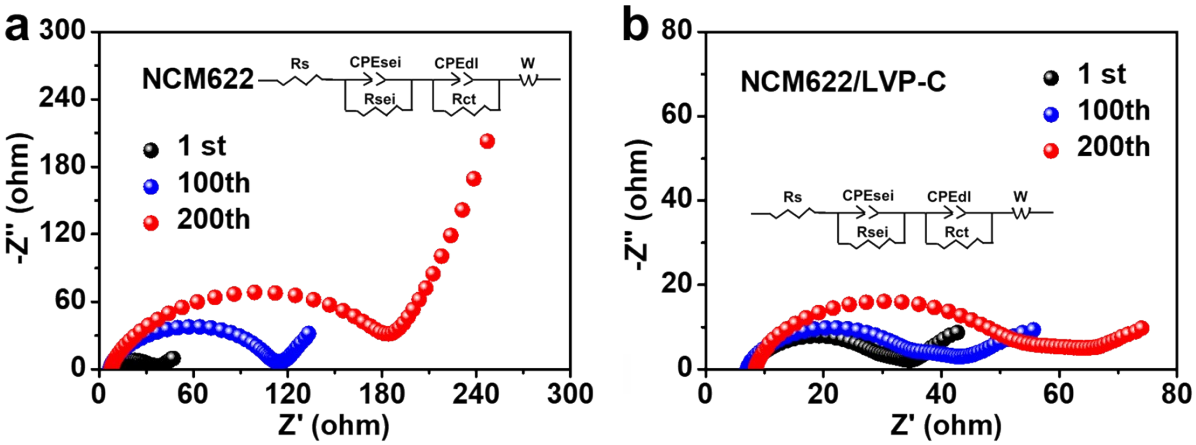

Figure S10. Nyquist plots of (a) NCM622 and (b) NCM622/LVP-C cathode after different cycles. The inset displays the equivalent circuit to fit the Nyquist plots. All the coin cells were cycled at 2 C between 3.0-4.3 V.

Table S1. The values of R_S and R_{ct} for cycled electrodes at 2 C between 3.0-4.3 V.

Samples	**1st**		**100th**		**200th**	
	***R*s (Ω)**	***R*ct (Ω)**	***R*s (Ω)**	***R*ct(Ω)**	***R*s (Ω)**	***R*ct(Ω)**
NCM622	9.73	43.2	12.86	111.6	20.74	179.7
NCM622/LVP-C	8.33	31.1	9.85	40.5	10.76	58.7

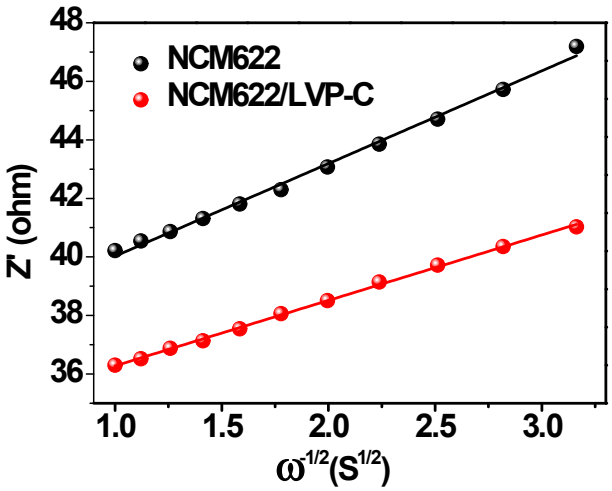

Figure S11. The plot of Z' versus $\omega^{-1/2}$ of NCM622 and NCM622/LVP-C electrode in the low-frequency region.

Table S2. Summary of the EIS calculation results of the two electrodes

Electrodes	σ	D_{Li+} **(cm² s⁻¹)**
NCM622	3.17	1.23×10^{-11}
NCM622/LVP-C	2.23	4.07×10^{-11}

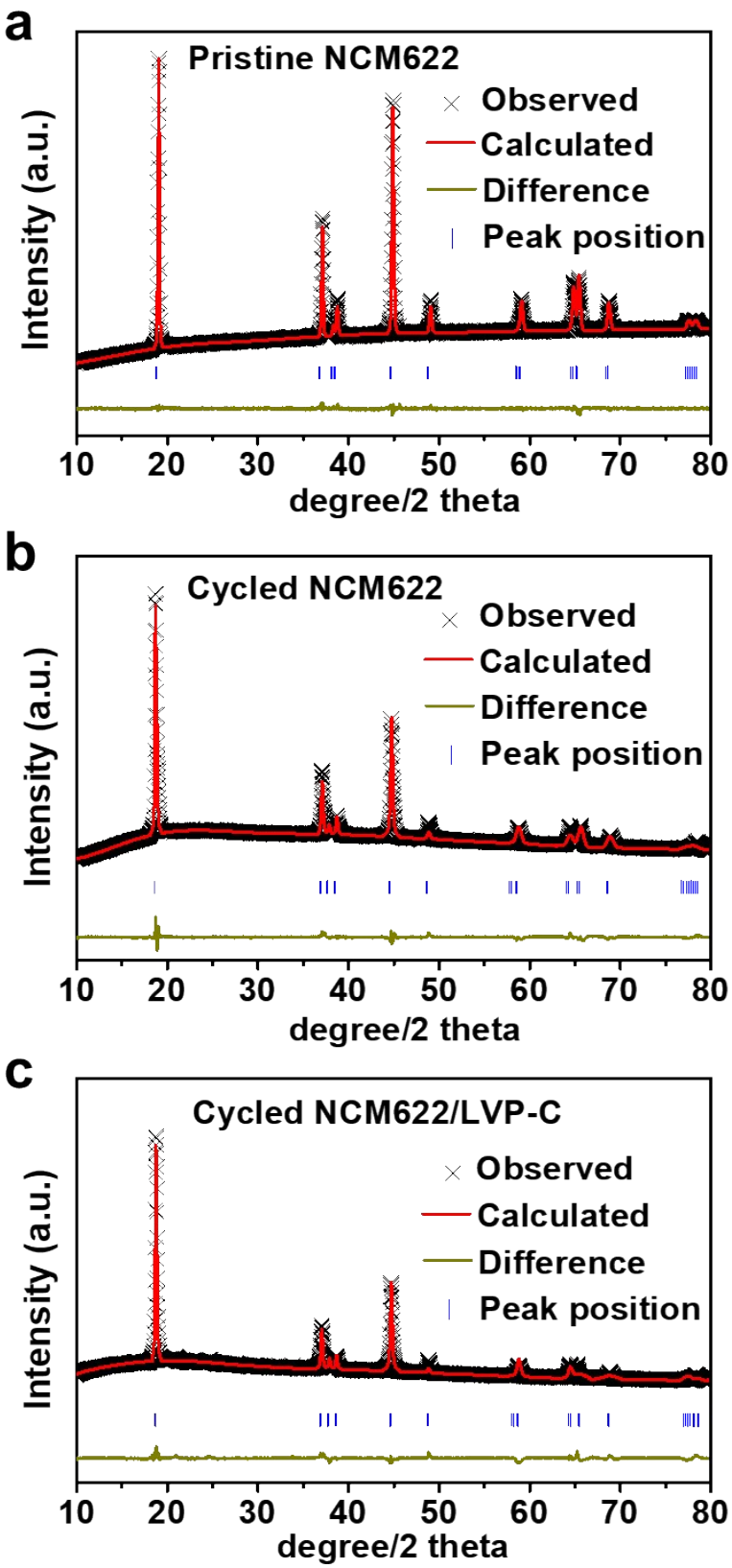

Figure S12. Rietveld refinement of the XRD patterns of (a) pristine NCM622; (b) cycled NCM622, and (c) cycled NCM622/LVP-C.