

## Supporting Information

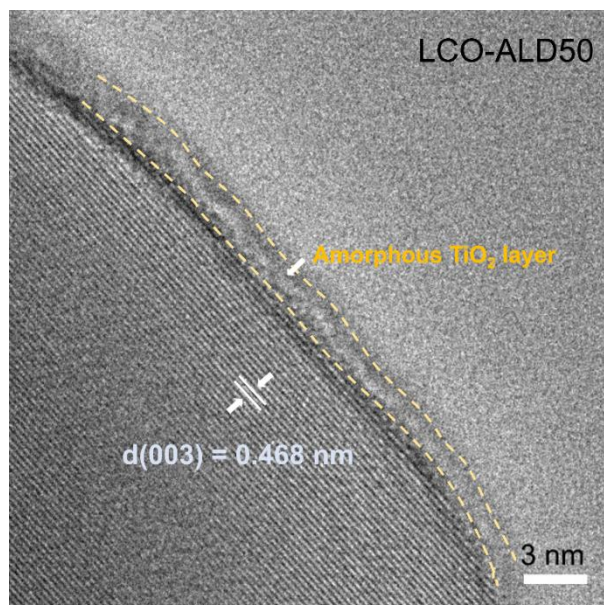


Figure S1. High-resolution TEM image of LCO-ALD50.

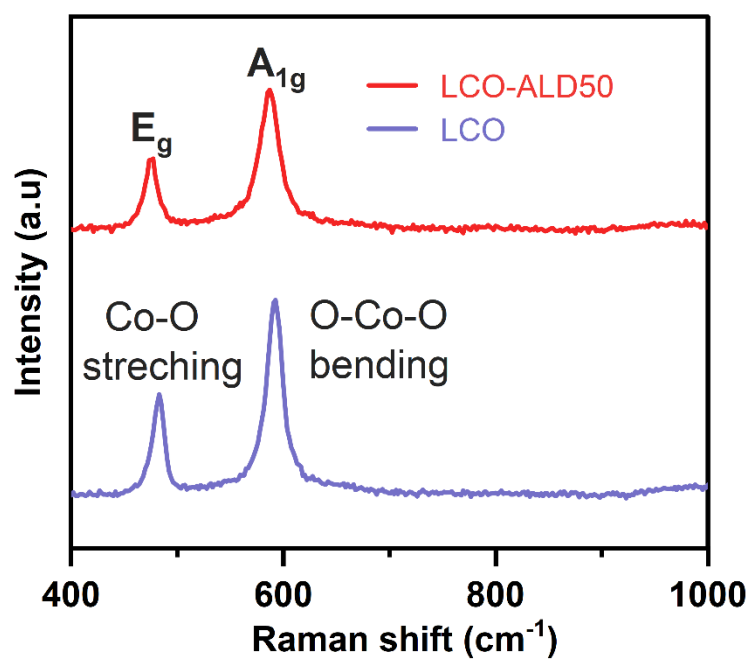


Figure S2. Raman spectra of bare LCO and LCO-ALD50.

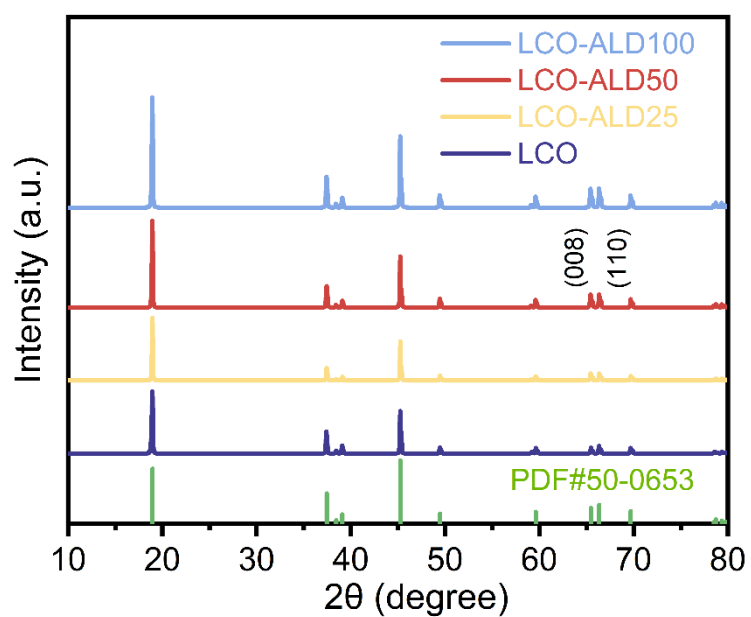


Figure S3. XRD patterns of bare LCO, LCO-ALD25, LCO-ALD50 and LCO-ALD100.

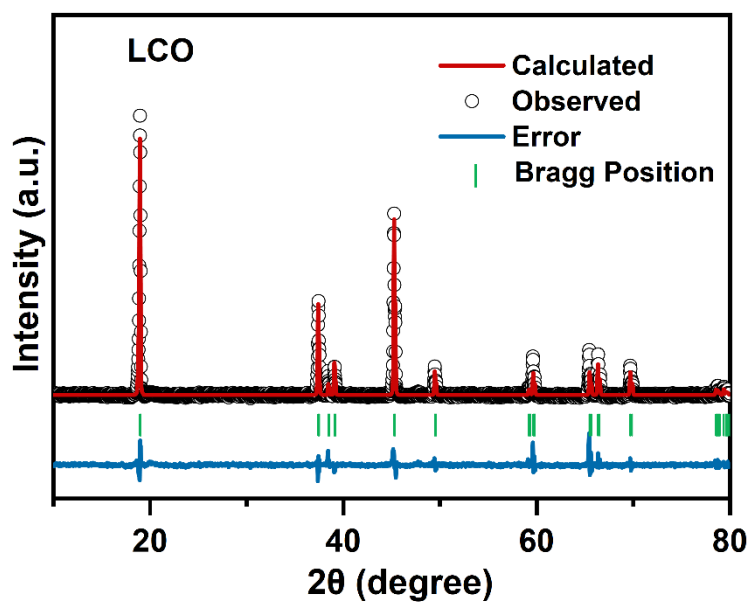


Figure S4. XRD pattern with Rietveld refinement of bare LCO.

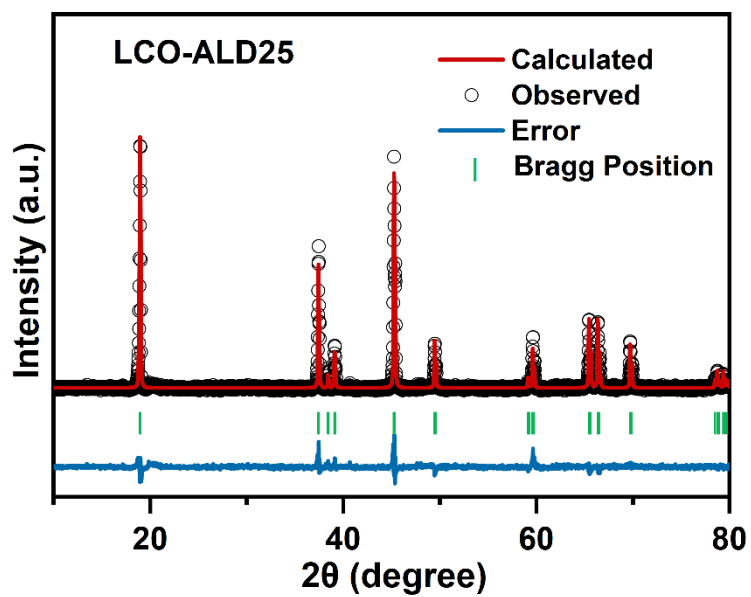


Figure S5. XRD patterns with Rietveld refinement of LCO-ALD25.

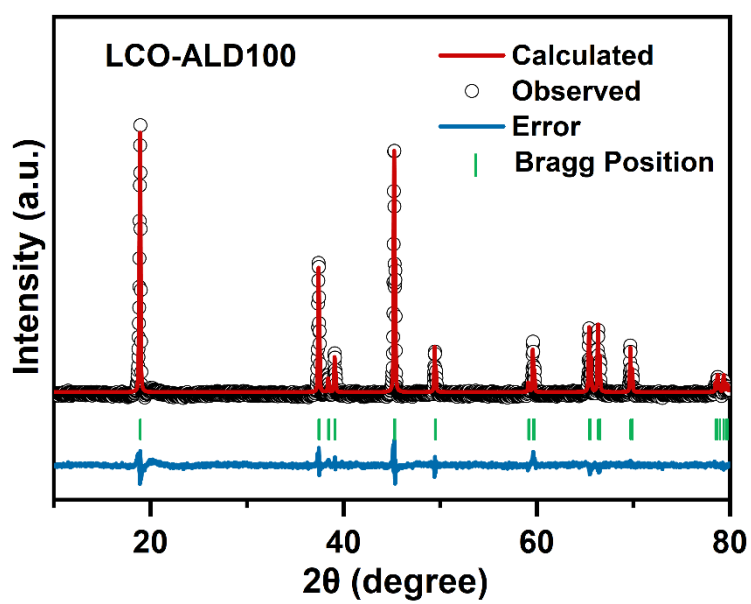


Figure S6. XRD patterns with Rietveld refinement of LCO-ALD100.

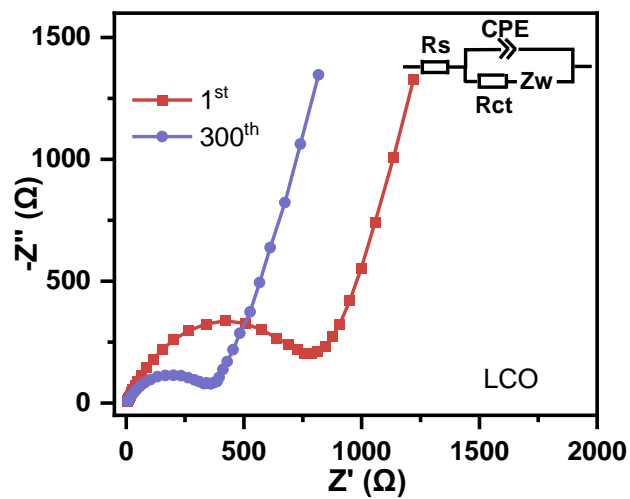


Figure S7. Nyquist plots before and after 300 cycles of bare LCO.

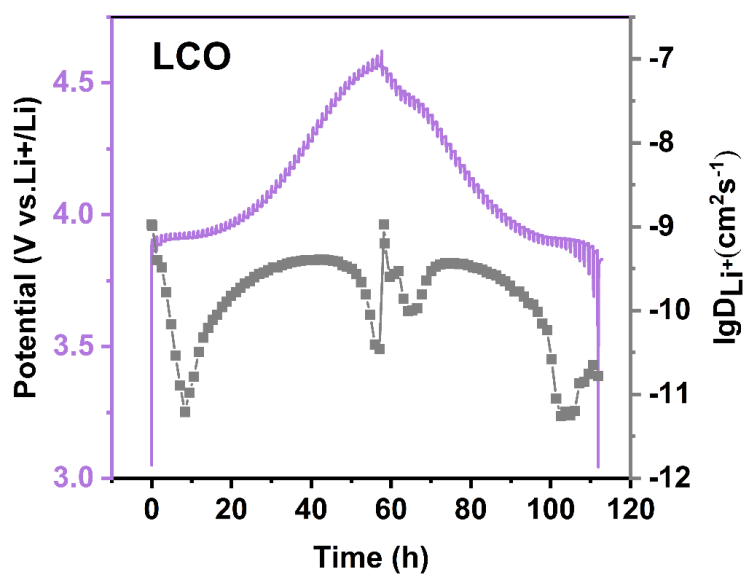


Figure S8. GITT curve and variations in apparent  $\text{Li}^+$  diffusion coefficient of LCO.

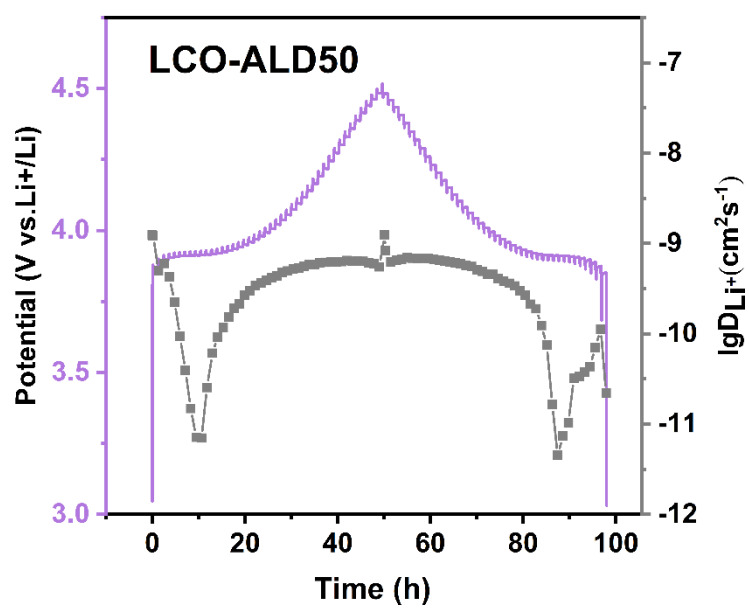
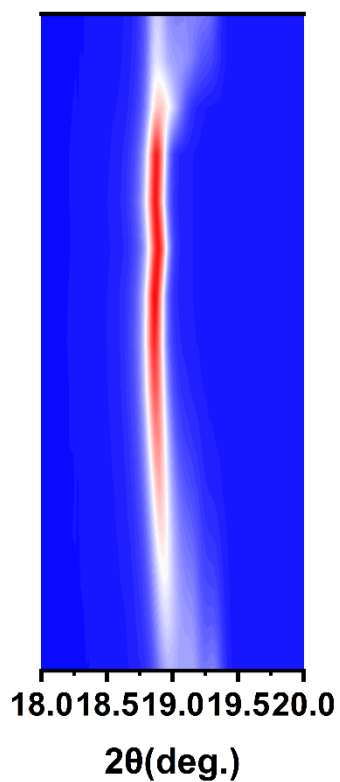


Figure S9. GITT curve and variations in apparent  $\text{Li}^+$  diffusion coefficient of LCO-ALD50.



Figure S10. In situ XRD patterns during the first cycle of LCO.



**Figure S11.** In situ XRD patterns during the first cycle of LCO-ALD50.

**Table S1.** Structural information of bare LCO and surface-modified LCO obtained from the XRD Rietveld refinement.

Sample	interlayer spacing		a	c	c/a
	003	104			
LCO	4.6793	2.0025	2.8157	14.0379	4.9855
ALD25	4.6881	2.0046	2.8175	14.0645	4.9914
ALD50	4.6883	2.0048	2.8177	14.0648	4.9917
ALD100	4.6882	2.0047	2.8176	14.0646	4.9916

**Table S2.** Impedance parameters obtained from equivalent circuit fittings.

Sample	$R_{ct}$ ( $\Omega$ )	Error (%)
LCO (before cycling)	863.2	6.4
LCO-ALD50 (before cycling)	352.4	7.9
LCO (after 100 cycles at 1C)	382.7	5.6
LCO-ALD50 (after 100 cycles at 1C)	189.2	6.1

**Table S3.** Diffusion coefficients of  $\text{Li}^+$ .

Samples	$D_{\text{Li}^+\text{in}} / 10^{-11} \text{ cm}^2\text{s}^{-1}$	$D_{\text{Li}^+\text{ex}} / 10^{-11} \text{ cm}^2\text{s}^{-1}$
Bare LCO	1.54	1.12
LCO-ALD50	2.82	2.18

$D_{\text{Li}^+\text{in}}$ : diffusion coefficient of  $\text{Li}^+$  during the charge process.

$D_{\text{Li}^+\text{ex}}$ : diffusion coefficient of  $\text{Li}^+$  during the discharge process.