

Supporting Information

V₂CT_x MXene Artificial Solid-Electrolyte Interphases toward Dendrite-Free Lithium Metal Anodes

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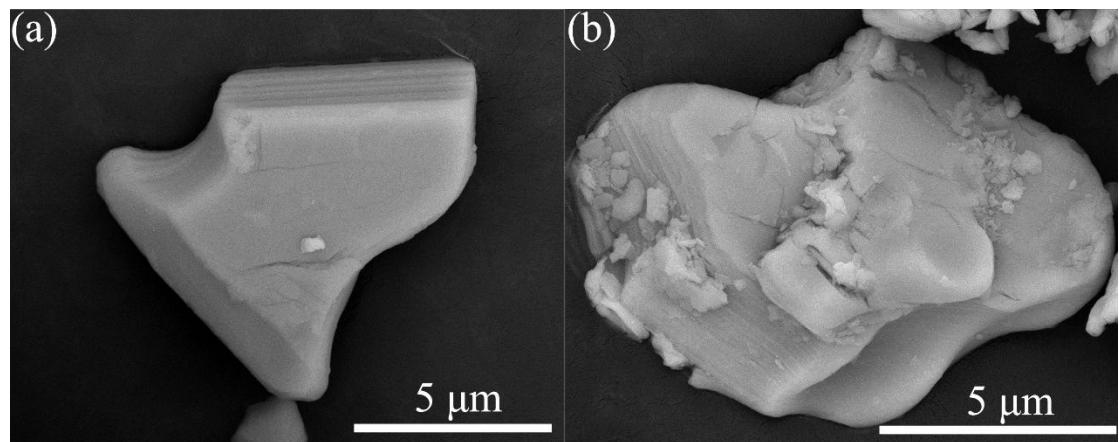


Figure. S1. (a, b) SEM images of V_2AlC MAX.

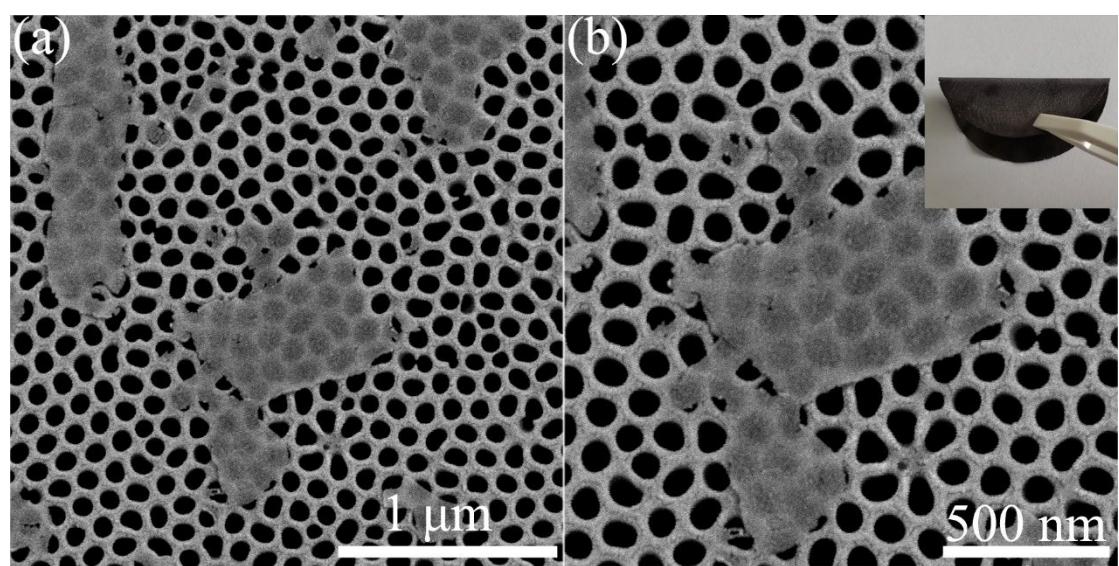


Figure. S2. (a, b) SEM images of V_2CT_x flakes at different magnification. Inset in Figure S2b: the digital photograph of flexible V_2CT_x film.

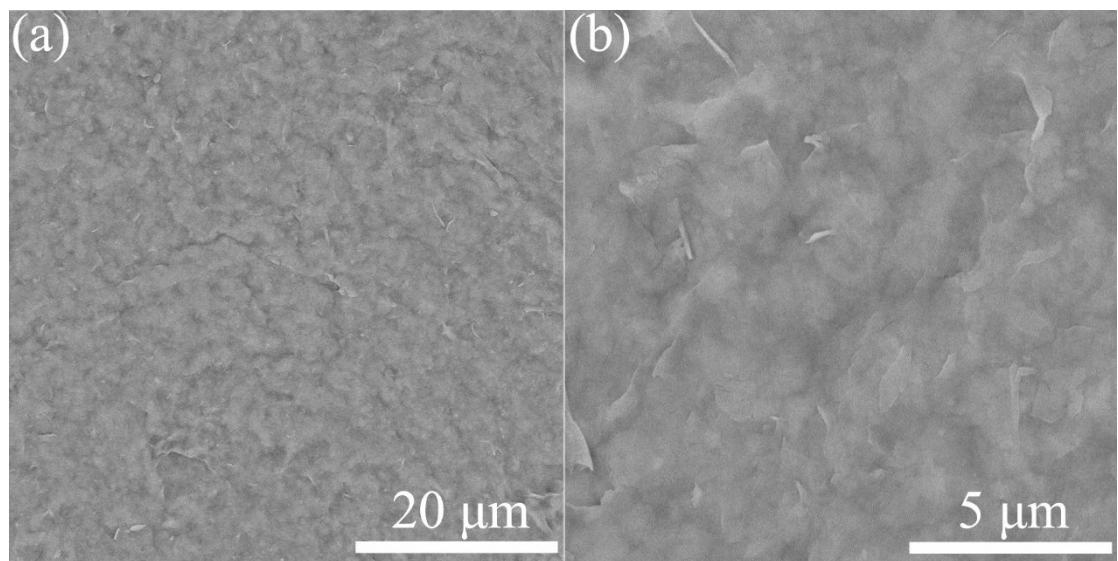


Figure. S3. (a, b) The SEM images from top-view of V_2CT_x film at different magnification.

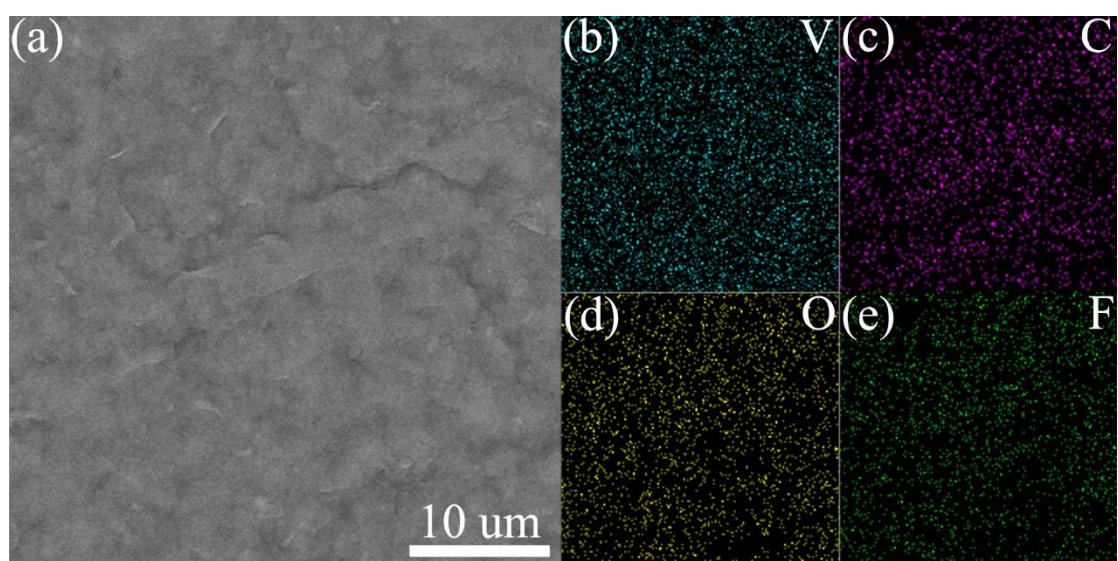


Figure. S4. SEM image from top-view of (a) V_2CT_x film and the corresponding energy-dispersive spectroscopy (EDS) mapping images of (b) vanadium, (c) carbon, (d) oxygen and (e) fluorine.

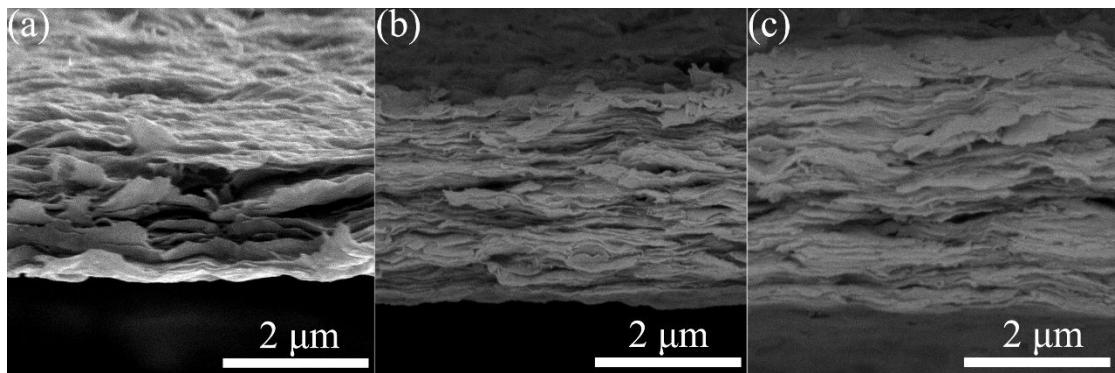


Figure. S5. The cross-section SEM images of a V_2CT_x film at the mass loading of (a) 0.4 mg cm^{-2} , (b) 0.8 mg cm^{-2} and (c) 1.2 mg cm^{-2} . According to the cross-section SEM images, the thickness of the film increases from $\sim 1.3 \mu\text{m}$ to $\sim 2.5 \mu\text{m}$ and $3.6 \mu\text{m}$ (labelled as V_2CT_x -1, V_2CT_x and V_2CT_x -2 respectively).

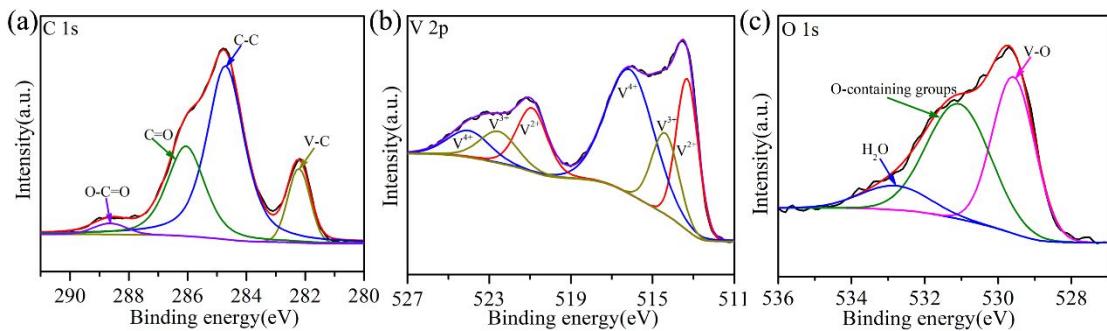


Figure. S6. High-resolution XPS spectra: (a) C 1s, (b) V 2p and (c) O 1s spectra of V_2CT_x film.

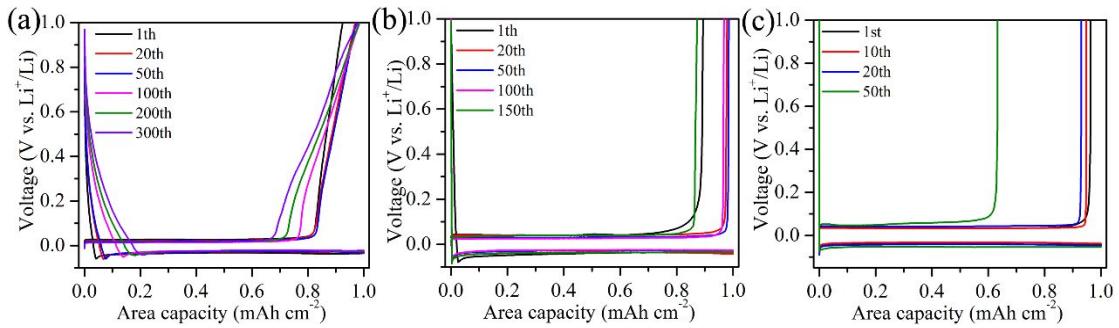


Figure. S7. The galvanostatic discharge-charge curves of (a) the Li||V₂CT_x-Cu, (b) Li||T₃C₂T_x-Cu and (c) Li||Cu half-cells at 1 mAh cm⁻² and 1 mA cm⁻².

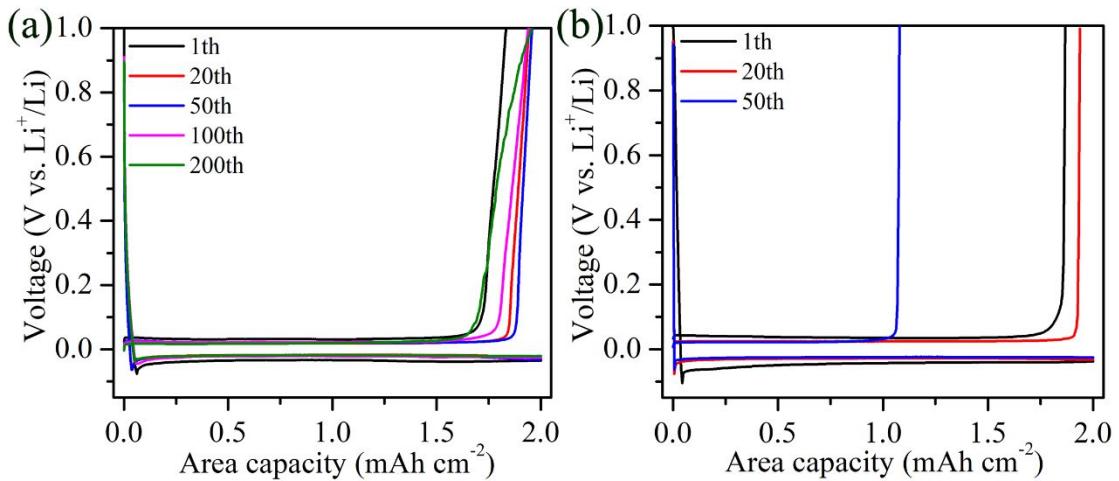


Figure. S8. The galvanostatic discharge-charge curves of (a) the Li||V₂CT_x-Cu and (b) Li||Cu half-cells at 2 mAh cm⁻² and 2 mA cm⁻².

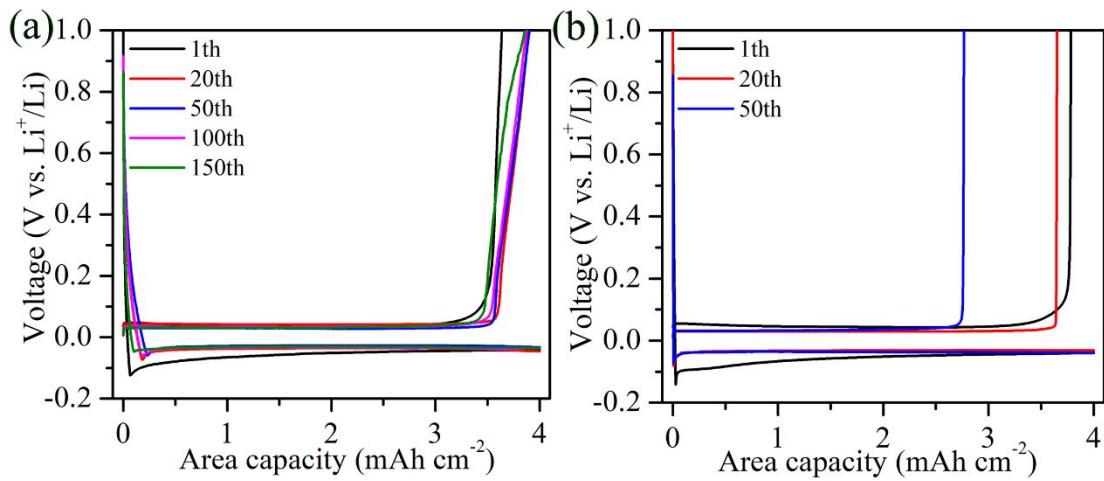


Figure. S9. The galvanostatic discharge-charge curves of (a) the Li||V₂CT_x-Cu and (b) Li||Cu half-cells at 4 mAh cm⁻² and 4 mA cm⁻².

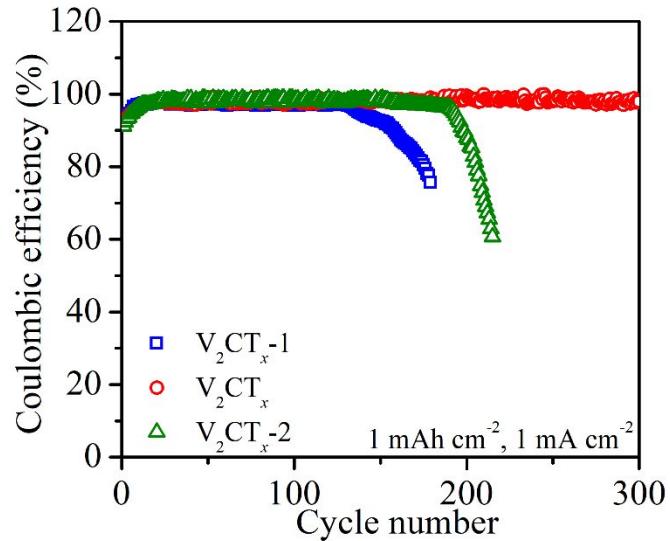


Figure. S10. The CE performance of the Li||V₂CT_x-1-Cu, Li||V₂CT_x-Cu and Li||V₂CT_x-2-Cu half-cells at 1 mAh cm⁻² and 1 mA cm⁻².

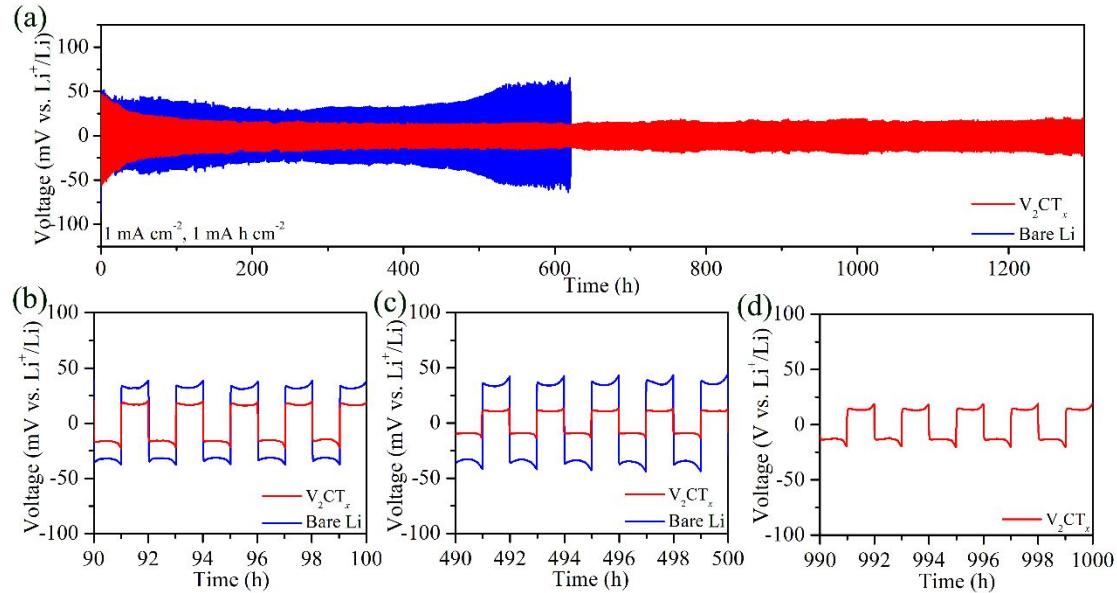


Figure. S11. (a) Cycling life of $\text{Li-V}_2\text{CT}_x||\text{V}_2\text{CT}_x-\text{Li}$ and $\text{Li}||\text{Li}$ symmetrical half-cells at an areal capacity of 1 mAh cm^{-2} and a current density of 1 mA cm^{-2} . The corresponding magnified voltage profiles at different cycling periods: (b) 90-100 h, (c) 490-500 h and (d) 990-1000 h.

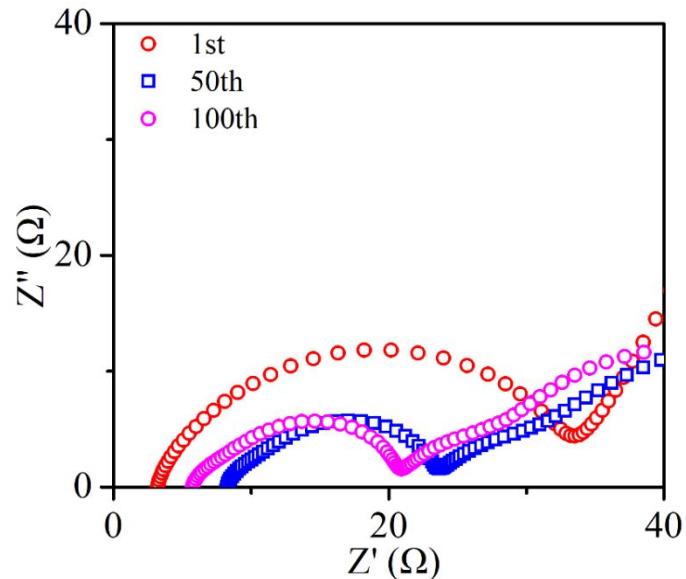


Figure. S12. The EIS spectra of the $\text{Li}||\text{V}_2\text{CT}_x-\text{Cu}$ half-cells at different cycles.

Table S1. The binding energies (eV) for Li ion on the surfaces of V_2CT_x and $\text{Ti}_3\text{C}_2\text{T}_x$

	C-site	M-site	O-site
V_2CO_2	-2.74	-2.59	-2.11
$\text{Ti}_3\text{C}_2\text{O}_2$	-2.20	-1.91	-1.61

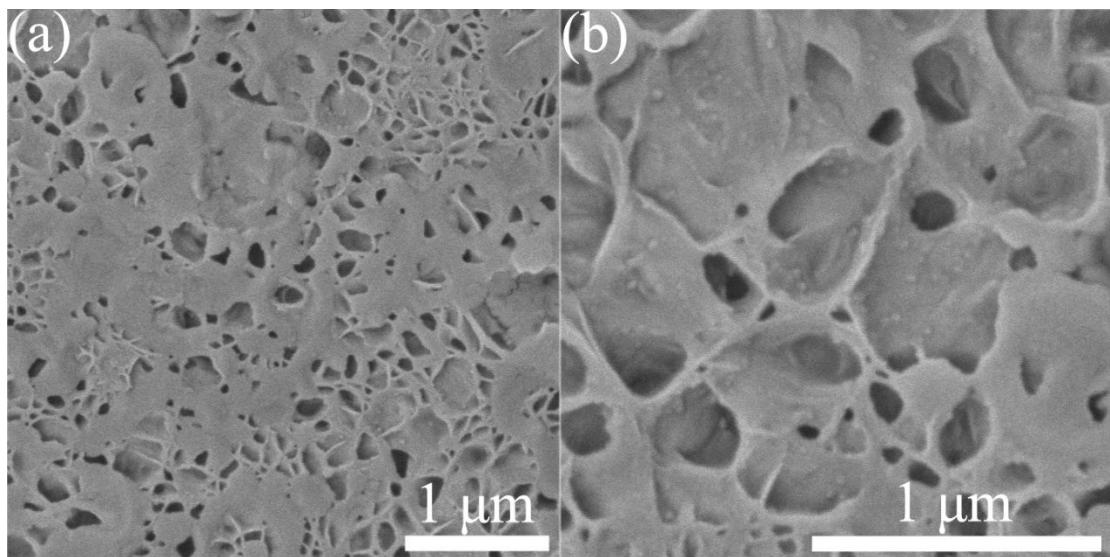


Figure. S13. (a, b) Top-view SEM images of V₂CT_x-Li after plating 1.0 mAh cm⁻² of Li at different magnification.

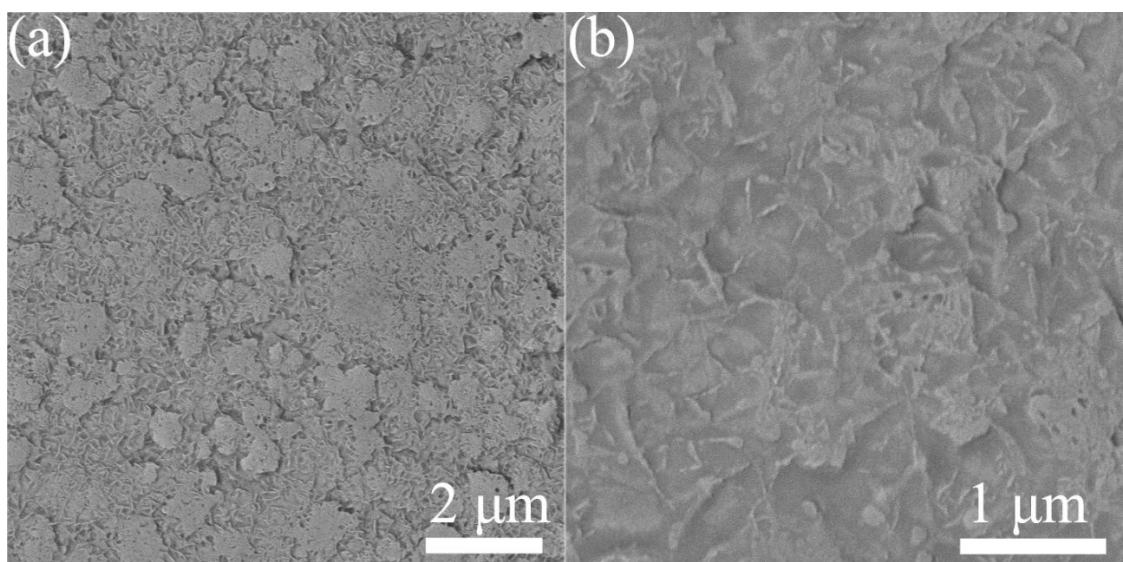


Figure. S14. (a, b) Top-view SEM images of V₂CT_x-Li after plating 2.0 mAh cm⁻² of Li at different magnification.

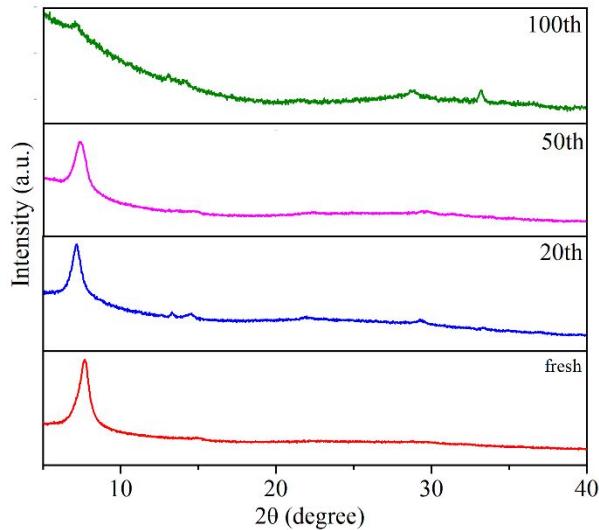


Figure. S15. *Ex situ* XRD patterns of V_2CT_x layer after different cycles.

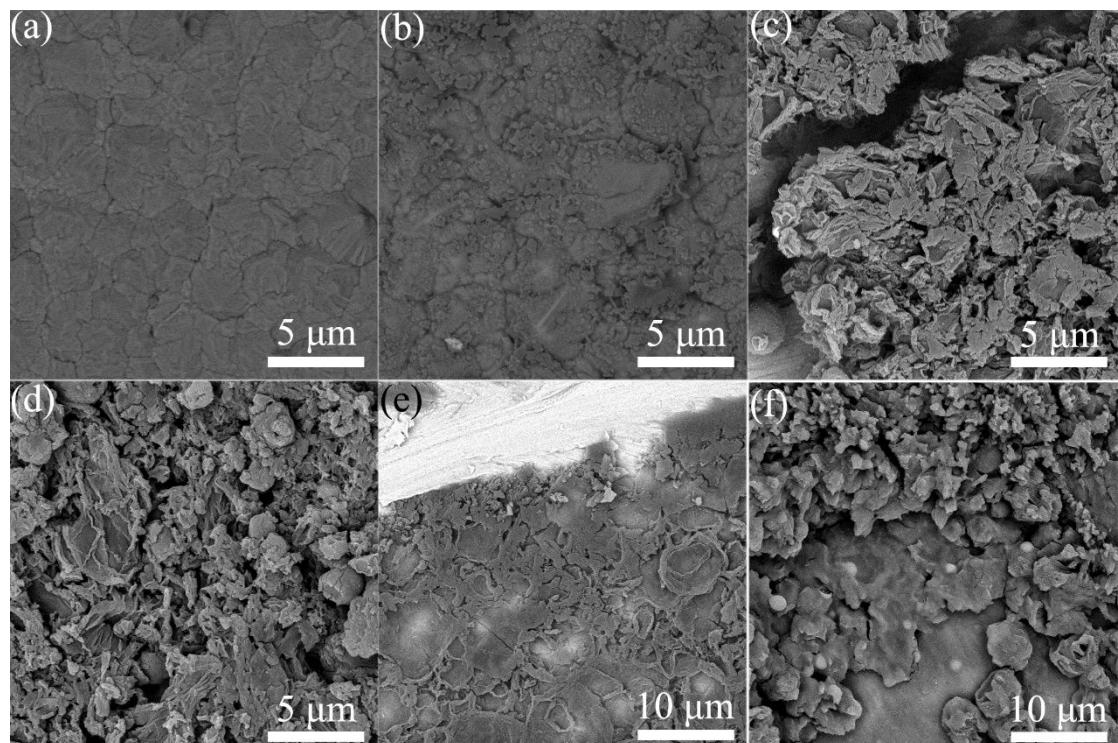


Figure. S16. Top-view SEM images of deposited Li on Cu at different stages: (a) fresh Cu foil, plating a capacity of (b) 0.1 mAh cm^{-2} , (c) 0.5 mAh cm^{-2} and (d) 1.0 mAh cm^{-2} of Li, (e) stripping to 1.0 V after plating 1.0 mAh cm^{-2} of Li. (f) Top-view SEM image of 1.0 mAh cm^{-2} of Li deposited on Cu after 20 cycles.

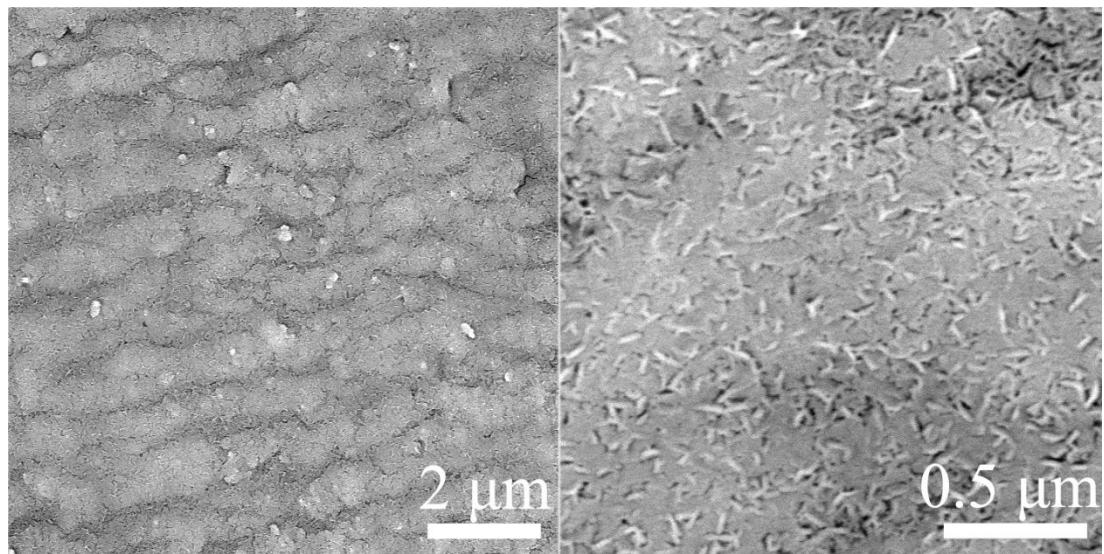


Figure. S17. Top-view SEM images of $\text{V}_2\text{CT}_x\text{-Li}$ after plating 5.0 mAh cm^{-2} of Li.

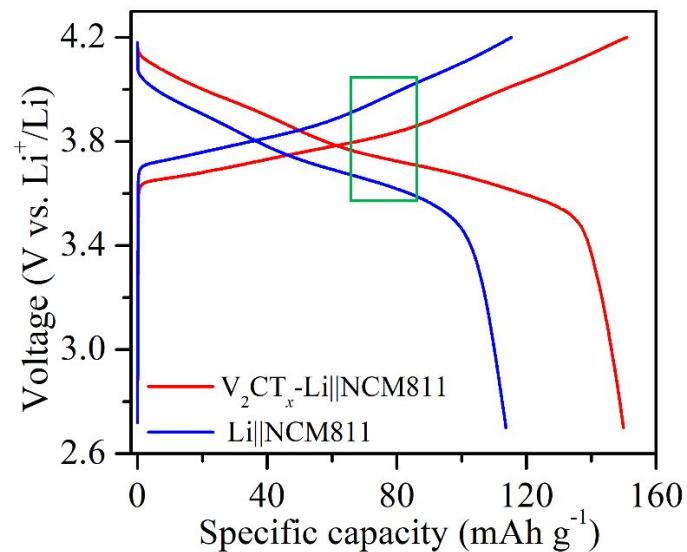


Figure. S18. Polarization voltage profile comparison of $\text{V}_2\text{CT}_x\text{-Li}||\text{NCM811}$ and $\text{Li}||\text{NCM811}$ full cells at 0.2 C after 180 cycles.

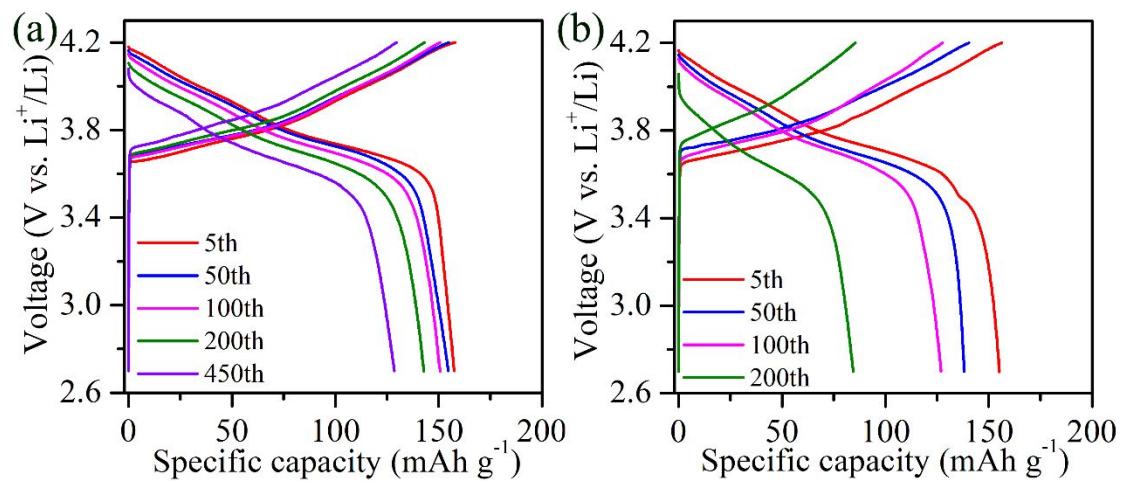


Figure. S19. Galvanostatic discharge-charge curves of (a) $\text{V}_2\text{CT}_x\text{-Li}||\text{NCM811}$ and (b) $\text{Li}||\text{NCM811}$ full cells at 0.5 C during different cycles.