Supporting Information

Insights into the Thermal and Chemical Stability of Multilayered V_2CT_x MXene Under Different Environments

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Figure S1. Raman spectra for various batches of V$_2$CT$_X$ MXene showing different amount of carbon on the surface. For present study, batch D was selected.

Figure S2. SEM image of (a) V$_2$AlC MAX phase and (b) V$_2$CT$_X$ MXene phase.
Figure S3. XPS spectra of (a) C1s region and (b) O1s region for the bare V$_2$CT$_x$ MXene. Surface charging were corrected using the C1s level at 284.8 eV. OR stands for organic compounds due to atmospheric surface contaminations. $^{1-4}$

Figure S4. XPS spectra of (a) C1s region and (b) O1s region for the V$_2$CT$_x$ MXene treated under nitrogen at 600°C. Surface charging were corrected using the C1s level at 284.8 eV. OR stands for organic compounds due to atmospheric surface contaminations. $^{1-4}$
Figure S5. XPS spectra of (a) C1s region and (b) O1s region for the V$_2$CT$_x$ MXene treated under Carbon dioxide at 600°C. Surface charging were corrected using the C1s level at 284.8 eV. OR stands for organic compounds due to atmospheric surface contaminations. \(^1\text{4}\)

Figure S6. In situ Raman spectra of air treated V$_2$CT$_x$ MXene. Surface V=O (vanadyl) shift to 995 cm$^{-1}$ from 1040 cm$^{-1}$ as a function of temperature.
Figure S7. XRD diffractogram of commercial bulk V$_2$O$_5$ and V$_2$CT$_x$ MXene after treating under air.$^6$ (JCPDS No. 41-1426).
Figure S8. XPS spectra of (a) C1s region and (b) O1s region for the V$_2$CT$_x$ MXene treated under air at 600$^\circ$C. Surface charging were corrected using the C1s level at 284.8 eV. OR stands for organic compounds due to atmospheric surface contaminations. 

Figure S9. In situ Raman spectra of hydrogen treated V$_2$CT$_x$ MXene. Surface V=O (vanadyl) as a function of temperature under H$_2$ environment.
Figure S10. In situ Raman spectra of hydrogen treated \( \text{V}_2\text{CT}_x \) MXene. G carbon signals increase as a function of temperature under \( \text{H}_2 \) environment.

Figure S11. XPS spectra of (a) C1s region and (b) O1s region for the \( \text{V}_2\text{CT}_x \) MXene treated under hydrogen at 600°C. Surface charging were corrected using the C1s level at 284.8 eV. OR stands for organic compounds due to atmospheric surface contaminations.\(^1\text{-}^4\)
References: