

Supporting Information

Fluorine-Free synthesis of ambient-stable delaminated Ti_2C_x (MXene)

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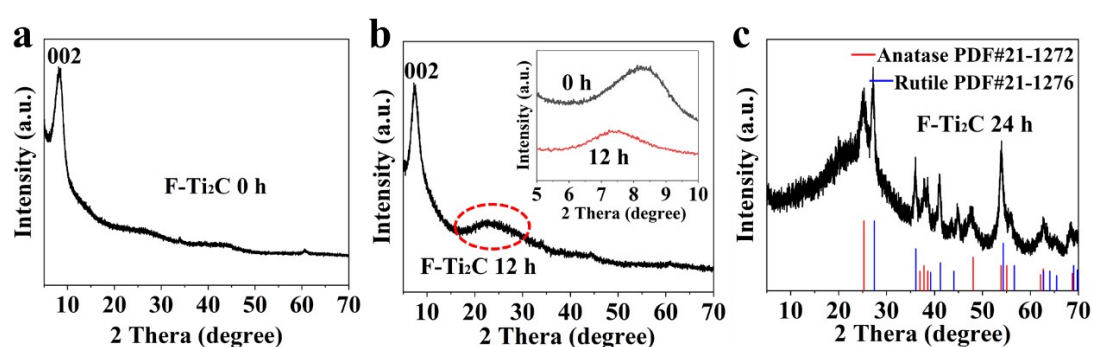


Fig. S1 XRD of F- Ti_2C solution stored at room temperature for 0 h, 12 h and 24 h.

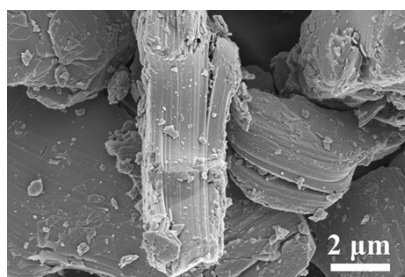


Fig S2. SEM of Ti_2AlC .

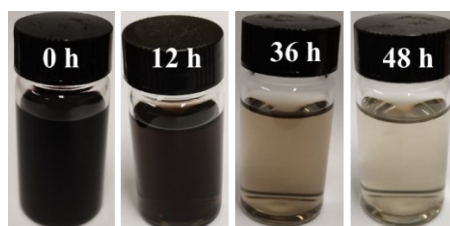


Fig. S3 Photograph of the F- Ti_2C solution stored at low temperature (4 $^\circ\text{C}$) for 0 h, 12 h, 36 h and 48 h.

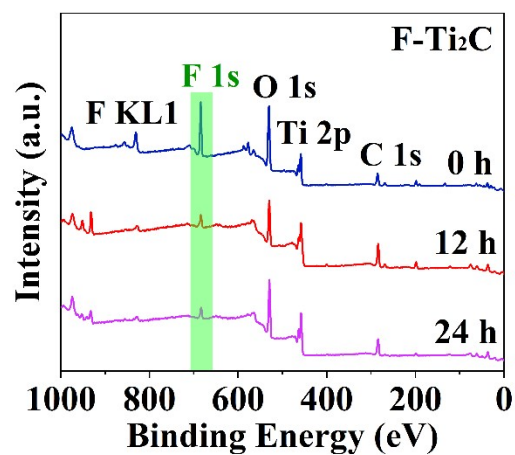


Fig. S4 XPS survey spectra of F-Ti₂C.

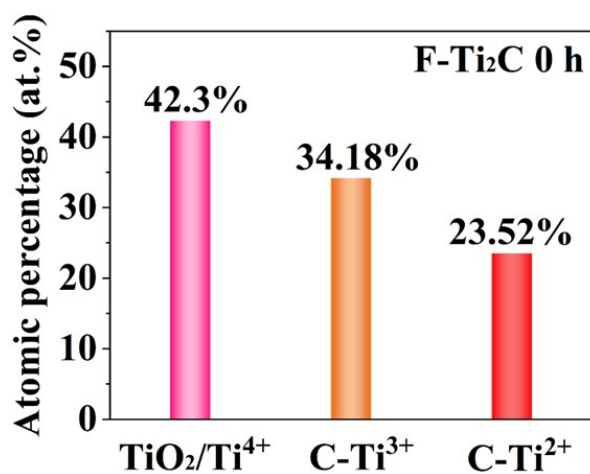


Fig. S5 The Ti 2p peak fitting results for F-Ti₂C at 0 day.

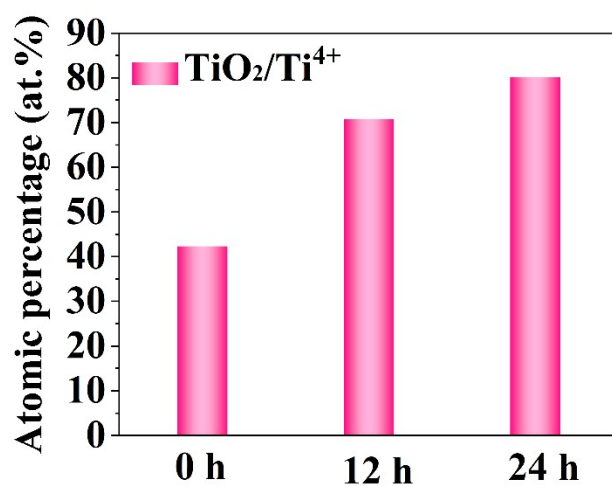


Fig. S6 The F-Ti₂C XPS peak fitting results for the TiO₂/Ti⁴⁺.

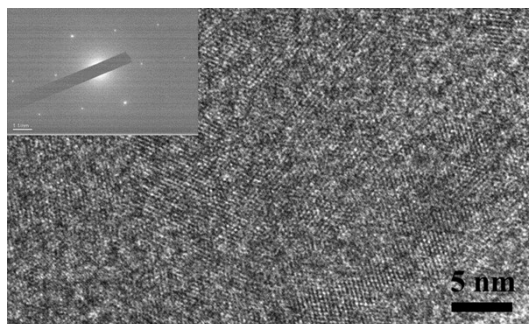


Fig. S7 HR-TEM images of O-Ti₂C, the inset is the selective area electron diffraction pattern.

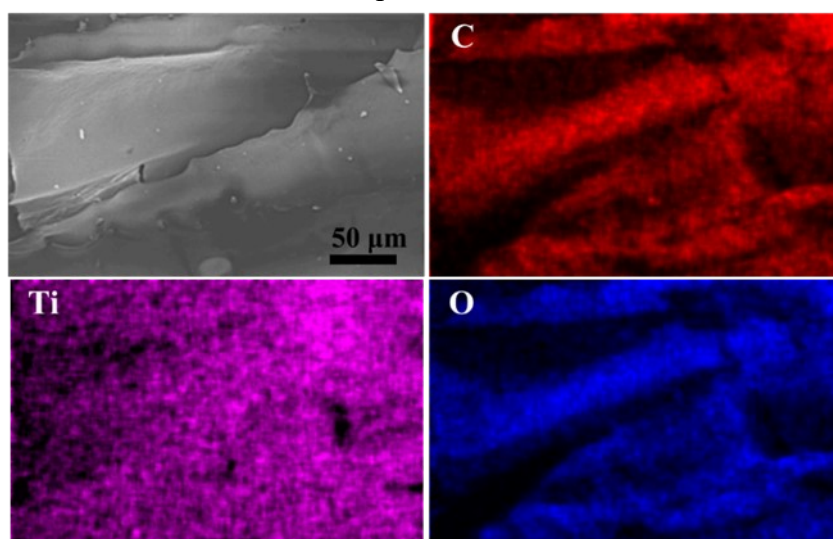


Fig. S8 EDS element map scanning images of O-Ti₂C.

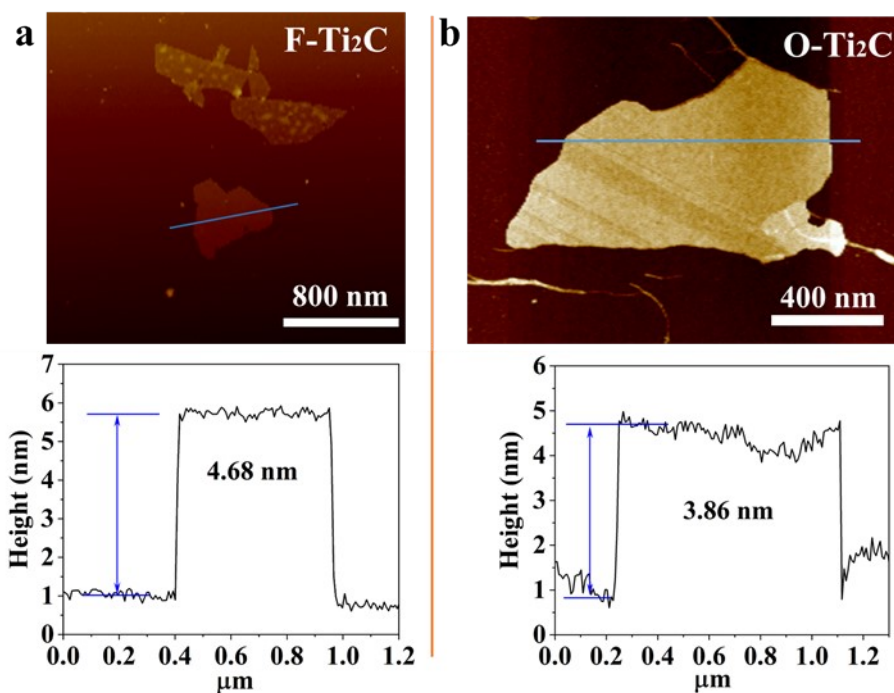


Fig. S9 AFM image of F-Ti₂C (a) and O-Ti₂C (b).

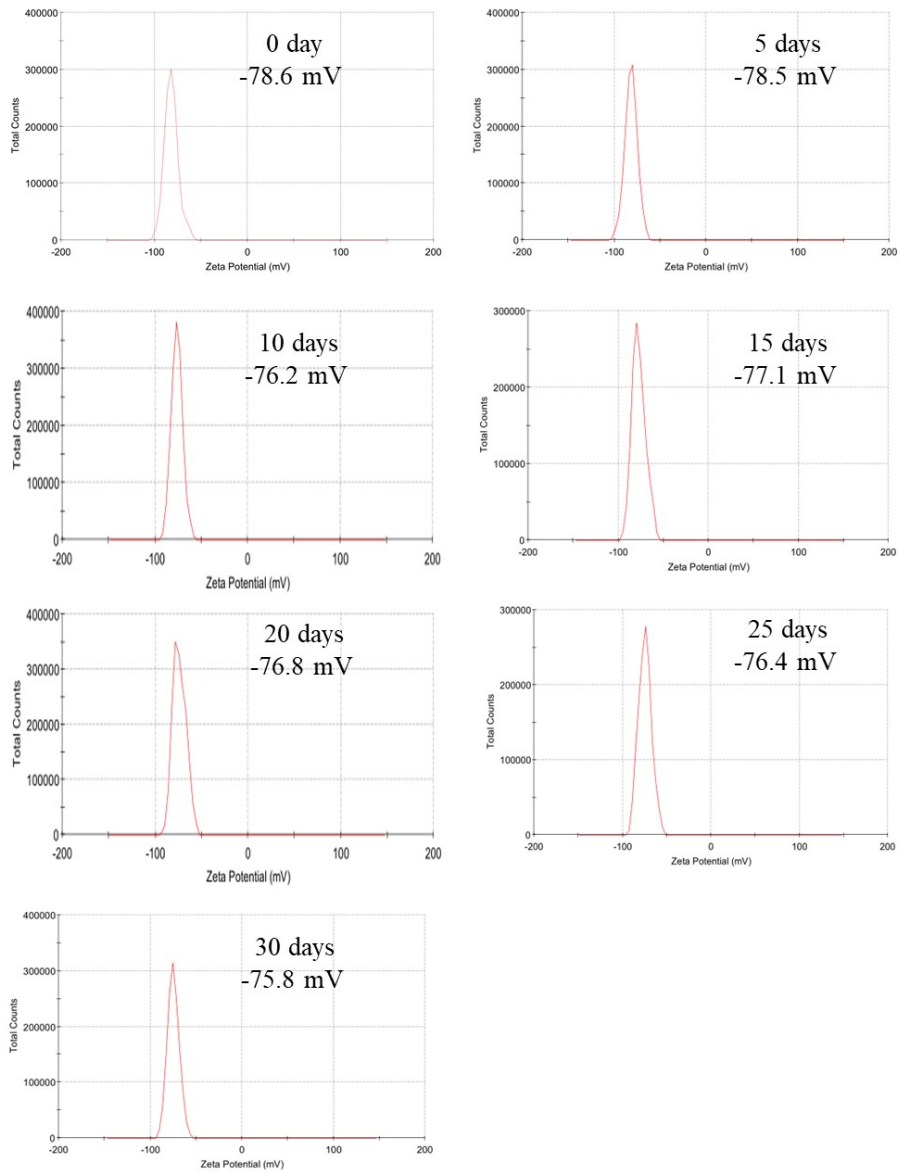


Fig. S10 Zeta potential of O-Ti₂C dispersion over time.

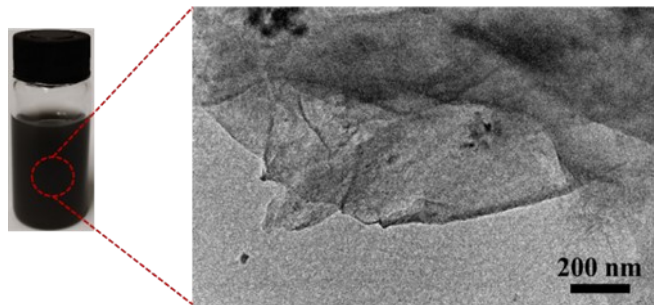


Fig. S11 TEM of O-Ti₂C solution stored for 30 days.

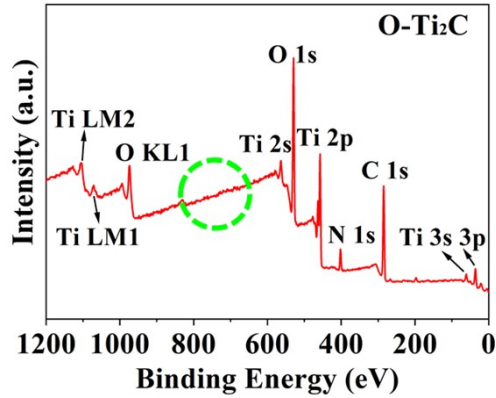


Fig. S12 XPS survey spectra of O-Ti₂C. The typical position of F 1s was marked by a green circle.

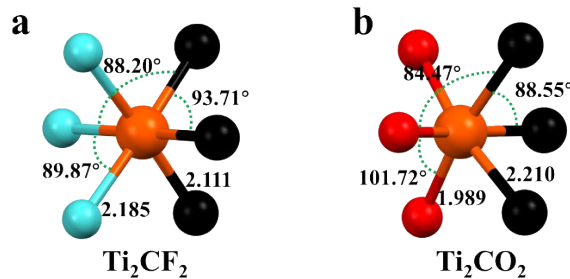


Fig. S13 Structural models of Ti₂CF₂ and Ti₂CO₂.

Table S1. Bader charge of Ti₂CF₂ and Ti₂CO₂ (T=F / O) monolayers in e^a.

Sample	Ti	C	T
Ti ₂ CF ₂	1.11	-0.89	-0.62
Ti ₂ CO ₂	1.27	-0.934	-0.78

The positive/negative values represent positively/negatively charged, respectively. ^a the e represent 1 electron charge.

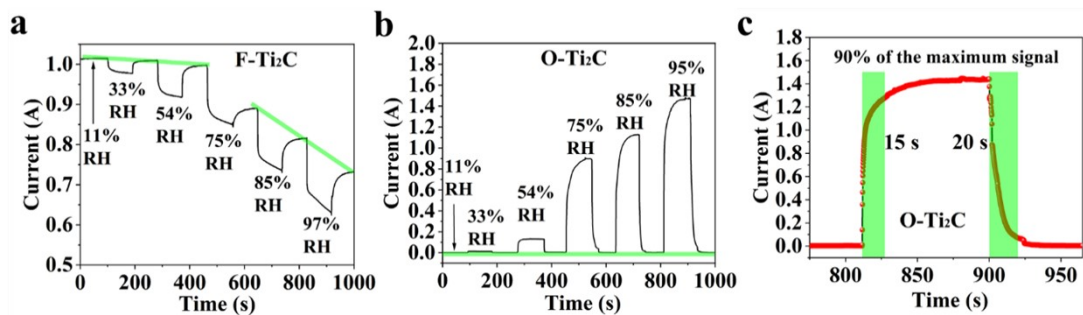


Fig. S14 (a) Typical I-t characteristics of F-Ti₂C sensor for various relative humidity. (b) Typical I-t characteristics of O-Ti₂C sensor for various relative humidity. (c) Response and recovery time of O-Ti₂C sensor between 11% RH and 97% RH at 25 °C.

Table S2. The comparison of humidity sensor performance of MXene.

Sample	Response	Response/recover time	Range	References
PVA/MXene	40	0.9/6.3 s	11-97%RH	1
S-Ti ₃ C ₂	12.8	6/2 s	11-97%RH	2
Ti ₃ C ₂ /K ₂ Ti ₄ O ₉	1.5	65.2/84.8 s	11-97%RH	3
Alkalized Ti ₃ C ₂	300	1/201 s	11-97%RH	4
O-MXene	1450	15/20 s	11-97%RH	This work

Supplementary References:

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2. R. Li, Y. Fan, Z. Ma, D. Zhang, Y. Liu and J. Xu, *Mikrochim. Acta*, 2021, **188**, 81.
3. J. Wu, P. Lu, J. Dai, C. Zheng, T. Zhang, W. W. Yu and Y. Zhang, *Sensor. Actuat. B: Chem.*, 2021, **326**, 128969.
4. Z. Yang, A. Liu, C. Wang, F. Liu, J. He, S. Li, J. Wang, R. You, X. Yan, P. Sun, Y. Duan and G. Lu, *ACS Sens.*, 2019, **4**, 1261-1269.