Electronic Supplementary Material (ESI) for New Journal of Chemistry.

New Journal of Chemistry

Supporting information

Heteroatoms preintercalated Cl-terminated $Ti_3C_2T_x$ MXene wrapped with Mesoporous Fe_2O_3 Nanospheres for improved Sodium ion Storage

Yishao Liu[a], Chenyu Gao[a], Ruxuan Zhou[a], Feng Hong[a], Guoqing Tong[a], Li Wang[b,*], Yang Jiang[a,*]

[a] School of Materials Science and Engineering, [b] School of Chemistry and Chemical Engineering, Hefei University of Technology, 230009, Hefei, P. R. China.

*Corresponding authors: Yang Jiang (email: apjiang@hfut.edu.cn), and Li Wang (email: wlgmri@sina.com)

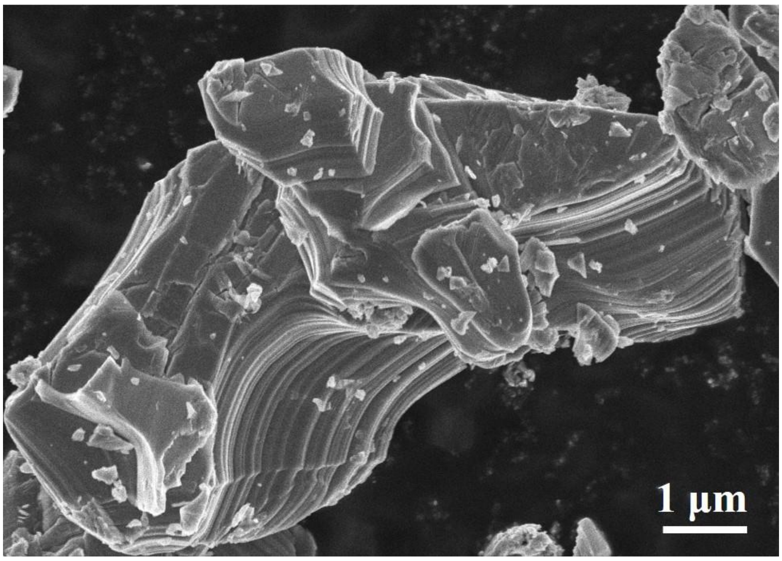

Figure S1. SEM image of the densely packed Ti_3AlC_2 precursor.

a)

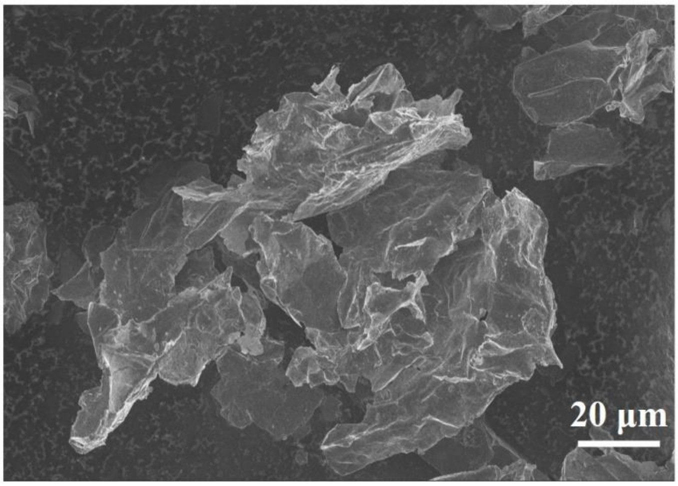

Figure S2(a). SEM image of $Ti_3C_2T_x$ MXene nanosheets after borohydride treatment.

b)

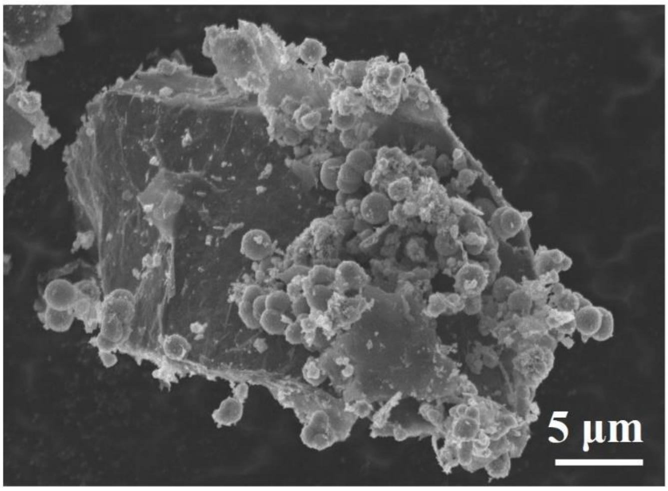

Figure S2(b). SEM image of Fe_2O_3-$Ti_3C_2T_x$composite.

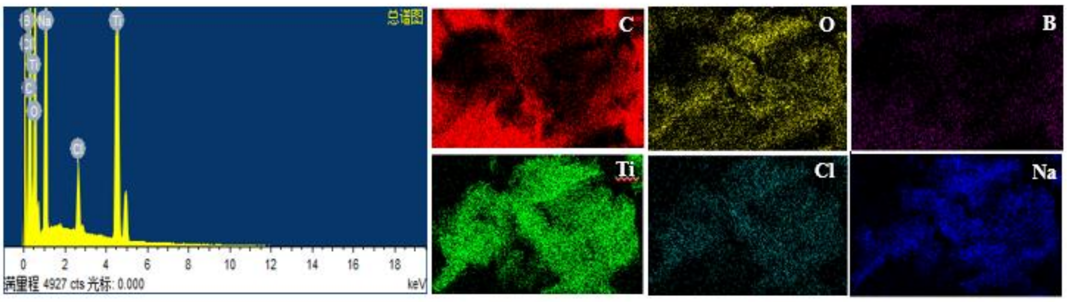

Figure S3. EDS mapping images of $Ti_3C_2T_x$ MXene nanosheets after borohydride treatment.

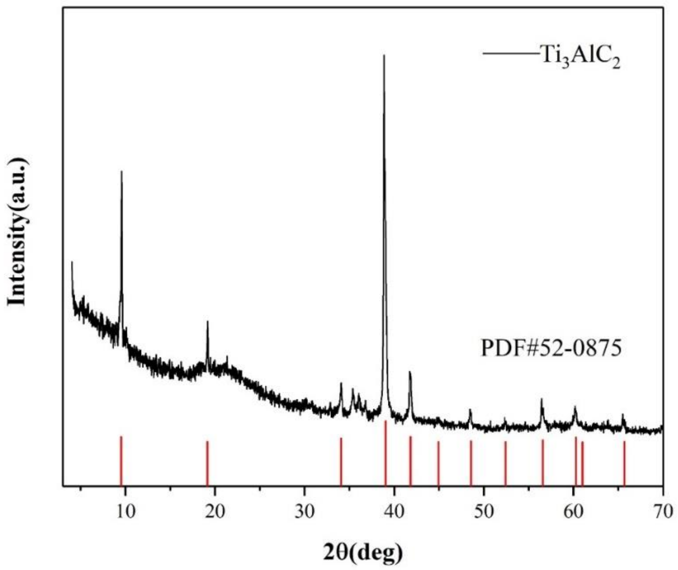

Figure S4. XRD pattern of pristine Ti_3AlC_2.

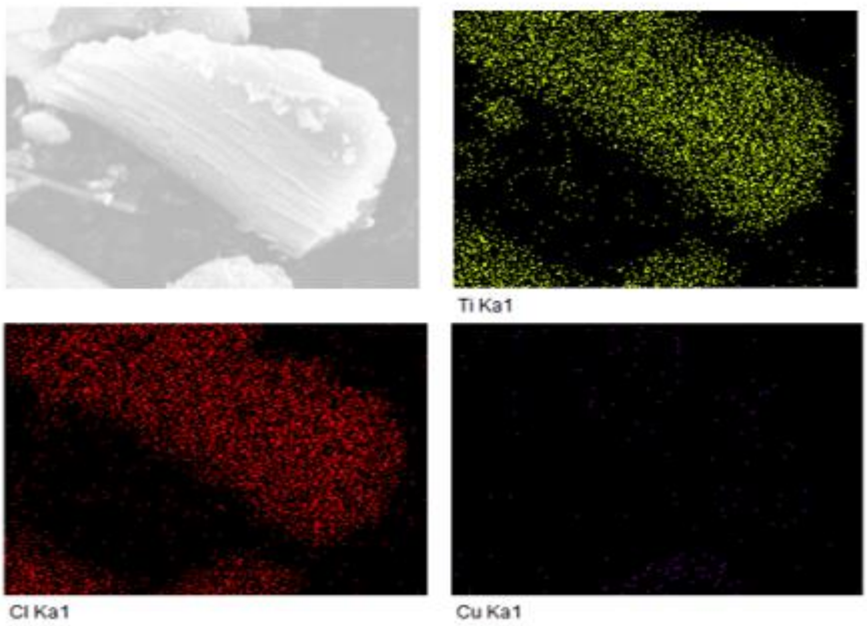

Figure S5. The corresponding EDS mapping images of Cl-terminated $Ti_3C_2T_x$ MXene after APS solution treatment.

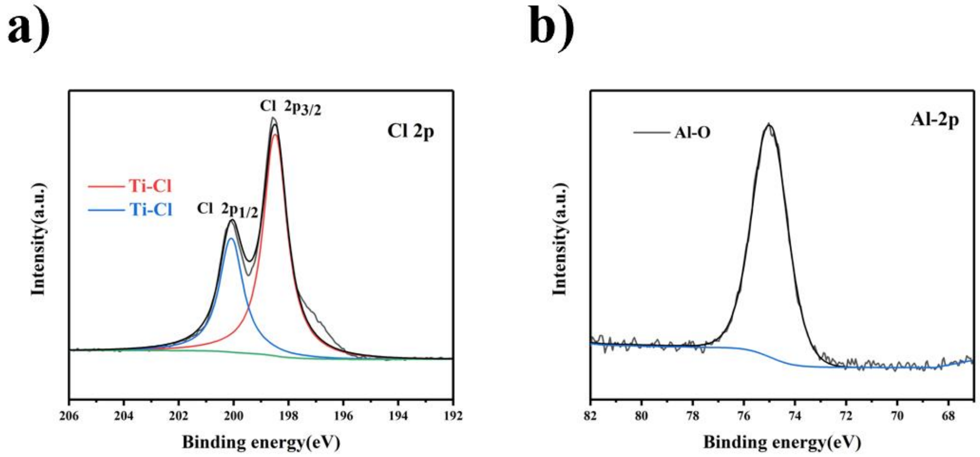

Figure S6. The high-resolution spectra of (a) the Cl 2p for Fe_2O_3@$Ti_3C_2T_x$composite, (b) and the Al 2p for $Ti_3C_2T_x$ MXene.

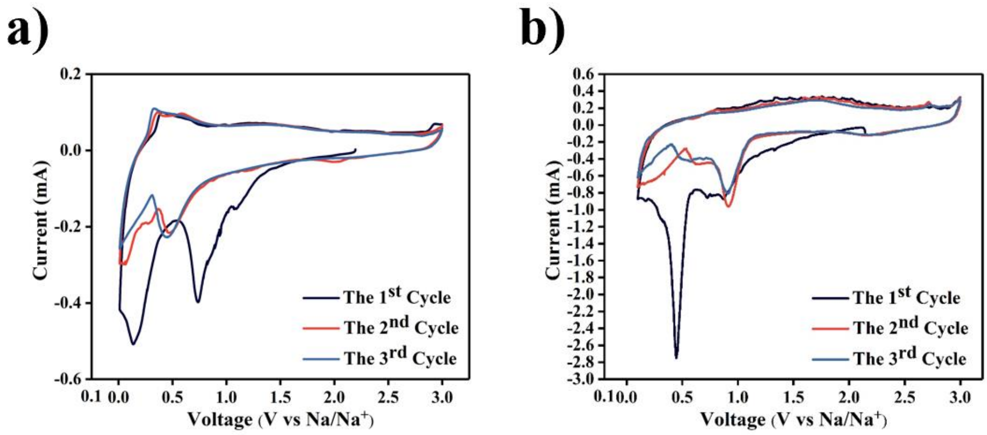

Figure S7. The CV curves of (a) $Ti_3C_2T_x$ MXene, (b) and Fe_2O_3 for initial three cycles at a scan rate of 0.1 mV s^{-1}.

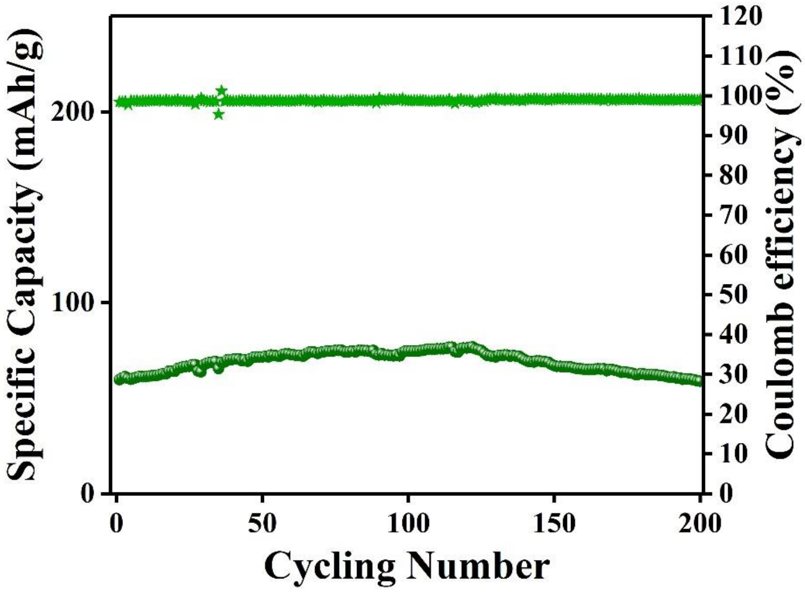

Figure S8. Cycling performance of MXene without heteroatoms pre-intercalation at a current density of 1.0 A g^{-1}.

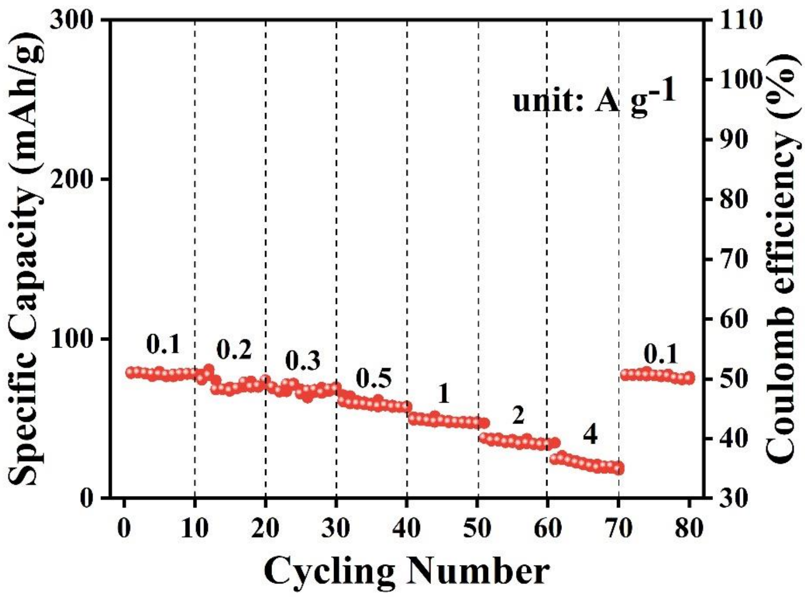

Figure S9. Rate capability performance of MXene without heteroatoms pre-intercalation anode.

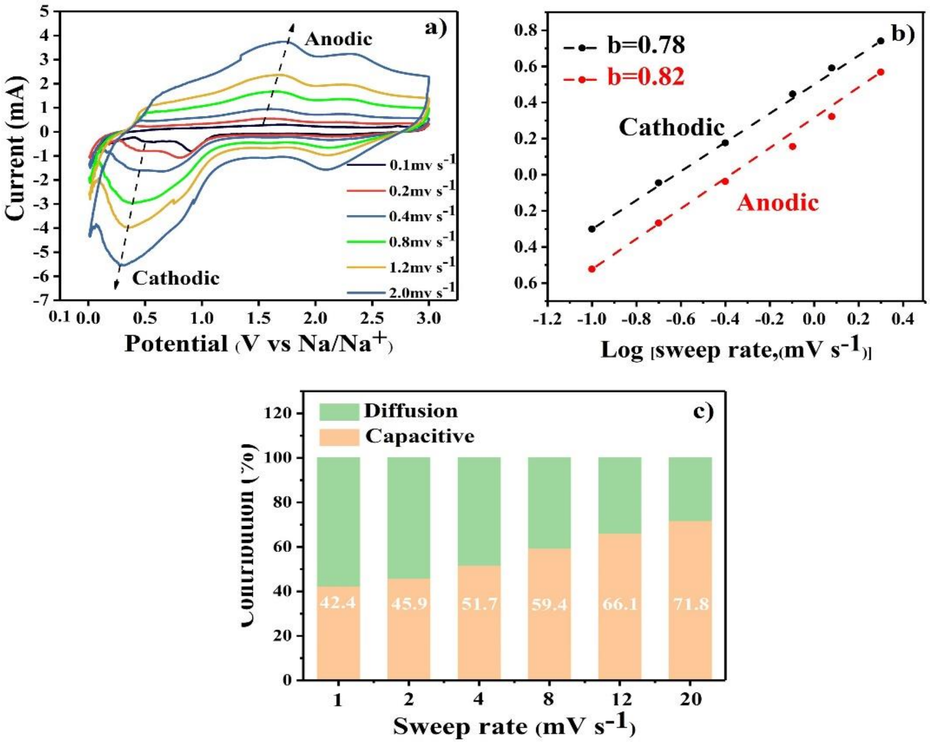

Figure S10. CV curves(a), Log (peak current) versus log (sweep rate) plots(b), and Contribution ratios of capacitive and diffusion-controlled behaviors(c) at different sweep rates of Fe_2O_3 electrode.

Materials	Performance		References
	Cycling [Capacity(mA h g^{-1})/Current density(A g^{-1})/Cycles]	Rate [Capacity(mA h g-1)/Current density(A g^{-1})]	
Fe_2O_3@MXene	350/1/200	188.5/4	This work
Fe_2O_3@mGC	377/0.1/100	267/4	S1[1]
Hierarchical Fe_3O_4 hollow nanostructures	150/0.1/50	80/1	S2[2]
Fe_2O_3:Ge NFs	320/0.05/50	140/2	S3[3]
C@Fe_2O_3	305/0.05/100	150/1	S4[4]
Fe_2O_3@GNS	440/0.1/100	126/2	S5[5]
MFe_2O_3@N-HCNs	417/0.1/100	102/5	S6[6]

Table S1. Comparison of electrochemical performance for the similar anode materials from this work and previous reports

References:

1. T. Hou, X. Sun, D. Xie, M. Wang, A. Fan, Y. Chen, S. Cai, C. Zheng and W. Hu, 2018, **24**, 14786-14793.
2. K. Zhou, Y. Zhen, Z. Hong, J. Guo and Z. Huang, *Materials Letters*, 2017, **190**, 52-55.
3. B. Petrovičovà, C. Ferrara, G. Brugnetti, C. Ritter, M. Fracchia, P. Ghigna, S. Pollastri, C. Triolo, L. Spadaro, R. Ruffo and S. Santangelo, 2021, **11**, 1483.
4. Y. Zhang, Z. Bakenov, T. Tan and J. Huang, 2018, **8**, 461.
5. D. Li, J. Zhou, X. Chen and H. Song, *ACS Applied Materials & Interfaces*, 2016, **8**, 30899-30907.
6. M. Chen, D. Niu, J. Mao, G. Jiang, K. Li, G. Huang, X. Jin and Y. Li, *ACS Applied Energy Materials*, 2021, **4**, 5888-5896.