Supplementary material

Enhancing the Lithium Storage Properties of Molten Salt-Etched $Ti_3C_2T_x$ through Sequential Intercalation of Alkali Ions

Yanchao Ou,[a] Peng Zhang,[a,b] Razium Ali Soomro,[a] Ning Qiao,*[a] Haonan Cui,[a] and Bin Xu*[a]*

[a] State Key Laboratory of Organic-Inorganic Composites, Beijing Key Laboratory of Electrochemical Process and Technology for Materials, Beijing University of Chemical Technology, Beijing 100029, China. E-mail: zp7312769@163.com, qiaoning@mail.buct.edu.cn, binxumail@163.com

[b] Henan Key Laboratory of Photovoltaic Materials, School of Future Technology, Henan University, Zhengzhou 450046, China

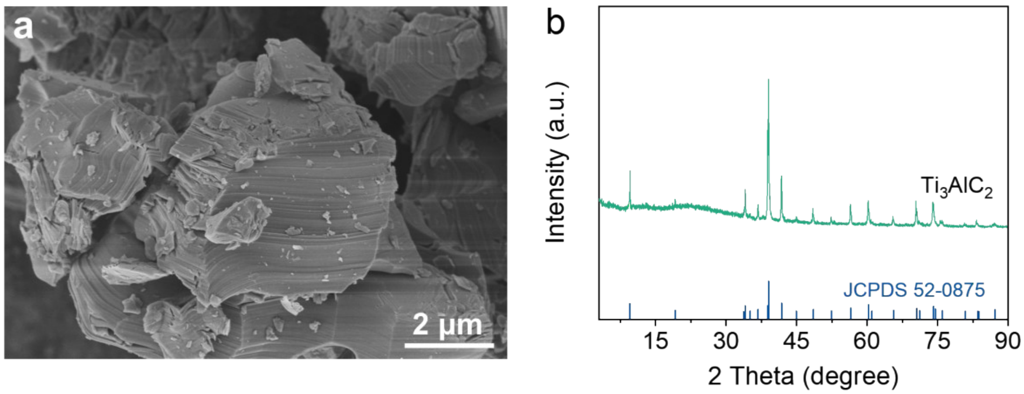

Fig. S1 (a) SEM image and (b) XRD pattern of the Ti_3AlC_2 powders.

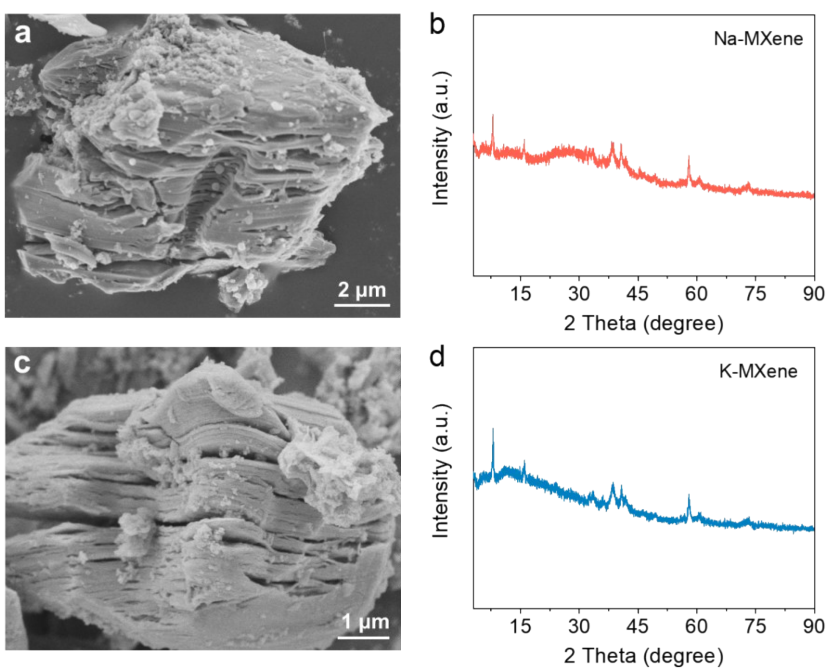

Fig. S2 (a) SEM image and (b) XRD pattern of the Na-MXene, (c) SEM image and (d) XRD pattern of the K-MXene.

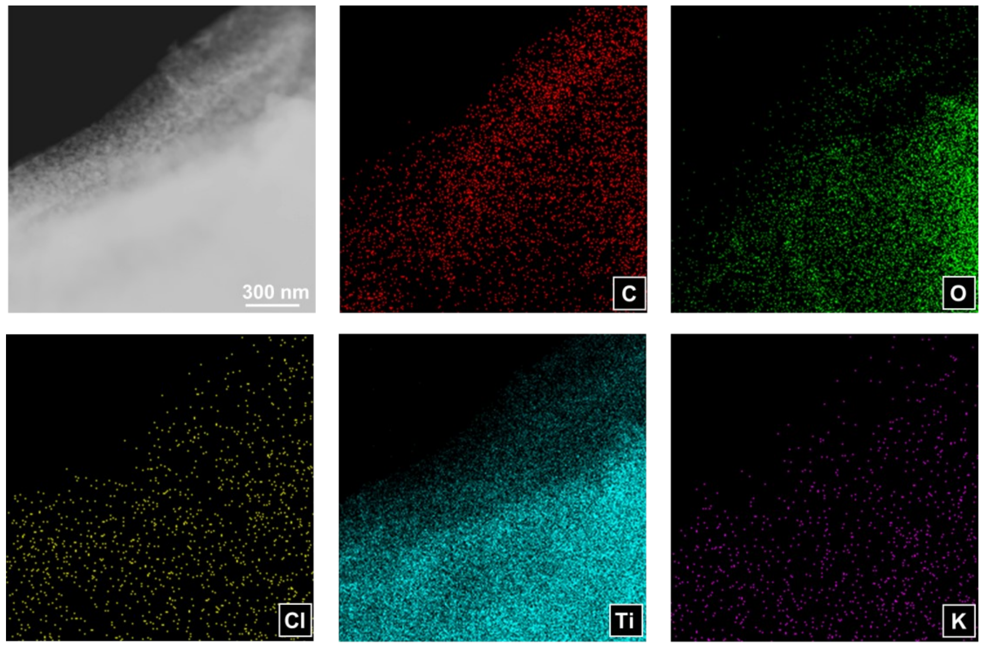

Fig. S3 STEM images of K-MXene and corresponding elemental mappings showing distribution of C, O, Cl, Ti, and K elements.

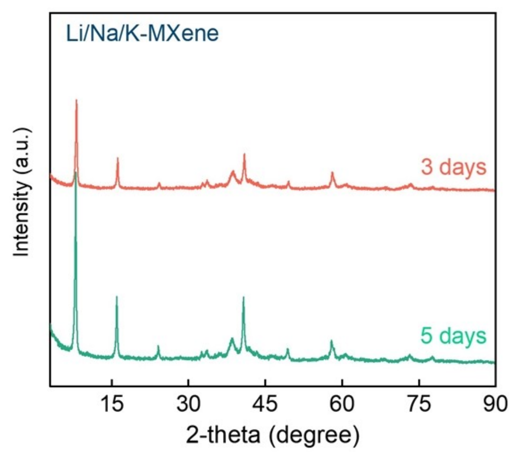

Fig. S4 XRD patterns of the Li/Na/K-MXene post treating in the mixed alkaline solution after 3 and 5 days.

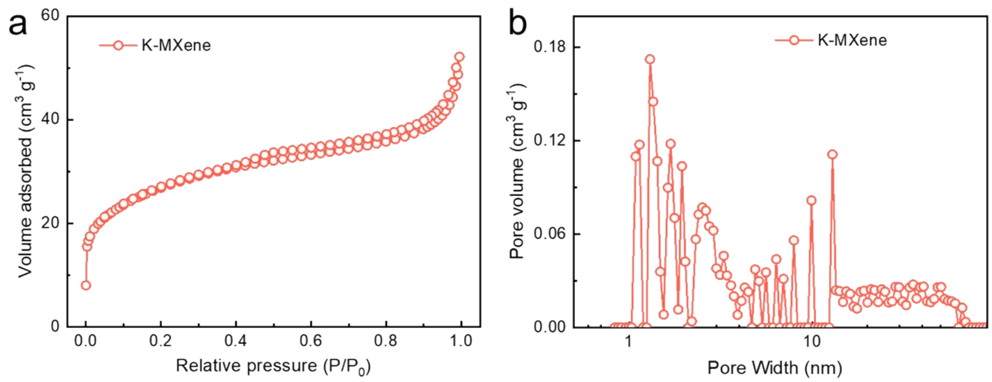

Fig. S5 (a) N_2 adsorption-desorption isotherm and (b) pore size distribution of the K-MXene.

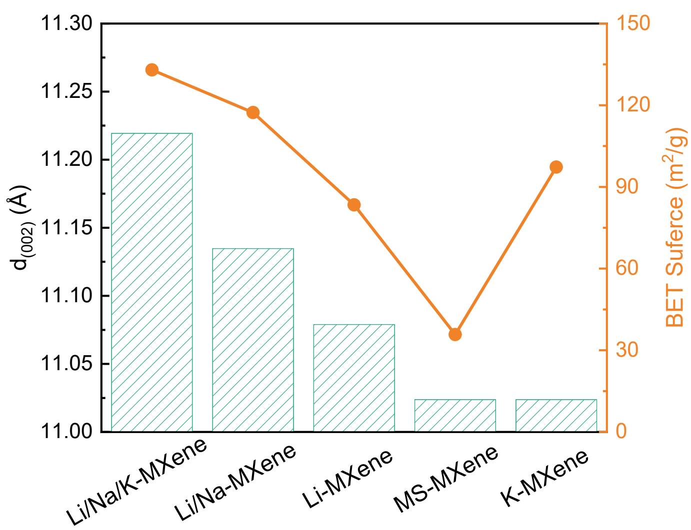

Fig. S6 Relationship between interlayer spacings and specific surface areas of the AII-MXene in reference to MS-MXene.

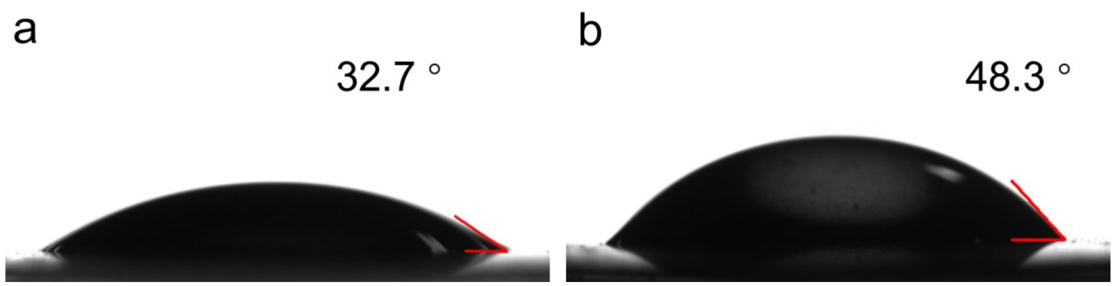

Fig. S7 Water contact angles of the (a) Li/Na/K-MXene, and (b) MS-MXene.

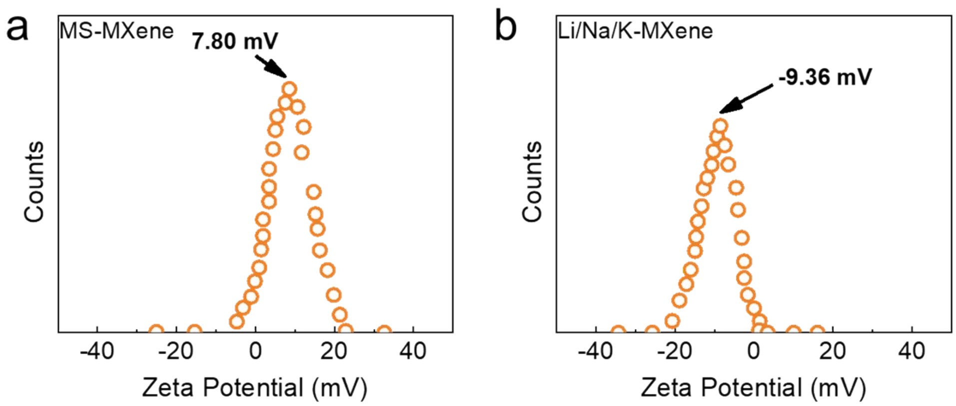

Fig. S8 Zeta potentials of the (a) MS-MXene and (b) Li/Na/K-MXene.

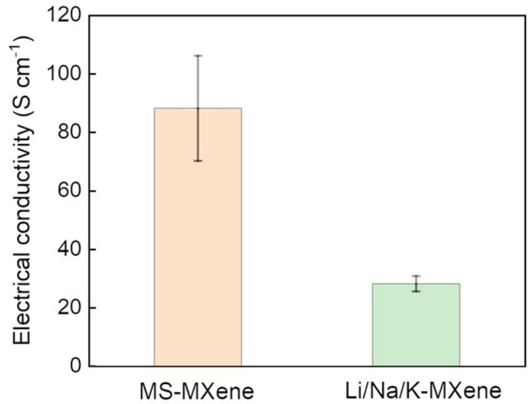

Fig. S9 Electrical conductivities of the Li/Na/K-MXene and MS-MXene.

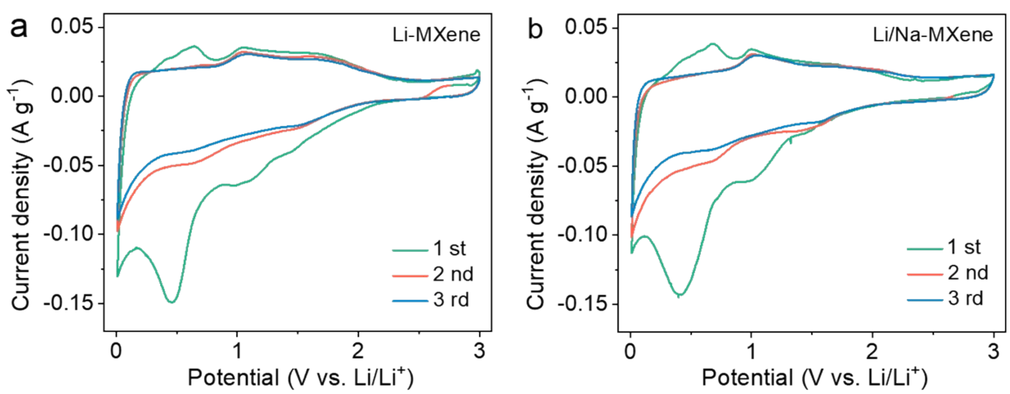

Fig. S10 CV curves of the (a) Li-MXene and (b) Li/Na-MXene.

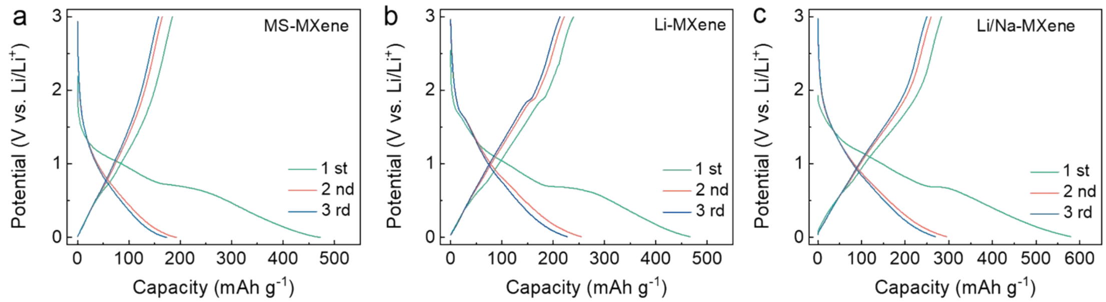

Fig. S11 Galvanostatic charge/discharge curves of the (a) MS-MXene, (b) Li-MXene, and (c) Li/Na-MXene at a current density of 50 mA g^{-1}.

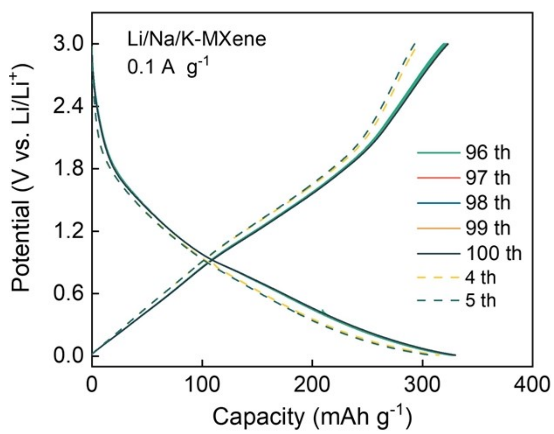

Fig. S12 The last five GCD curves of the Li/Na/K-MXene during100 cycles at 0.1 A g^{-1}.

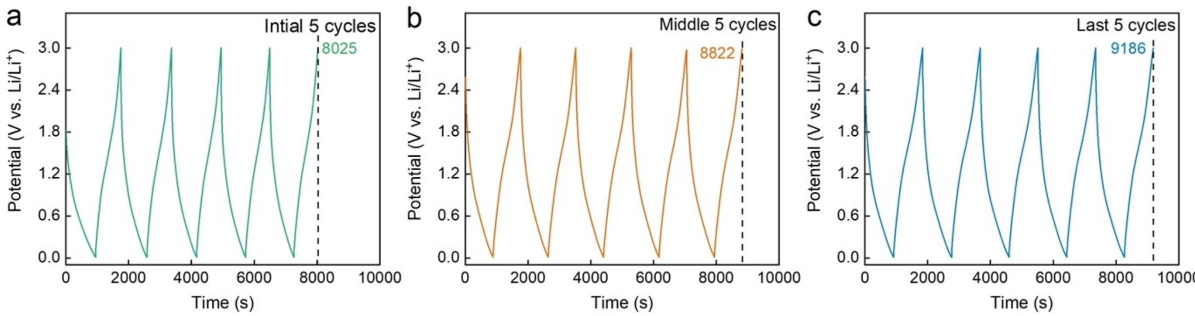

Fig. S13 (a) initial, (b) middle, and (c) last five GCD curves of the Li/Na/K-MXene during 1200 cycles at 1 A g^{-1}.

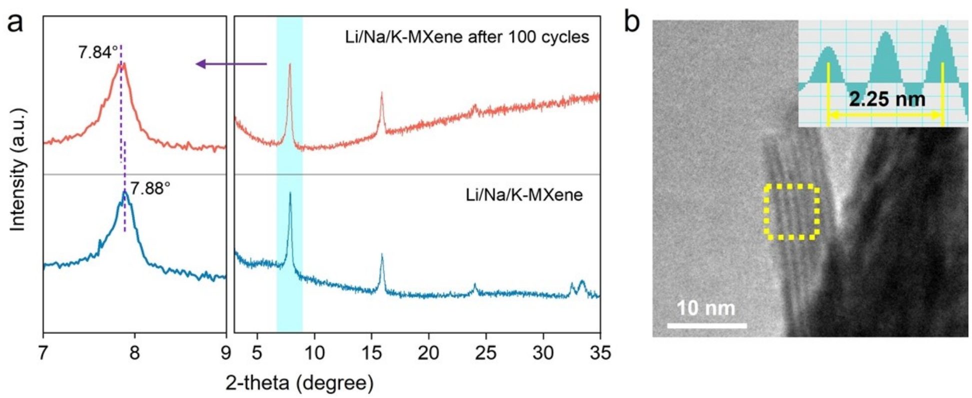

Fig. S14 (a) XRD pattern and (b) TEM images of the Li/Na/K-MXene after 100 cycles at 1 A g^{-1}.

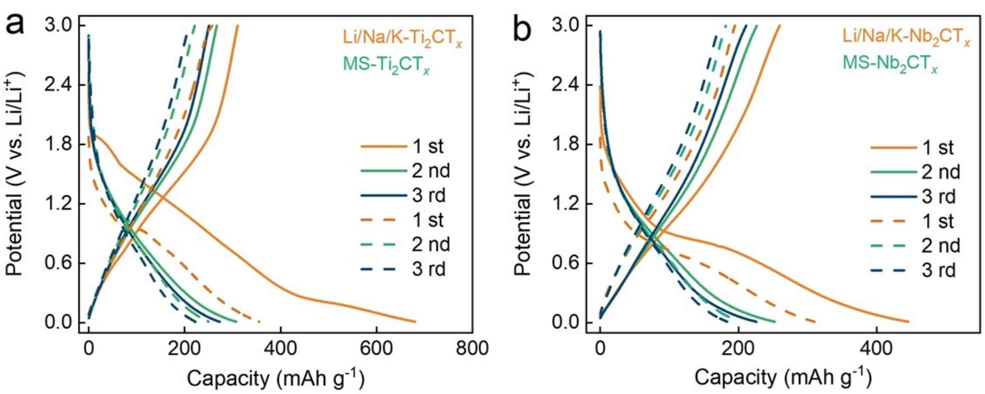

Fig. S15 Initial three GCD curves at 100 mA g^{-1} of the (a) Li/Na/K-Ti_2CT_x and (b) Li/Na/K-Nb_2CT_x in comparison with their MS-Ti_2CT_x and MS-Nb_2CT_x counterparts.

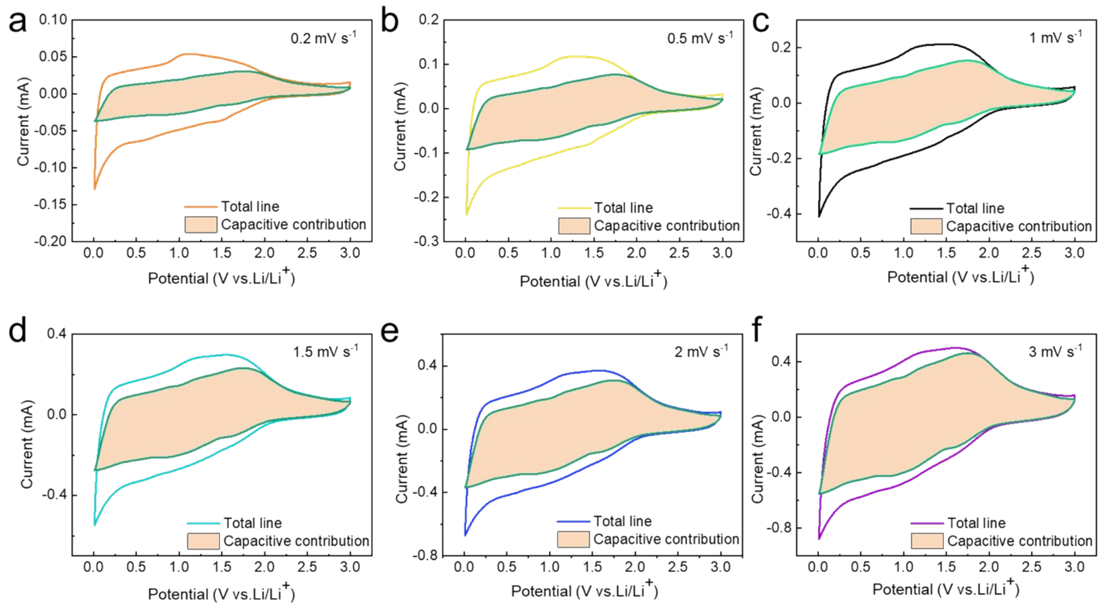

Fig. S16 CV profile measured at various scan rates of (a) 0.2, (b) 0.5, (c) 1, (d) 1.5, (e) 2, and (f) 3 mV s^{-1} with shaded area displaying the corresponding capacitive contributions for the Li/Na/K-MXene.

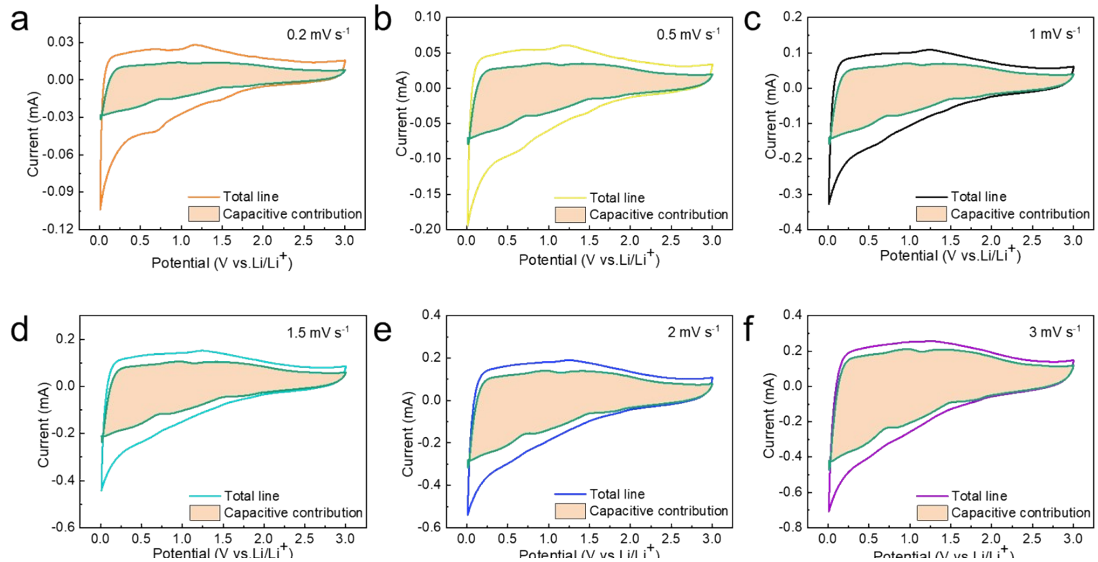

Fig. S17 CV profile measured at various scan rates of (a) 0.2, (b) 0.5, (c) 1, (d) 1.5, (e) 2, and (f) 3 mV s^{-1} with shaded area displaying the corresponding capacitive contributions for the MS-MXene.

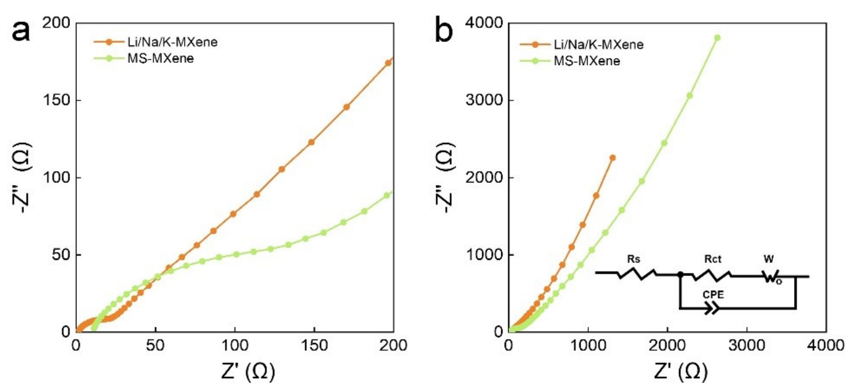

Fig. S18 EIS spectra of the Li/Na/K-MXene and MS-MXene after 20 cycles at 50 mA g^{-1}.

Table S1 Comparison of the lithium storage properties of Li/Na/K-MXene with other previously reported MS-MXene.

Samples	Cycle performance				Rate performance		Ref.
	Initial capacity (mAh g^{-1})	Current density (mA g^{-1})	Cycle number	Final capacity (mAh g^{-1})	Current density (A g^{-1})	Capacity (mAh g^{-1})	
Li/Na/K-MXene	346.7	50	100	323.1	2	170.0	This work
		1000	1200	254.7			
Self-supported MS-MXene	225	200	-	-	2	~150	S1
	-	4000	2000	~85	16	95	
MS-Nb_2CT_x	305	100	-	-	2	~150	S2
	-	1000	1500	~190	10	80	
MS-$Ti_3C_2T_x$	-	-	-	-	~0.12 (0.6 C)	205	S3
	-	-	-	-	~1.8 (13 C)	142	
Cl-terminated Ti_2CT_x	-	-	-	-	0.1	277	S4
	-	-	-	-	2	162	
$Ti_3C_2Br_x$	-	-	-	-	0.05	189	S5
	-	1000	1000	~80	2	70	
MS-Ti_2CT_x	-	500	200	99.2	2	88.0	S6
	-				8	57.6	

References

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