Electronic Supplementary Material

Nickel(II) ion-intercalated MXene membranes for enhanced H_2/CO_2 separation

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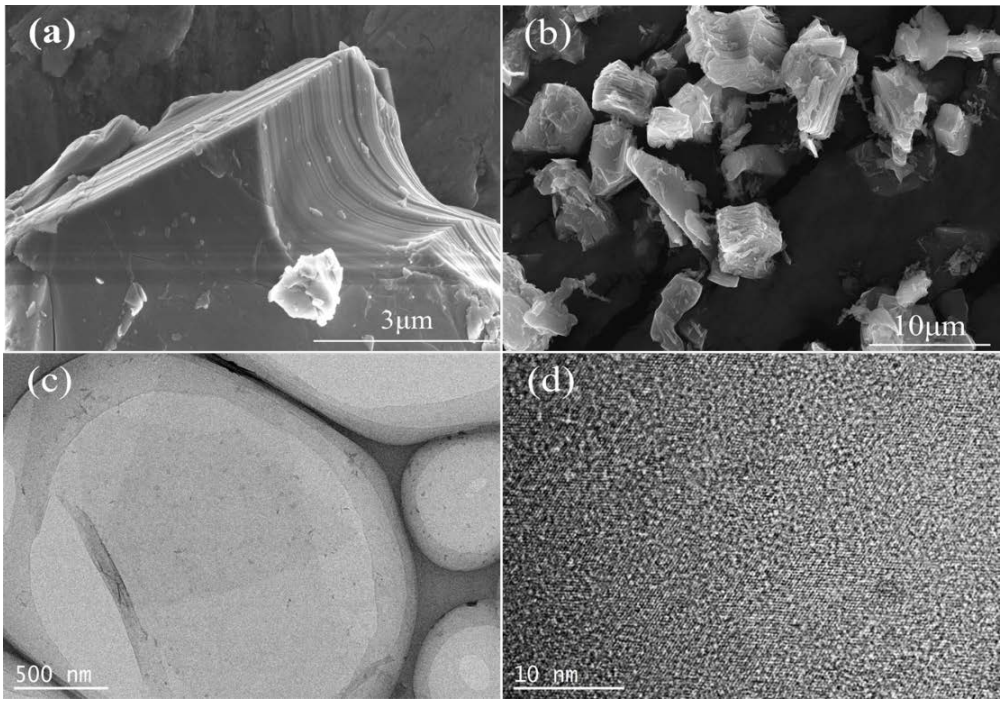

Fig. S1 (a) SEM image of MAX precursor. (b) SEM image of MXene powder. (c) TEM image of Ni^{2+}-$Ti_3C_2T_x$ nanosheets. (d) High-resolution TEM image of Ni^{2+}-$Ti_3C_2T_x$ nanosheets.

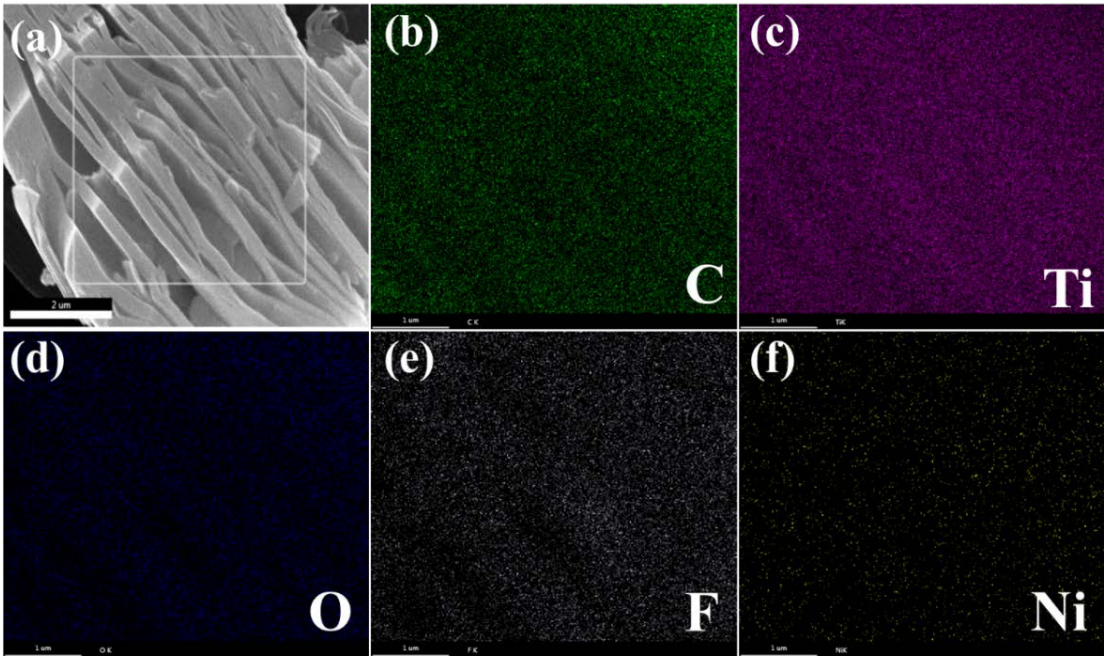

Fig. S2 SEM image and the corresponding element distribution mappings of one typical Ni^{2+}-$Ti_3C_2T_x$ MXene powder.

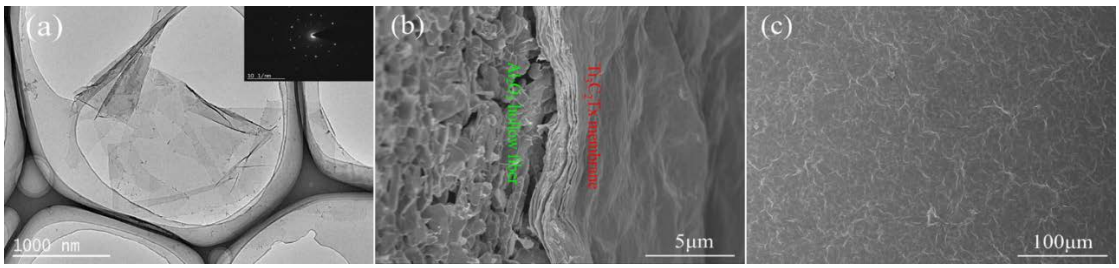

Fig. S3 (a) TEM image of Ti_3C_2Tx nanosheets. (b) Cross-sectional SEM image of the $Ti_3C_2T_x$ membrane. (c) The surface of $Ti_3C_2T_x$ membrane.

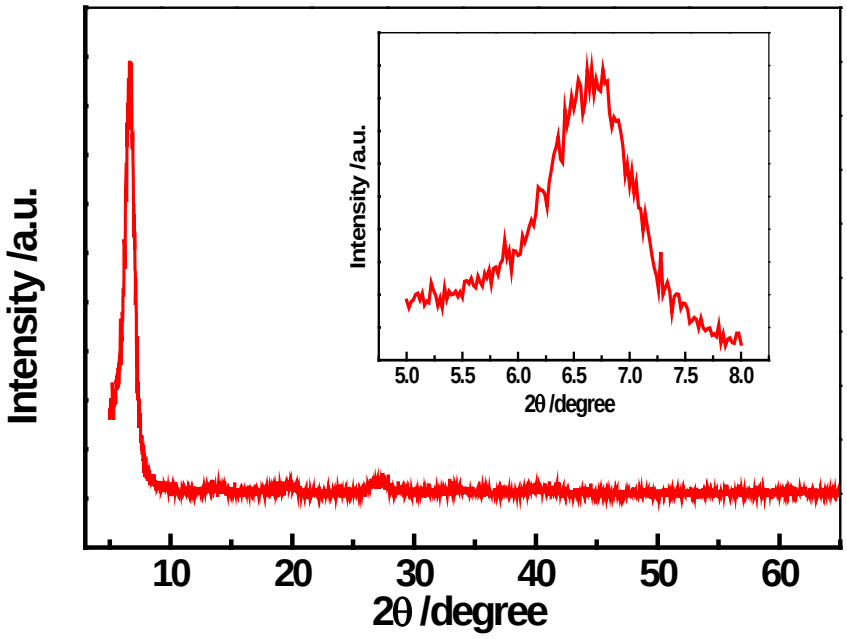

Fig. S4 the XRD pattern of the Ni^{2+}-$Ti_3C_2T_x$ membrane.

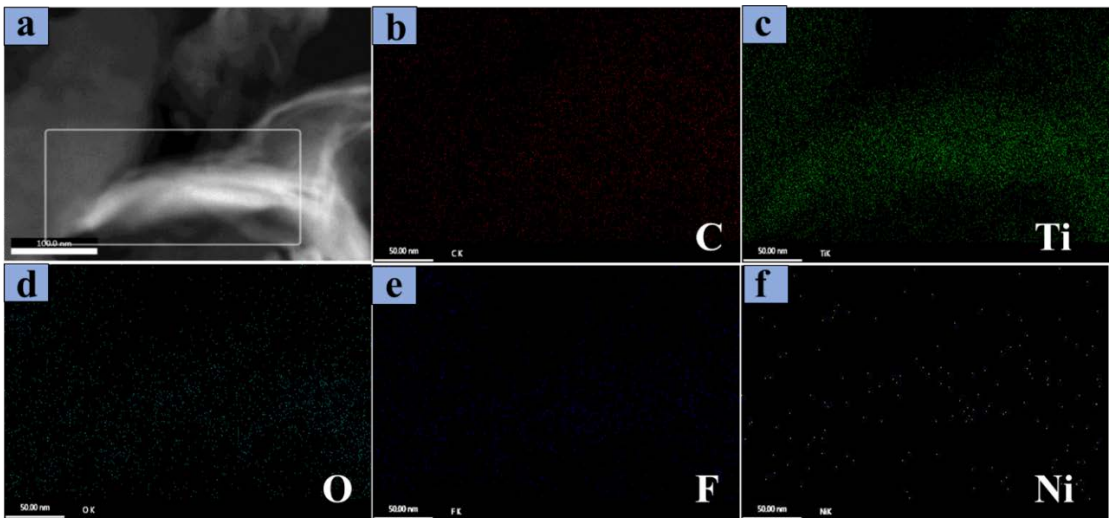

Fig. S5 TEM image and the corresponding element distribution mappings of the Ni^{2+}-$Ti_3C_2T_x$ membrane.

Supplementary Table S1 Detailed test conditions of the data points shown in main text Fig. 7(d).

membrane material	thickness / μm	Temperature /℃	Permeable $10^{-10}molm^{-2}s^{-1}Pa^{-1}$	selectivity	ref
MXene/AAO	0.02	25	5322.4	27	[1]
MXene/AAO	2	25	7370	166.6	[2]
EFDA/GO	1	25	2814	30	[3]
$Zn_2(bim)_4/\alpha\text{-}Al_2O_3$		120	7638	230	[4]
MAMS-1/AAO	0.04	25	1852.5	235	[5]
UiO-66-NH_2/GO	1.9	25	390	6.35	[6]
GO/AAO	0.02	25	3400	240	[7]
MFI zeolite/Al_2O_3	2	500	100	46.5	[8]
ZIF-8/GO	0.07	25	670	4.6	[9]
ZIF-8	0.2	25	20500	12.8	[10]
ZIF-8/GO	20	250	26000	15	[11]
Silicon carbide	2	200	117.88	50	[12]
ZIF-7	2	220	909.86	13.6	[13]
GO	0.009	20	10.38	3400	[14]
ZIF-8	6	25	1071	7.1	[15]
MOFs	0.16	30	140	7.5	[16]
MoS_2	0.06	35	491.8	4.4	[17]
$Ni^{2+}\text{-}Ti_3C_2Tx/Al_2O_3$	2.7	25	835	615	This work

Supplementary References

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