Supplementary Information (SI) for Sustainable Energy & Fuels.

Supporting Information

Multilayer $Ti_3C_2T_x$ MXene Electrode Decorated with Polypyridine for Efficient Symmetric Supercapacitor

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1. Characterizations of materials

X-ray diffraction (XRD) characterization was conducted utilizing a Bruker D8 X-ray diffractometer (Bruker D8 Advance diffractometer, Germany). The microstructure and morphology were recorded on Gemini SEM 300 and Dimension ICON SPM. X-ray diffraction was used to evaluate crystal structures using Mini Flex 600 (Rigaku, Japan). XPS spectra were determined using a monochromatic AL-Ka (1486.6 eV) radiation source (Shimadzu, Axis Suora). The specific surface areas (Brunnauer-Emmett-Teller) was calculated using N_2 gas adsorption isotherms.

2. Electrochemical measurements

All electrochemical tests, including Cyclic voltammetry (CV), galvanostatic charge-discharge (GCD) and the electrochemical impedance spectroscopy (EIS) tests, were studies by CHI 660E electrochemical workstation (Shanghai Chenhua) with 1M H_2SO_4 at room temperature. Three-electrode measurement system was conducted with as-prepared electrode (working electrode), platinum (counter electrode) and saturated calomel electrode (Ag/AgCl in saturated KCl).The working electrode was prepared by mixing the active materials with acetylene black and polytetrafluoroethylene (8:1:1 in mass ratio) in N, N-dimethylformamide to form a slurry, which was coated on the carbon foam collector (1 cm × 1 cm) and dried at 60 ℃ for 24 h in a vacuum oven.

3. Figures

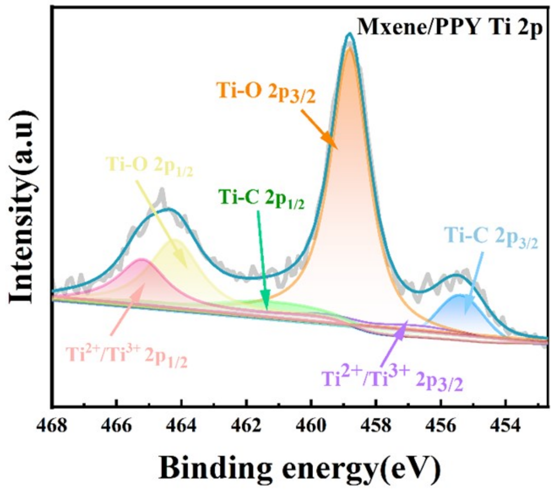

Figure S1. XPS spectra for MXene/PPY, high resolution XPS spectra of Ti 2*p*.

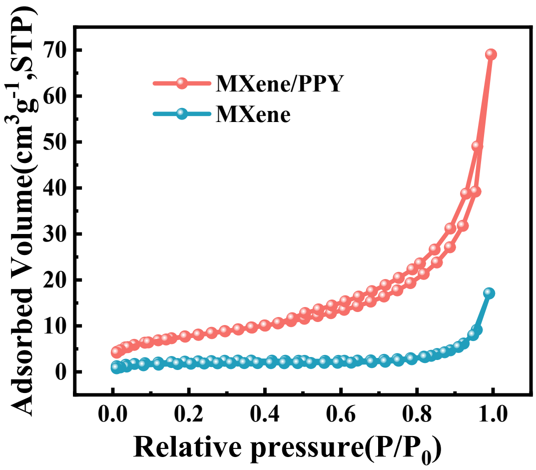

Figure S2. N_2 adsorption-desorption isotherms of MXene and PPY/MXene composite.

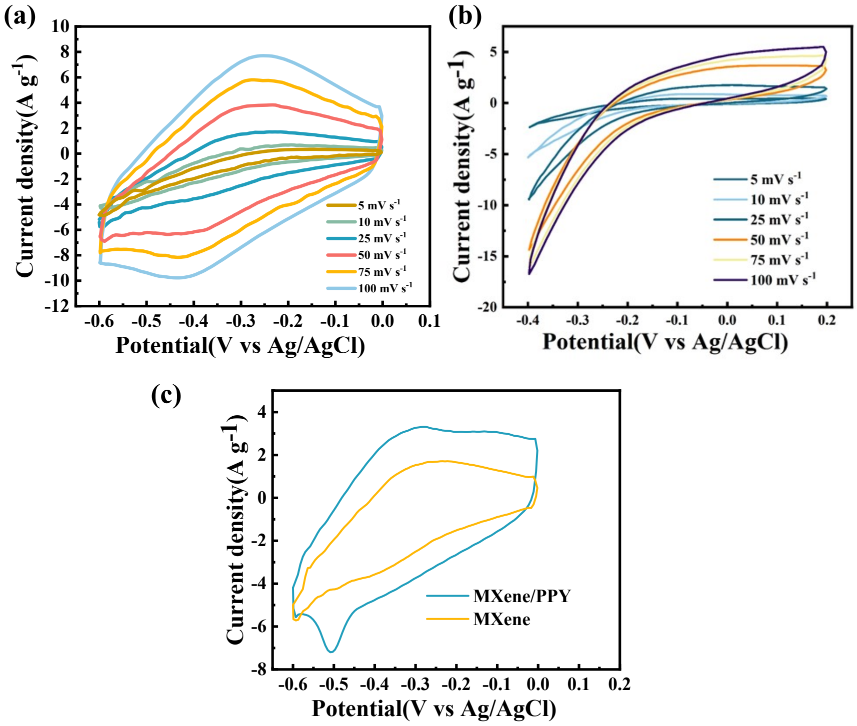

Figure S3. CV curves of pristine MXene (a) and pristine PPY (b) at the scan rate from 5 mV s^{-1} to 100 mV s^{-1}; (c) Comparison of CV curves for MXene and MXene/PPY at a scan rate of 25 mV s^{-1}.

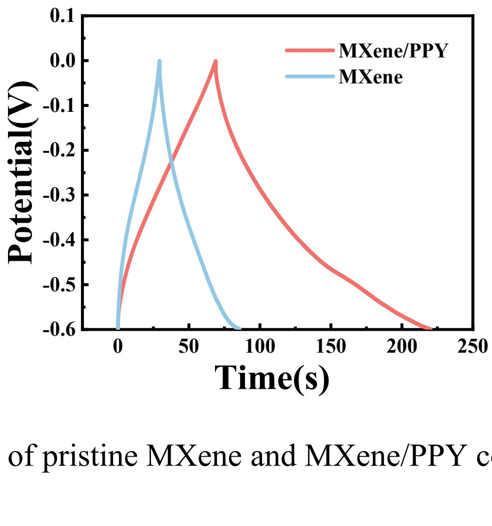

Figure S4. GCD plots of pristine MXene and MXene/PPY composite.

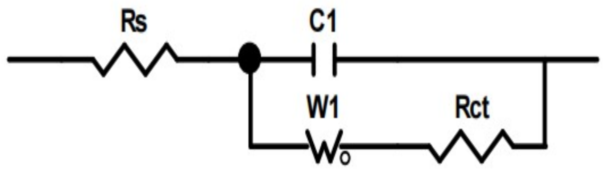

Figure S5. Equivalent circuit.

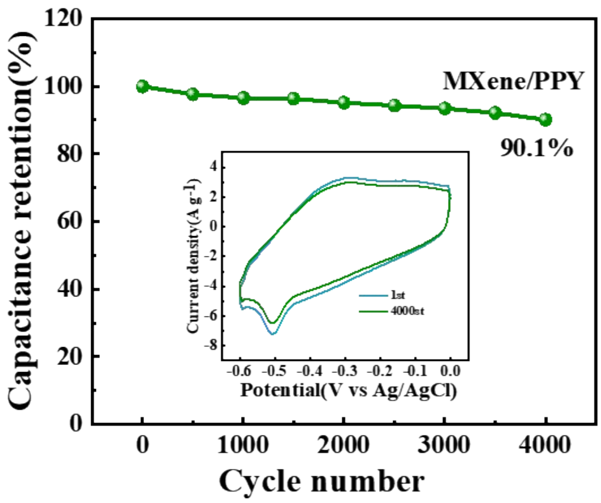

Figure S6. Cyclic stability of MXene/PPY at 25 mV s^{-1}. The inset image represents the CV curves of PPY/MXene electrode before and after 4000 charge and discharge cycles.

4. Tables

Table S1. Fitted data of Nyquist plot

Parameter	R	C_1	R_2	W_1-R	W_1-T	W_1-P
	1.35	0.0023815	0.38037	3.639	0.36558	0.47427

Table S2. The comparison of supercapacitor electrochemical performance

Cathode Material	Negative Material	Electrolyte	Pd [W/kg]	Wd [Wh/kg]	Ref
Ti_3CN	Ti_3CN	2 M KOH	500	5.7	Ref[1]
Ti_3CNT_X	rGO	2 M H_2SO_4	154	5	Ref[2]
GAC-2	GAC-2	1 M H_2SO_4	3500	14.4	Ref[3]
PPy/Ti_3C_2-S2	PPy/Ti_3C_2-S2	3.5 M KCl	499.94	21.61	Ref[4]
Graphene/MnO_2	Graphene/MnO_2	0.5 M Na_2SO_4	62	6.2	Ref[5]

5. References

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