

Supplementary Material

Flexible zinc-ion hybrid supercapacitors with high energy density and long cycling life enabled by microfluidic assembly of MXene composite fibers

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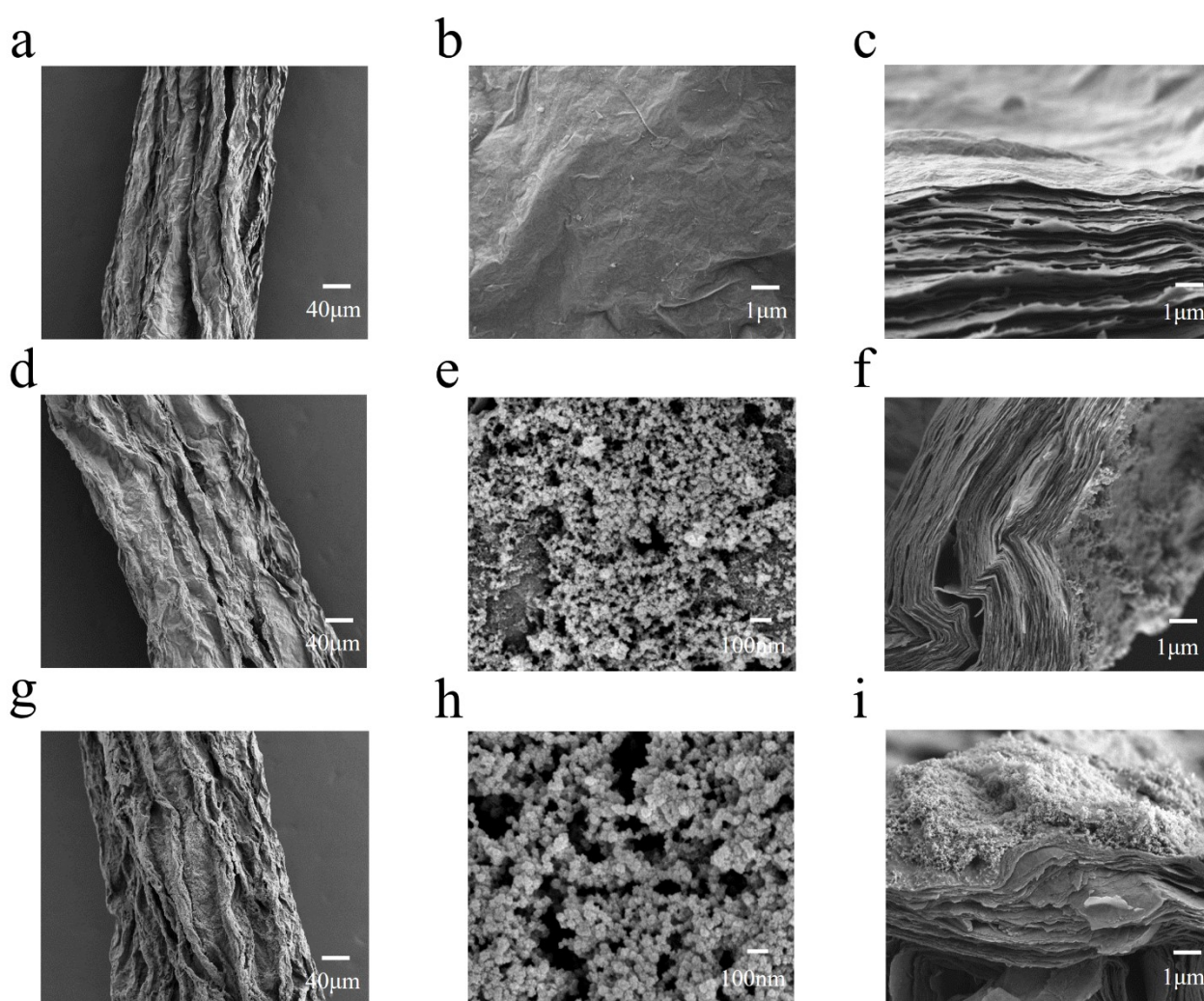


Fig. S1 (a-c) Surface and cross-sectional scanning electron micrographs of MXene fibers; (d-f) Surface and cross-sectional scanning electron micrographs of MXene/MnO₂-1 fibers; (g-i) Surface and cross-sectional scanning electron micrographs of MXene/MnO₂-3 fibers.

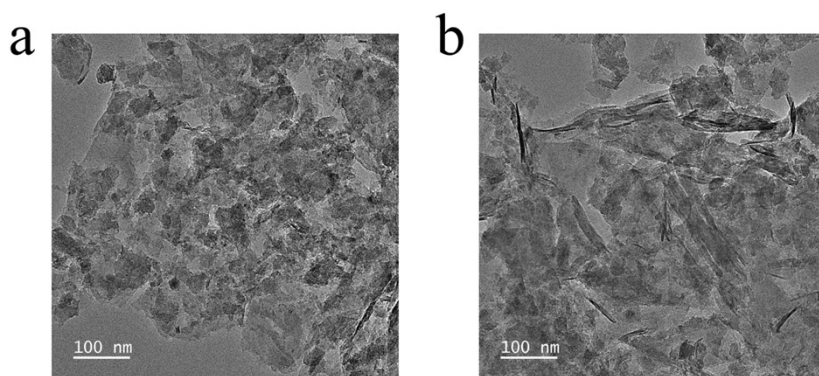


Fig. S2 TEM image of MXene/MnO₂-2 composite fibers

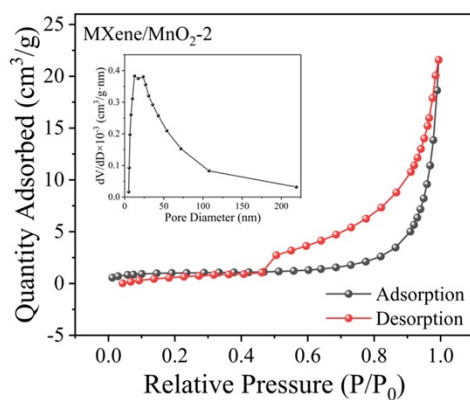


Fig. S3 N₂ adsorption-desorption isotherms and pore size distribution curves of MXene/MnO₂-2 composite fibers

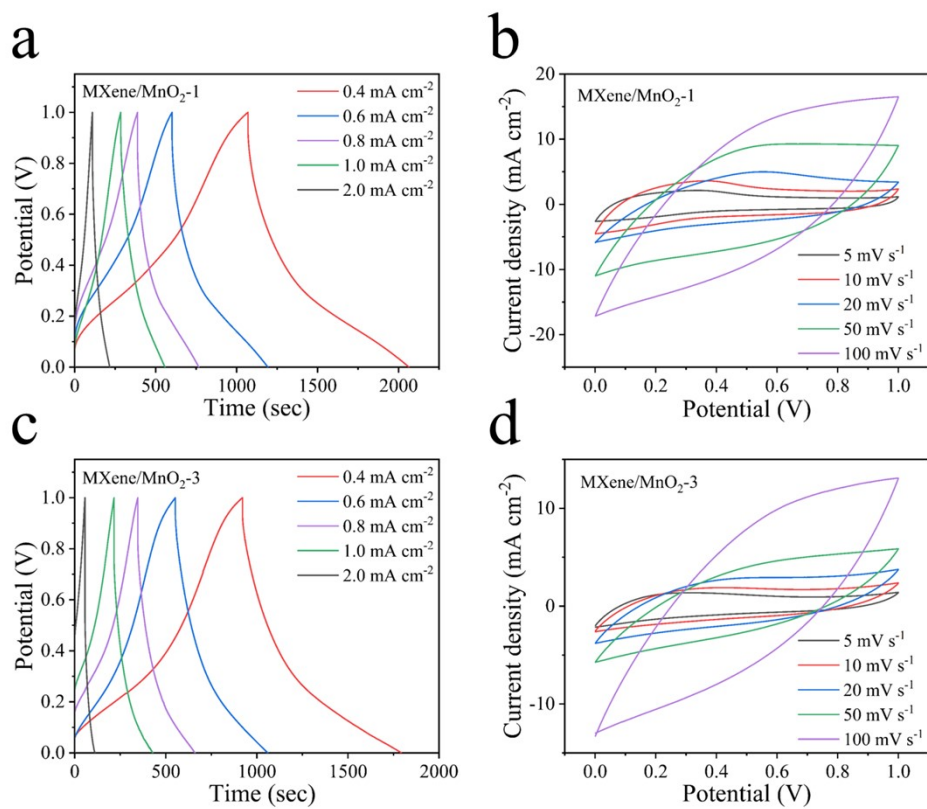


Fig. S4 Flexible symmetric supercapacitors assembled from MXene/MnO₂-1 and MXene/MnO₂-3 fibers under a 0-1 V voltage window in PVA/H₂SO₄ electrolyte: (a, c) Comparison of GCD curves at current densities of 0.4-2.0 mA cm⁻², (b, d) Comparison of CV curves at scan rates of 5-100 mV s⁻¹.

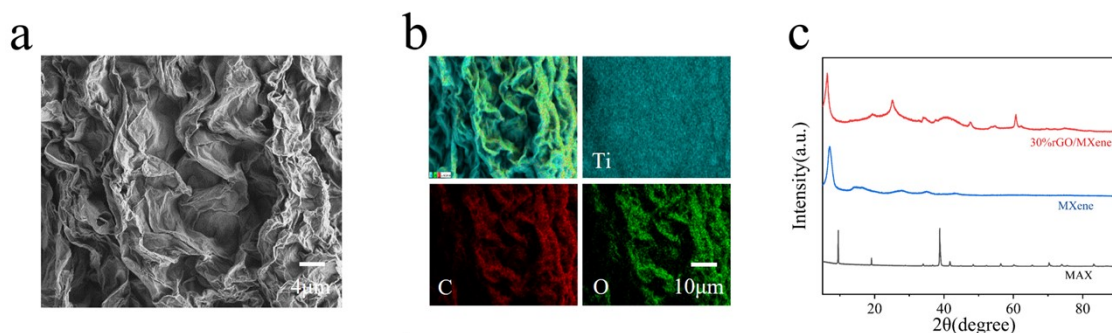


Fig. S5 (a) SEM image of 30% rGO/MXene fibers; (b) EDX elemental mapping of 30% rGO/MXene fibers; (c) XRD patterns of MAX, MXene and 30% rGO/MXene.

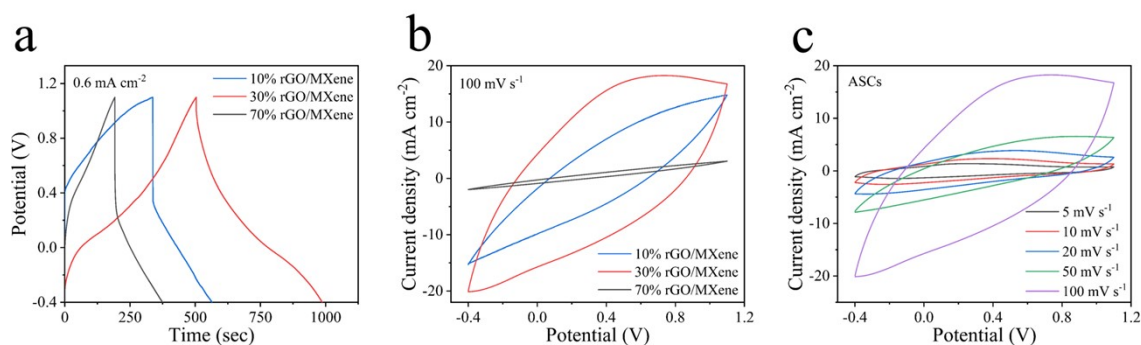


Fig. S6 Flexible ASCs assembled by MXene/MnO₂ composite fibers and rGO/MXene composite fibers with various rGO contents under voltage window of -0.4-1.1 V in PVA/H₂SO₄ gel electrolyte: (a) Comparison of GCD curves at a current density of 0.6 mA cm⁻², (b) Comparison of CV curves at a scan rate of 100 mV s⁻¹, (c) CV curves at scan rates of 5-100 mV s⁻¹ for flexible ASCs assembled by MXene/MnO₂//30% rGO/MXene composite fibers.

Table S1 Comparison of specific areal capacitance with other zinc-ion hybrid supercapacitors

Electrode materials	Electrolyte	Specific capacitance (mF cm ⁻²)	Voltage windows (V)	Ref.
V ₂ CT _x /CNT//Zn	PAM/ZnSO ₄	246.88 (0.5 mA cm ⁻²)	-0.2-1.9V	[1]
10% rGO/MXene// 70% rGO/MXene@Zn	PVA/Zn(CF ₃ SO ₃) ₂	1180 (0.4 mA cm ⁻²)	0-1.6V	[2]
V ₂ O ₅ //MXene	PAM/ZnSO ₄	129 (0.34 mA cm ⁻²)	0-1.65V	[3]
CNT//CNT@Zn	ZnSO ₄	83.2 (1 mA cm ⁻²)	0.2-1.8V	[4]
N-CNF//Zn	ZnCl ₂	700.7 (1 mV s ⁻¹)	0.2-1.8V	[5]
AC@CF//2D-Zn@CF	PVA/ZnSO ₄	56 (0.05 mA cm ⁻²)	0.2-1.8V	[6]
α-MnO ₂ @rGO// AC@CC	CMC/PVA-EG /Zn(CF ₃ SO ₃) ₂	575.5 (6 mA cm ⁻²)	0-2V	[7]
Ti ₃ C ₂ T _x MXene//Zn	Gelatin/ZnSO ₄	214 (5 mV s ⁻¹)	0-1.2V	[8]
CNT//Zn	PAM/ZnSO ₄	73 (0.34 mA cm ⁻²)	0-1.8V	[9]
T-Nb ₂ O ₅ /rGO@CC// ACcp@CC	ZnSO ₄	718.56 (1 mA cm ⁻²)	0-2V	[10]
Al _x V ₂ O ₅ -NMP// m-Ti ₃ C ₂ MXene	PVA/Zn(CF ₃ SO ₃) ₂	233.66 (0.5 mA cm ⁻²)	0-1.8V	[11]
MXene/MnO ₂ // 30%rGO/MXene	ZnSO ₄	1356 (0.6 mA cm ⁻²)	-0.1-1.5V	This work

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