ACCSCIENCE PUBLISHING

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ORIGINAL RESEARCH ARTICLE

Multifunctional polycaprolactone/MXene ultrafine fiber scaffolds with tunable topology and photothermal response

Supplementary File

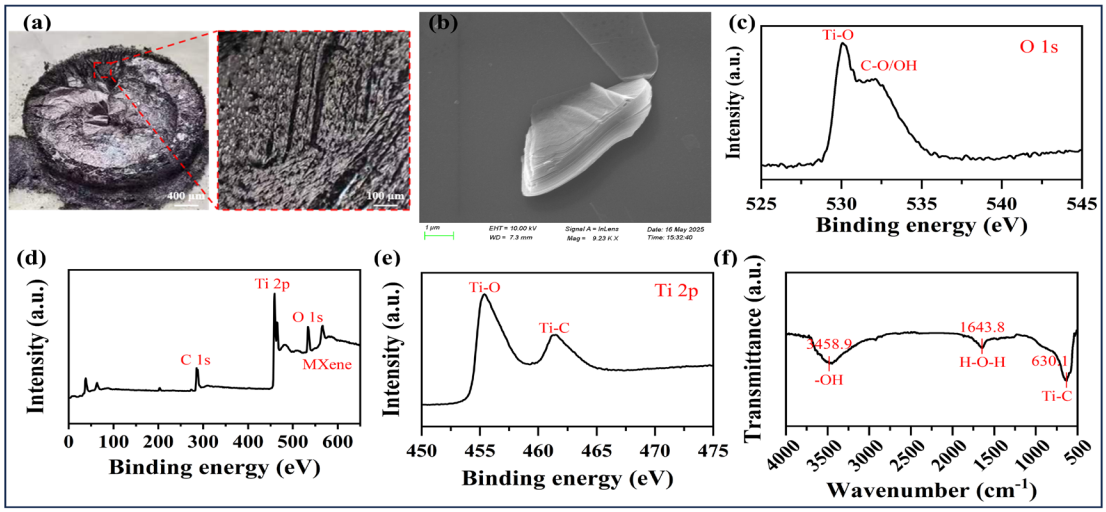

Figure S1. (a) Micrographs of the as-prepared MXene and its magnified view. Scale bar: 400 μm, (inset) 100 μm↕; magnification: 10×, (inset) 50×. (b) Scanning electron microscopy images of Ti3C2Tx after HF/HCl etchin. Scale bars: 1 μm; magnification: 9.23K×. (c) O 1s spectrum. (d) X-ray photoelectron spectroscopy survey spectrum. (e) Ti 2p spectrum. (f) Fourier transform infrared spectroscopy spectrum.

Table S1. Influence of printing temperature on fiber forming

Temperature (°C)	Fiber diameter (μm)	Jet stability
90	–	Discontinuity
100	43.8 ± 2.5	Stable
110	50.2 ± 2.1	Stable
120	58.6 ± 3.4	Stable
130	63.5 ± 12.8	Unstable

Table S2. Influence of pneumatic pressure on fiber formation

Air pressure (kPa)	Fiber diameter (μm)	Jet stability
40	35.2 ± 7.2	Unstable
50	43.8 ± 2.5	Stable
60	50.5 ± 2.2	Stable
70	56.3 ± 3.1	Stable
80	64.8 ± 5.2	Stable

Table S3. Influence of printing speed on fiber forming

Printing speed (mm/min)	Fiber diameter (μm)	Jet stability
800	68.5 ± 4.2	Discontinuity
1,000	58.2 ± 3.5	Stable
1,200	50.4 ± 2.4	Stable
1,400	43.6 ± 3.0	Stable
1,600	–	Discontinuity

Table S4. Orthogonal experimental results of 4 wt.% PCL/MXene ink

Experiment no.	A	B	C	Fiber diameter (μm)
1	1 (100°C)	1 (50 kPa)	1 (1,000 mm/min)	61.5
2	1	2 (60 kPa)	2 (1,200 mm/min)	54.2
3	1	3 (70 kPa)	3 (1,400 mm/min)	48.6
4	2 (110°C)	1	2	51.8
5	2	2	3	46.3
6	2	3	1	56.5
7	3 (120°C)	1	2	43.8
8	3	2	3	50.2
9	3	3	1	47.5

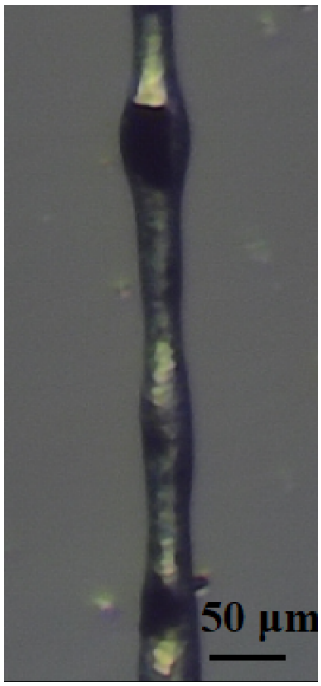

Figure S2. Bead-on-string morphology of 7 wt.% PCL/MXene fibers at 50 μm target diameter. Scale bar: 50 μm; magnification: 10×.

Table S5. Summary of calculation parameters for photothermal conversion efficiency

Parameter	1 wt.% PCL/MXene	4 wt.% PCL/MXene	Data source
Sample mass (m; g)	0.0066	0.0070	Measured by weighing
Sample area (S; cm^2)	0.25	0.25	Projected area
Laser power density (I_0; W/cm^2)	0.50	0.50	Instrument default
Laser power (I; W)	0.125	0.125	Power density × area
Ambient temperature (T_{amb}; °C)	20.0	20.0	Experimental record
Equilibrium temperature (T_{max}; °C)	55.0	60.0	Experimental record
Absorbance (A_{808})	1.28	1.30	Measured by UV–vis–NIR
Specific heat capacity (C_p; J/g/K)	2.20	2.43	Measured by DSC

Abbreviations: DSC: Differential scanning calorimetry; NIR: Near-infrared; PCL: Polycaprolactone.