Supporting information

Anti-swelling and Photo-responsive MXene-based Polyampholyte Hydrogel Sensors for Underwater Positioning and Urban Waterlogging Pre-warning

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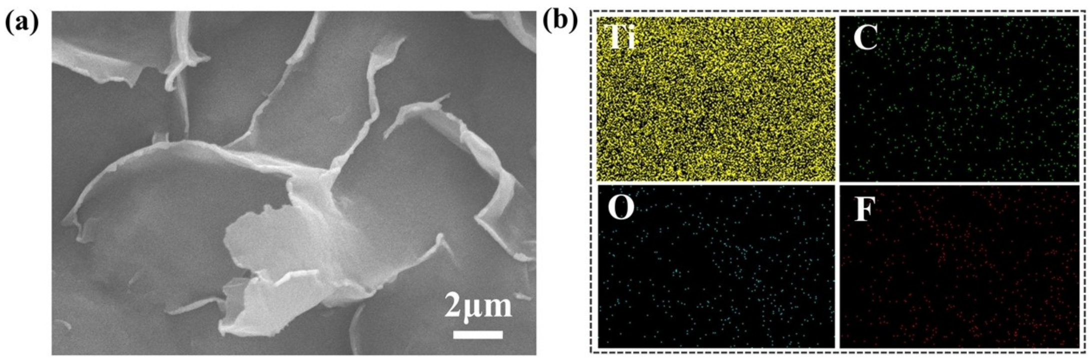

Figure S1 (a) The SEM image and (b) the corresponding element distribution of MXene nanosheets.

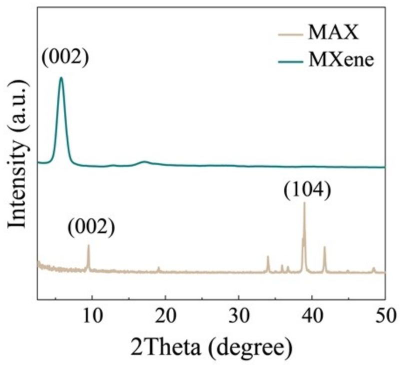

Figure S2 The XRD of MAX and MXene nanosheets.

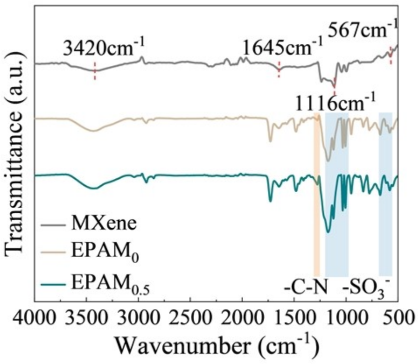

Figure S3 The FTIR of MXene nanosheets, $EPAM_0$ and $EPAM_{0.5}$ hydrogels.

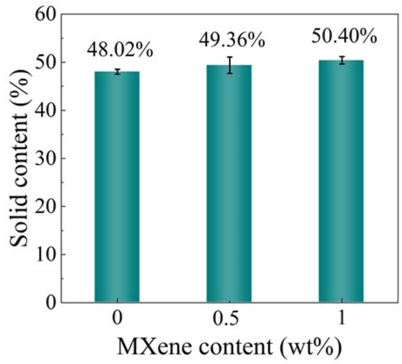

Figure S4 The solid contents of the $EPAM_x$ hydrogels.

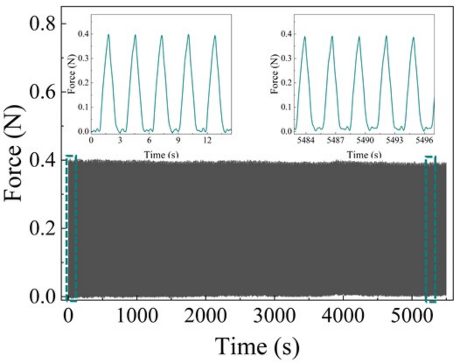

Figure S5. The cyclic tensile tests of the hydrogel for 2000 cycles at 50% strain underwater.

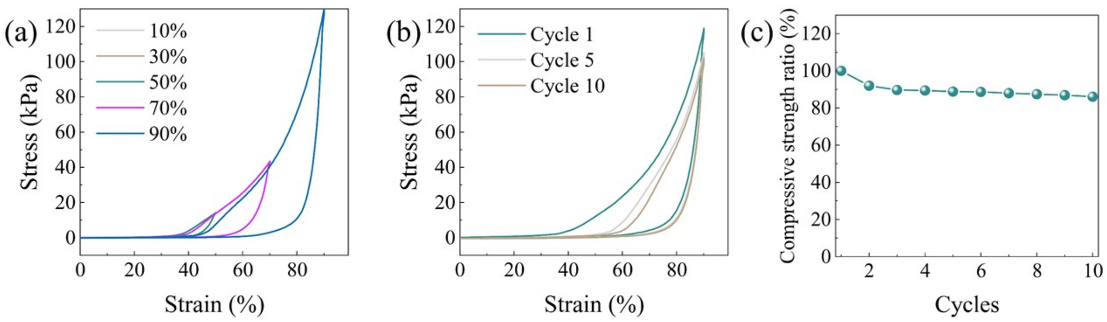

Figure S6. (a) Continuous loading-unloading tests with compressive strain ranging from 10% to 90%. (b) Cyclic compressive loading-unloading tests of the hydrogels under a compression of 90%. (c) Peak force change rate after ten cycles of compression.

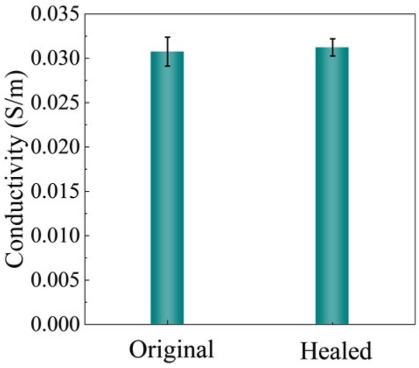

Figure S7. The conductivity of the original and healed hydrogels.

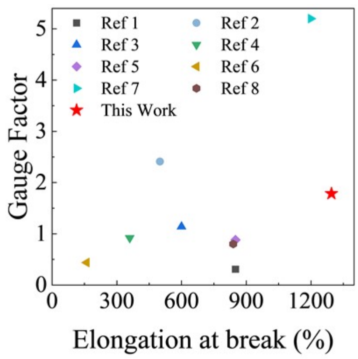

Figure S8. The sensing performance of the EPAM hydrogel sensor compared to other reported anti-swelling hydrogel sensors.

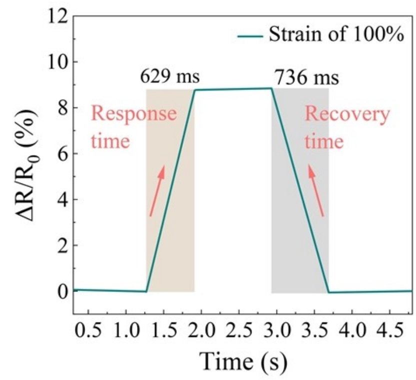

Figure S9 The response and recovery time of the $EPAM_{0.5}$ hydrogel-based sensor of 100% strain underwater.

Table S1. The composition of $EPAM_x$ hydrogels.

5mL	NaSS (g)	DMAEA-Q (g)	MXene (mL)	MBAA (mg)	V50 (mg)	H_2O (mL)
$EPAM_0$	1.15	1.42	0	1.8	6.2	4.71
$EPAM_{0.5}$	1.15	1.42	0.75	1.8	6.2	3.9
$EPAM_1$	1.15	1.42	1.5	1.8	6.2	3.21

Table S2. The relative resistance changes of hydrogel-based sensor under water pressure.

Water pressure (kPa)	Resistance change ratio (%)
0	0
0.98	-61.67
2.94	-93.61
4.9	-94.65
6.86	-95.00
8.82	-95.21
10.78	-95.31
12.74	-95.49

References

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