

Supporting Information

Swelling-resistant microgel-reinforced hydrogel polymer electrolytes for flexible all-in-one supercapacitors with high performances

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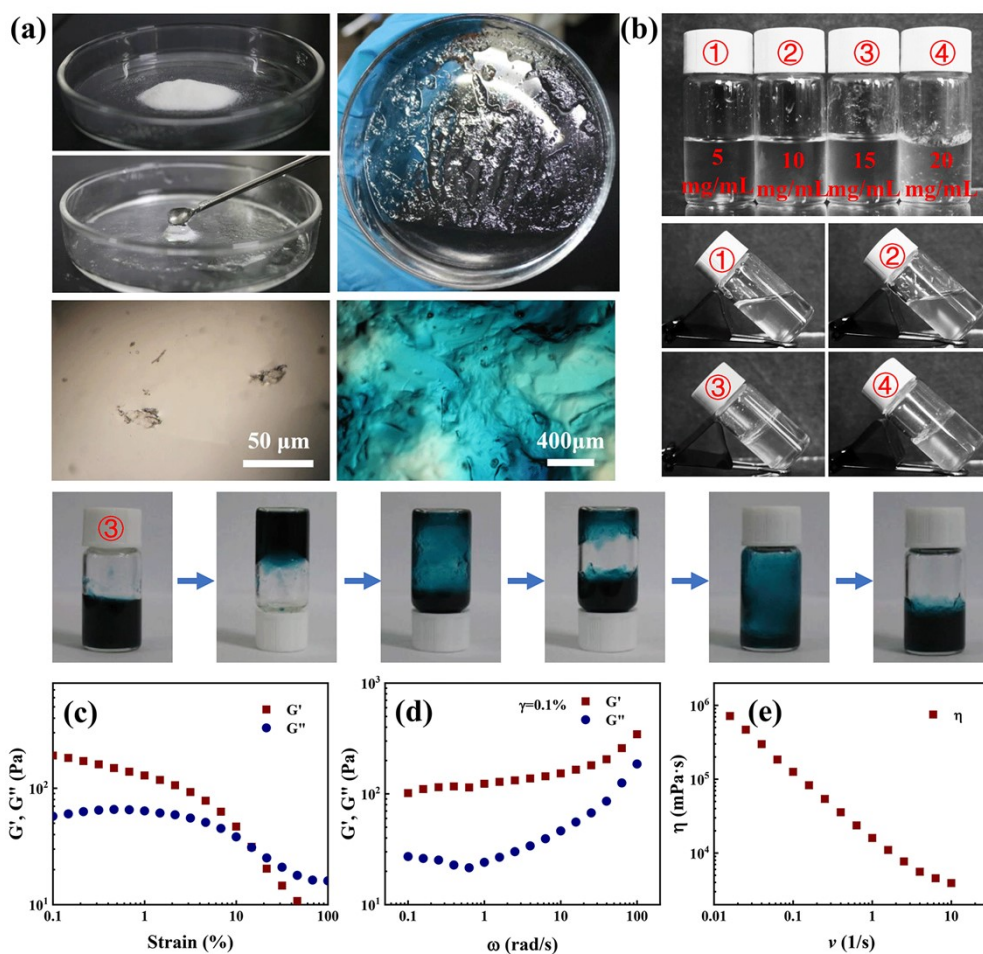


Fig. S1 (a) PAMPS gel particles (powders) in dried state. Swollen PAMPS particles and optical photograph in AM aqueous solution before gelation. (b) Demonstration images of injectability with different PAMPS concentrations. (c) Strain sweeping measurement at a constant angular frequency of 5 rad/s. (d) Angular frequency sweeping measurement at a constant strain of 1%. (e) Flow curves obtained by shear rheology.

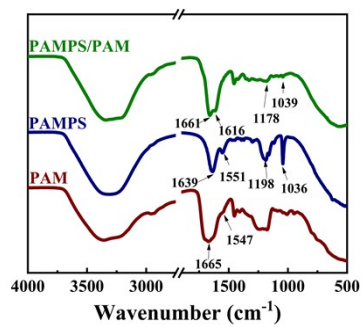


Fig. S2 FTIR spectra of PAM, PAMPS and PAMPS/PAM gels.

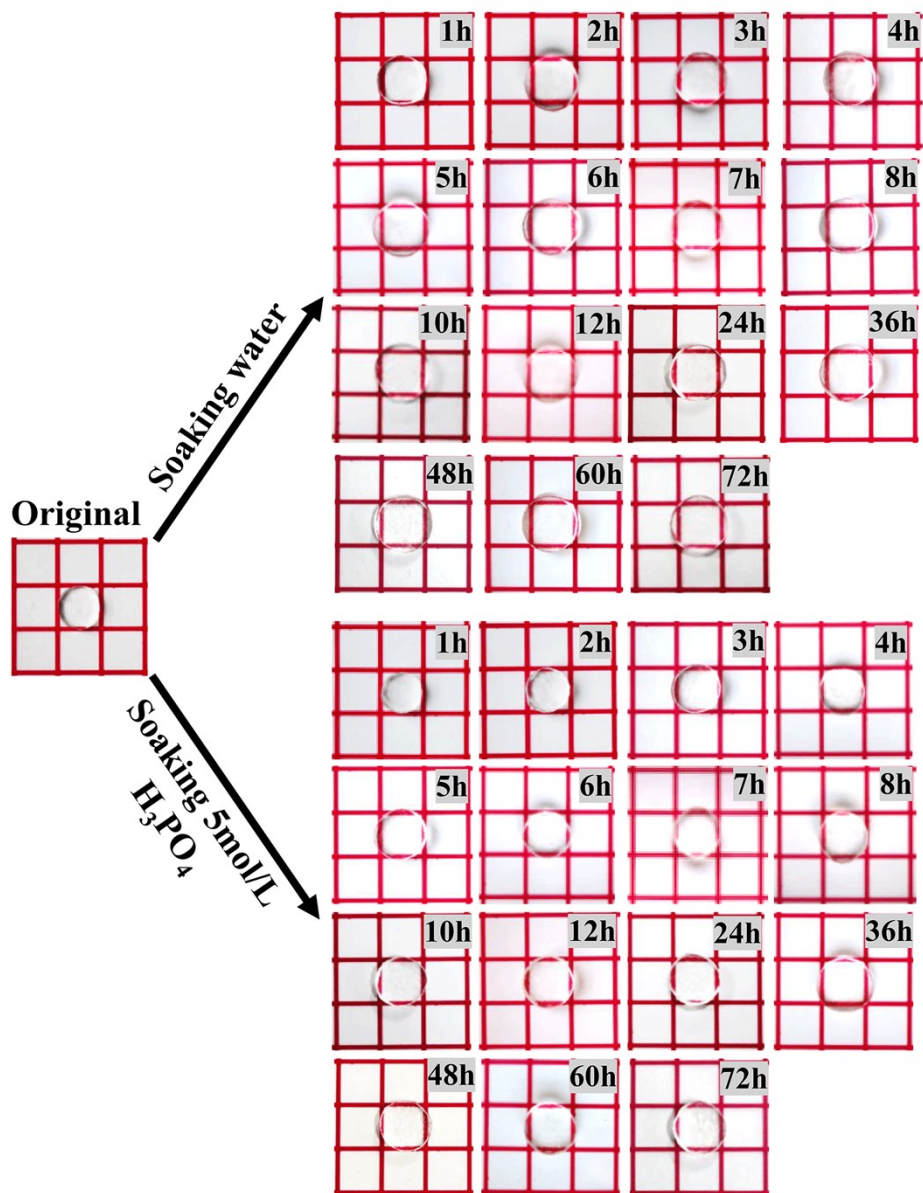


Fig. S3 Swelling images of PAMPS/PAM MR gels soaked in water and 5 mol/L H₃PO₄ solutions for different times.

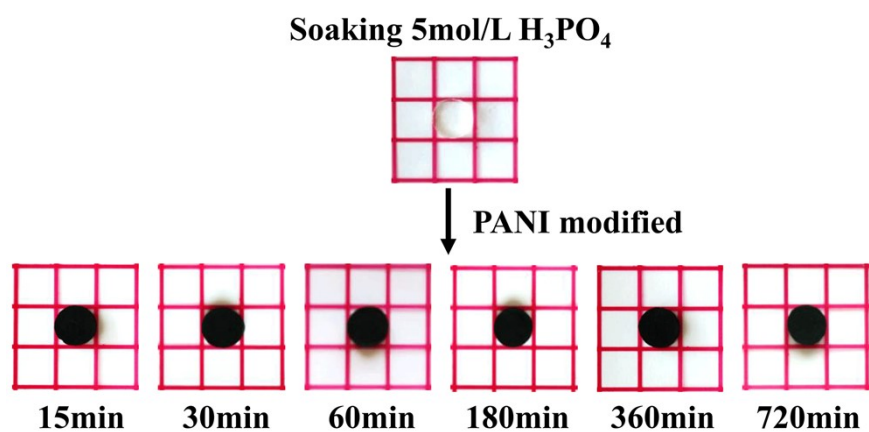


Fig. S4 Swelling images of PAMPS/PAM-5P MR HPE in PANI environment for different times.

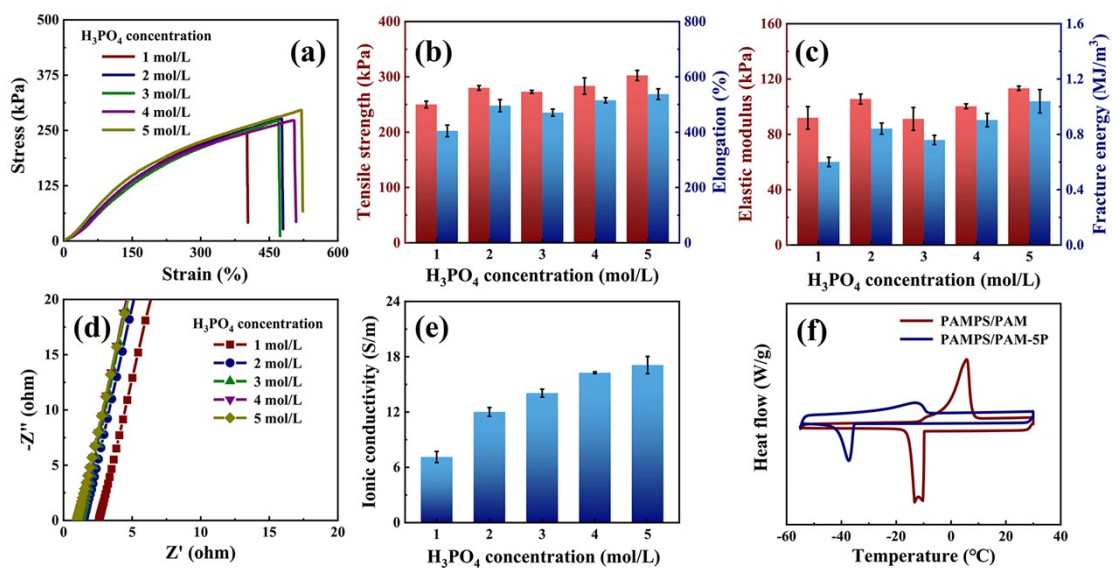


Fig. S5 (a) Stress-strain curves, (b) Tensile strength-elongation histograms, (c) elastic modulus and fracture energy histograms, (d) EIS curves and (e) ionic conductivity of PAMPS/PAM-xP MR HPE. (f) DSC curves of PAMPS/PAM MR gels and PAMPS/PAM-5P MR HPE.

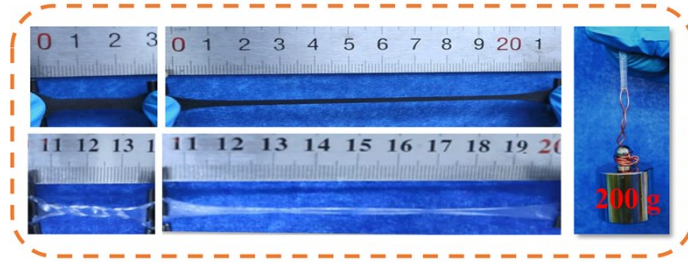


Fig. S6 Mechanical demonstration images of PAMPS/PAM-5P MR HPE and all-in-one supercapacitor.

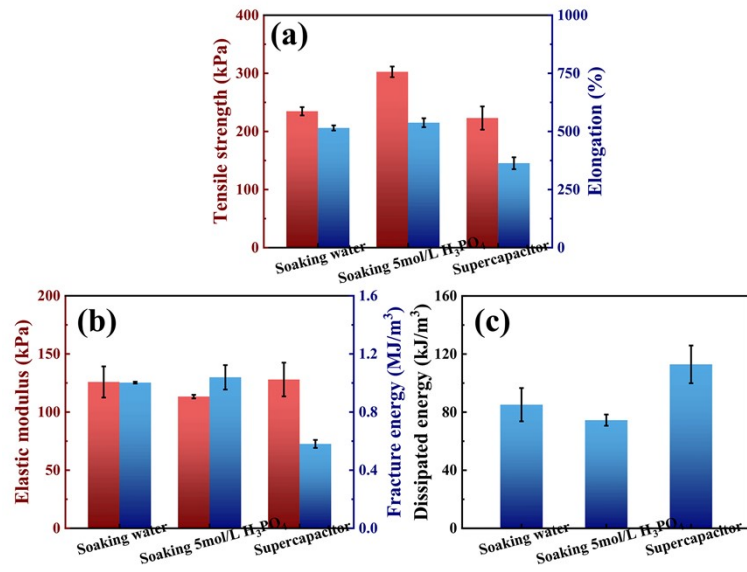


Fig. S7 (a) Tensile strength-elongation histograms, (b) elastic modulus and fracture energy histograms and (c) dissipated energy histograms of PAMPS/PAM MR gels soaking in water, 5 mol/L H₃PO₄ and all-in-one supercapacitors.

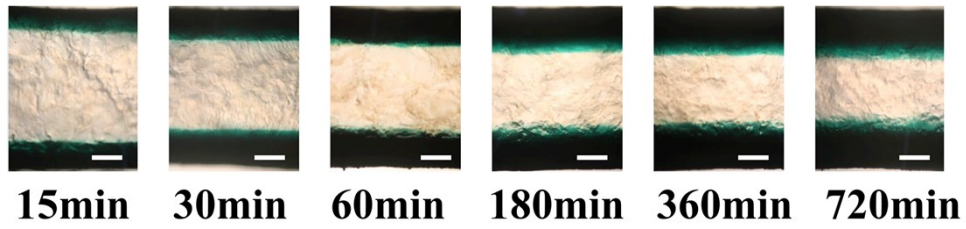


Fig. S8 The cross-section optical photographs of flexible all-in-one supercapacitor at different polymerization time (Scale bars of 500 μm).

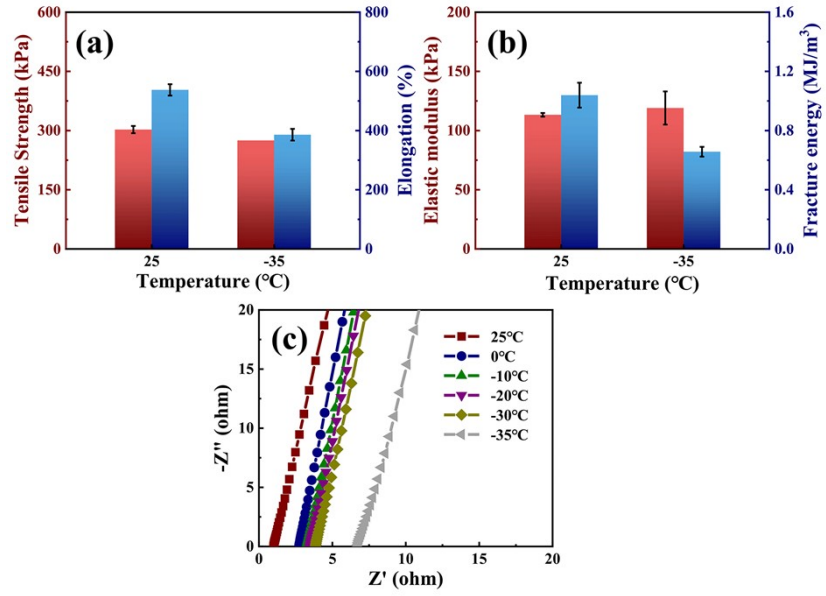


Fig. S9 (a) Tensile strength-elongation histograms, (b) elastic modulus and fracture energy histograms and (c) EIS curves of PAMPS/PAM-5P MR HPE at low temperature.

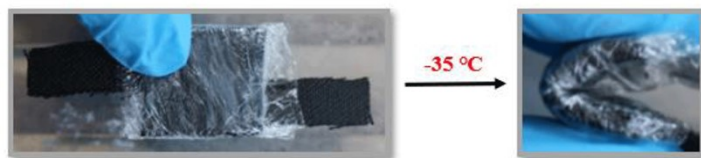


Fig. S10 Anti-freezing demonstration of all-in-one supercapacitor.

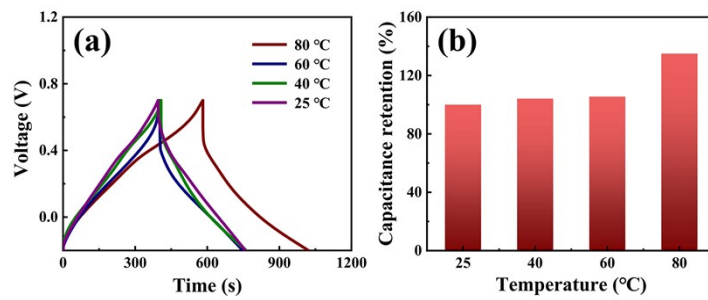


Fig. S11 (a) GCD curves and (b) corresponding capacitance retention and coulombic efficiency of all-in-one supercapacitor at high temperature at 1.0 mA/cm².

Tab. S1 Comparison of reported all-in-one supercapacitors.

Materials	Conductive polymer concentration (mol/L)	Deposited Time	Specific capacitance (mF/cm ²)	Tensile strength (kPa)	Elongation (%)	Refs
PANI/PAMPS/PAM	0.5	1 h	441 (1.0 mA/cm ²)	234	375	This work
PANI/PVA/PHEA	2	4 min	98 (0.2 mA/cm ²)	1070	1467	²²
PANI/PAM/KC	0.5	15 min	219 (1.0 mA/cm ²)	225	1040	²³
PANI/GO-GELE	No data	0.5 h	223 (0.2 mA/cm ²)	200	2600	³⁵
PANI/PVA	No data	8 h	297 (0.5 mA/cm ²)	No data	No data	³²
PPy/PVA	0.6	8 h	224 (0.8 mA/cm ²)	No data	No data	³⁴
PPy/EG-PME	0.6	9 h	212 (0.8 mA/cm ²)	No data	No data	³⁶
PANI/APH	0.5	10 h	26 (0.05 mA/cm ²)	300	300	³¹
PANI/AF-OPH	0.17	12 h	14 (0.03 mA/cm ²)	25	350	³³
PPy/PVA	No data	12 h	59 (0.2 mA/cm ²)	56	110	³⁷