Supporting Information

Ultra-robust, High-adhesive, Self-healing, and Photothermal Zwitterionic Hydrogels toward Multi-sensory Application and Solar-Driven Evaporation

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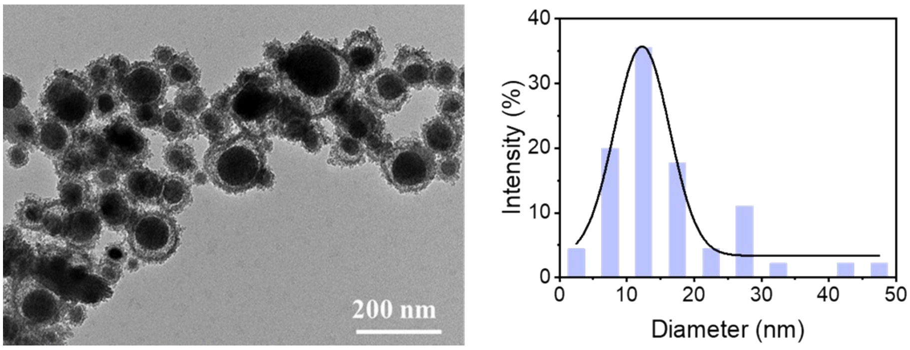

Figure S1. TEM image and diameter distribution of PDA shell thickness.

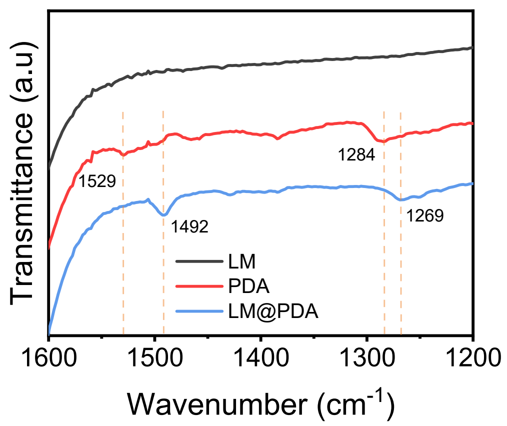

Figure S2. FTIR spectra of LM, PDA, and LM@PDA.

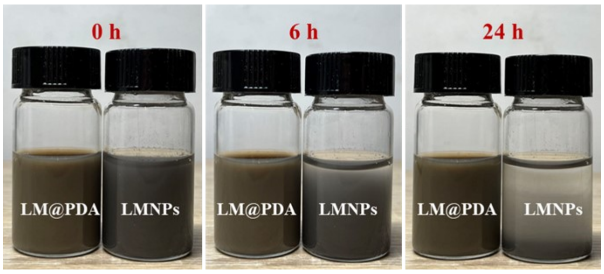

Figure S3. Time-dependent dispersion of LM@PDA after self-polymerization (left) and LMNPs in water after ultrasonication (right).

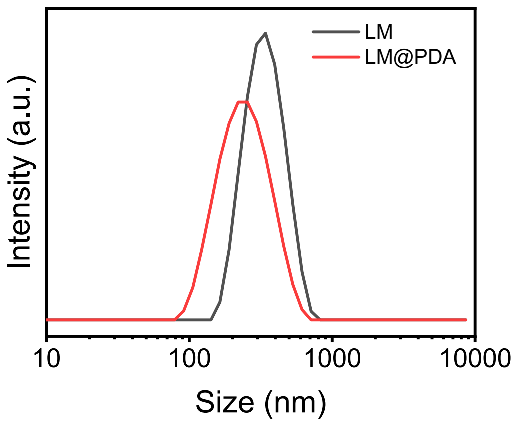

Figure S4. Size distributions of LM and LM@PDA.

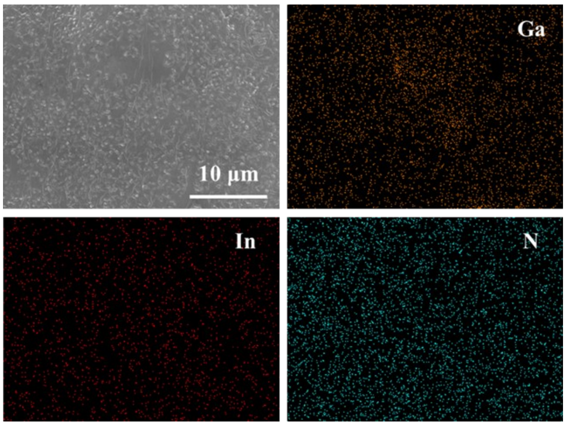

Figure S5. SEM image of the cross section of the freeze-dried PSBMA-LM@PDA hydrogel with corresponding elemental mapping by EDS.

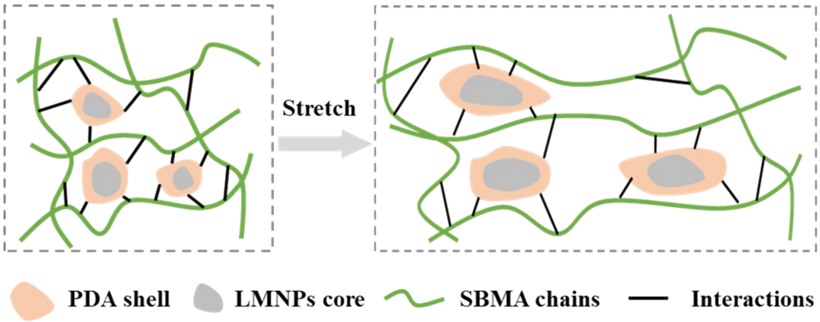

Figure S6. Illustration of PSBMA-LM@PDA hydrogels upon stretching.

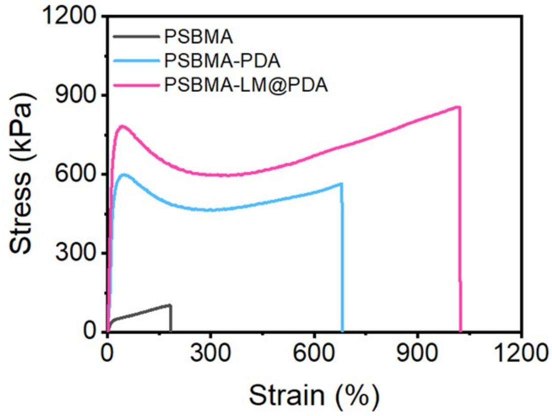

Figure S7. Tensile stress-strain curves of the pure PSBMA, PSBMA-PDA and PSBMA-LM@PDA hydrogels.

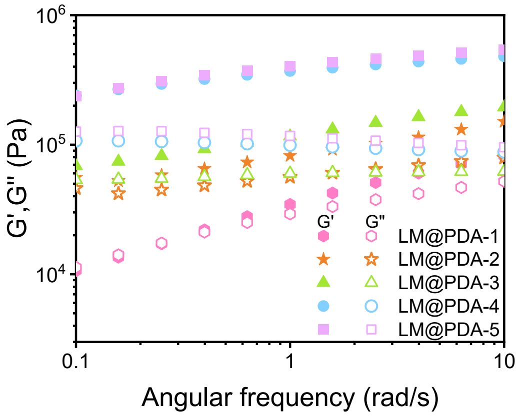

Figure S8. Frequency sweeps of PSBMA-LM@PDA hydrogels with different LM@PDA contents

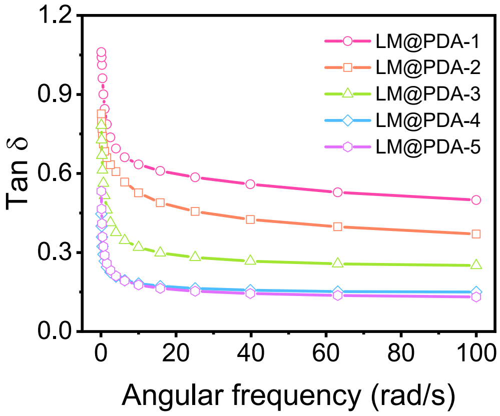

Figure S9. Tan δ of PSBMA-LM@PDA hydrogels with different LM@PDA contents

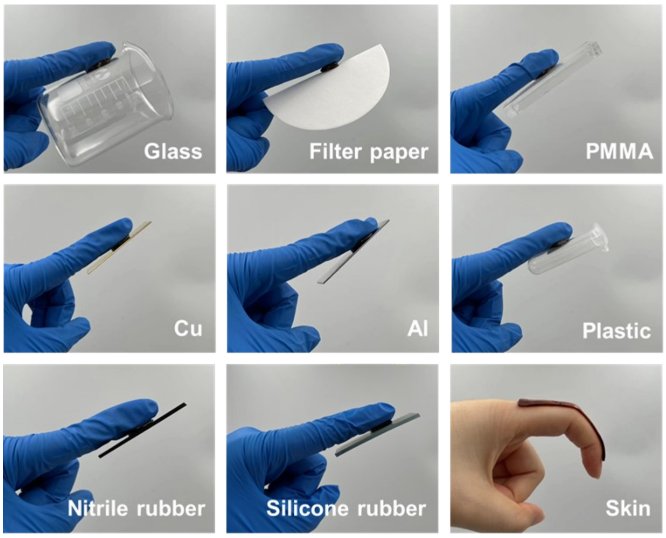

Figure S10. Photos of PSBMA-LM@PDA-5 hydrogel adhered on glass, filter paper, poly(methyl methacrylate) (PMMA), Cu, Al, plastic, nitrile rubber, silicone rubber, and human skin.

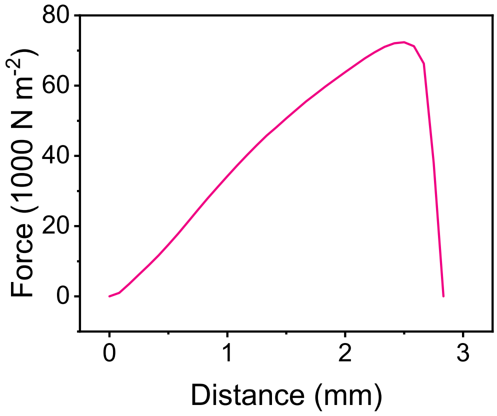

Figure S11. Lap sheer curve of pure PSBMA hydrogel adhered on Al.

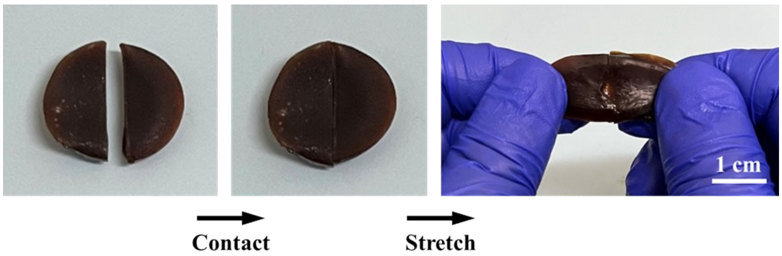

Figure S12. Optical images of two fractured hydrogel segments contact together and then under stretching.

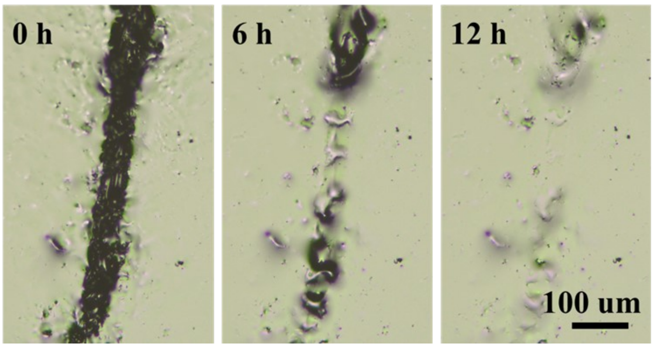

Figure S13. Self-healing process observed by an optical microscope. A crack autonomously disappeared after 12 h at room temperature.

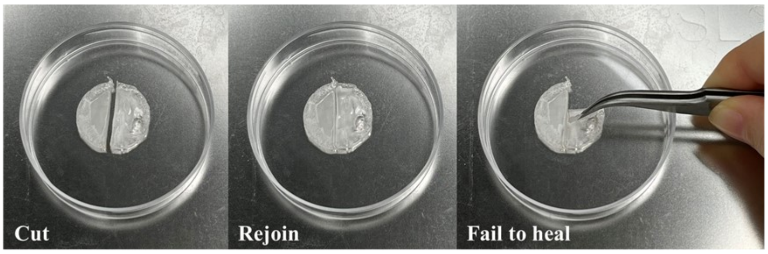

Figure S14. Optical images of two fractured PSBMA hydrogel segments contacted together and failed to heal.

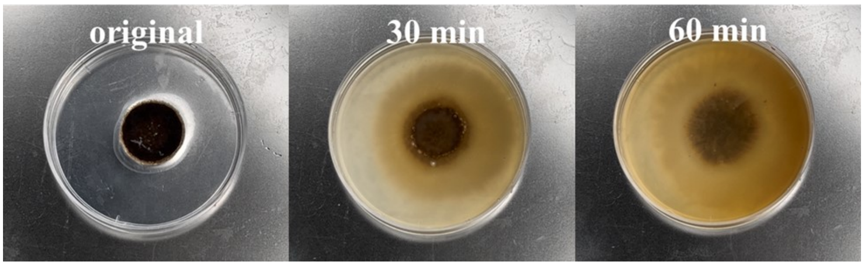

Figure S15. Photographs of the PSBMA-LM@PDA-5 hydrogel placed in water for different times.

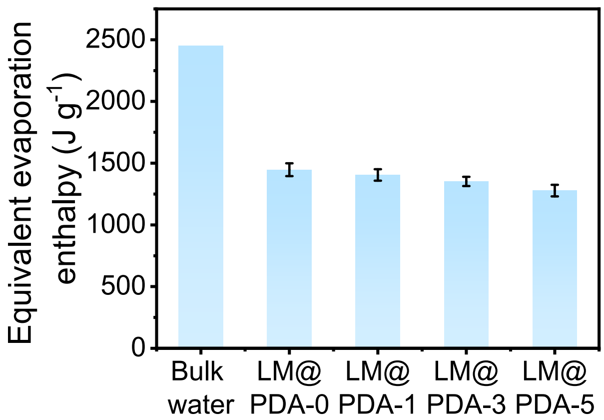

Figure S16. The water evaporation enthalpy of bulk water and water in PSBMA-LM@PDA-0, PSBMA-LM@PDA-1, PSBMA-LM@PDA-3, PSBMA-LM@PDA-5 hydrogels.

Table S1. Comparisons of PSBMA-LM@PDA hydrogels with those reported zwitterionic hydrogels in terms of tensile strength, strain, and toughness, respectively.

Zwitterionic hydrogels	Tensile strength (MPa)	Stain (%)	Toughness (MJ/m^3)	REF
PSBMA-LM@PDA-5	**1.30**	**555.5**	**4.73**	**This work**
PSBMA-LM@PDA-2	**0.69**	**1343**	**7.28**	
PSBMA-LM@PDA-1	**0.44**	**1555**	**6.66**	
CS-P(AM-MPC-AA)-Fe^{3+}	1.07	1075	7.03	[37]
PCB/PSB	1.00	170	—	[15]
AMPS/SBAA	0.91	33.6	—	[38]
PSBMA/SA-Ca^{2+}	0.73	410	—	[39]
PCBAA/SA-Ca^{2+}	0.69	330	—	[40]
CNC@P(SBMA-co-AM)	0.61	1250	—	[41]
Ca-GG/PAAm-ZP	0.41	1890	3.27	[42]
PVA-P(SBMA-co-HEMA)-HCl	0.38	337	0.52	[43]
(pCBM/pSB)	0.32	225	—	[44]
PSBMA-Clay-LiCl	0.30	2200	5.48	[45]
VBIPS	0.20	440	0.24	[46]
PBA/CPA	0.08	1095	0.045	[47]
PSBMA-NIPAAm-MPBA	70	273	—	[48]
p(CBMA-co-HEMA)	52	532	—	[49]

"—": Not available or not mentioned in references.

Table S2. Comparison of performance parameters with various temperature sensors reported in the literature.

Material	TCR ($^{o}C^{-1}$)	Temperature range (^{o}C)	REF
PSBMA-LM@PDA	**0.15**	**20-60**	**This work**
PSBMA-Clay-LiCl	0.14	-20-10	[45]
PVA/CA/AgNPs	0.076	30-40	[57]
PVA/PU/$Ti_3C_2T_x$	0.0527	0-30	[58]
PVA/DMSO/rGO/GO	0.038	15-90	[59]
PVA/Gly/AgNPs@CNT	0.0299	-20-20	[60]
PAM-SBMA/TEMPO-CNF-PANI/Gly	0.02	20-80	[47]
PANI NFs	0.0164	40-110	[61]
XSBR/SSCNT	0.0163	30-100	[62]
rGO	0.013	25-45	[63]
CNTs/CB/PVA/Gly	0.00935	30-90	[64]

Table S3. Water evaporation performance of the PSBMA-LM@PDA-5 hydrogel-based evaporator compared with previous reports under 1 sun.

Material		Evaporation rate (kg m^{-2} h^{-1})	Efficiency (%)	REF
Hydrogel	**PSBMA-LM@PDA**	**2.54**	**90.3**	**This work**
	PVA/SLS-CNT	2.09	80.4	[69]
	Chitosan/PNAGA-CNTs	2.42	92	[70]
Coating	PU/CNT/ZCB	2.2	93.5	[71]
	PDMAPS	1.9	98.8	[72]
Aerogel	APNP	1.41	87.6	[73]
	IP-SLC	1.29	94	[74]
	rGO-SA-CNT	1.622	83	[75]
Biomass	Mushroom	1.475	78	[76]
	Plasmonic wood	1	68	[77]

Table S4. Comparison between this work and previously reported representative hydrogels in terms of tensile strength, self-adhesive, self-healing, photothermal, strain sensing, pressure sensing, temperature sensing, and solar evaporation performance.

Journal	Materials	Conductivity ($S\ m^{-1}$)	Tensile strength (MPa)	Self-adhesive	Self-healing	Photothermal	Strain sensing	Pressure sensing	Temperature sensing	Solar evaporation	REF
	PSBMA-LM@PDA	**0.45**	**1.3**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**This work**
Adv. Funct. Mater	PM-CNC-PANI-EGaIn	0.0002	0.11	No	—	Yes	Yes	Yes	Yes	Yes	[78]
Adv. Funct. Mater	PAM/PSA-LMGO	0.036	0.303	Yes	Yes	—	Yes	Yes	—	—	[25]
Nano Energy	PAA-CNF-LMNPs	0.45	0.12	No	Yes	—	Yes	Yes	—	—	[19]
ACS nano	PSBMA-DA	0.03	Yes	Yes	Yes	No	Yes	Yes	Yes	No	[4]
ACS Appl. Mater. Interfaces	PAA-co-PDP	1.65	0.095	Yes	Yes	No	Yes	Yes	Yes	No	[79]
Adv. Funct. Mater	Betaine-AgNPs-NaCl-Gly/water	0.00485	7.33	No	—	No	Yes	—	Yes	No	[80]
Chemical Engineering Journal	PCMCS/PSA-SHA-Bn	4.208	0.071	Yes	Yes	No	Yes	Yes	Yes	No	[81]
Chemical Engineering Journal	PAM/PSA-LM/CNTs	94	0.018	Yes	Yes	No	Yes	—	—	No	[23]
ACS nano	PVA-GO	—	1.77	No	—	Yes	—	—	—	Yes	[82]
Macromol. Mater. Eng.	PAA-PEDOT	6.6	0.78	—	—	Yes	Yes	Yes	—	Yes	[83]
Materials Today	PNIPAAm-PPy	Yes	0.03	—	—	Yes	Yes	—	—	—	[84]
Chemical Engineering Journal	PAM/PAA-[$VBIM^+$]-AuNRs	10.73	0.148	No	—	Yes	Yes	Yes	Yes	—	[85]
Adv. Funct. Mater	PVA/SA/PAAS	—	0.026	—	Yes	Yes	—	—	—	Yes	[86]
Nano Energy	PVA/PHEAA-Sb2S3@PPy-DA	2.26	1.25	Yes	Yes	Yes	Yes	—	—	—	[87]

"—": Not mentioned in references.