

## Supporting Information

### Microphase separation induced polyelectrolyte ionogel with tough, highly conductive, self-healing and shape-memory properties for wearable electrical devices

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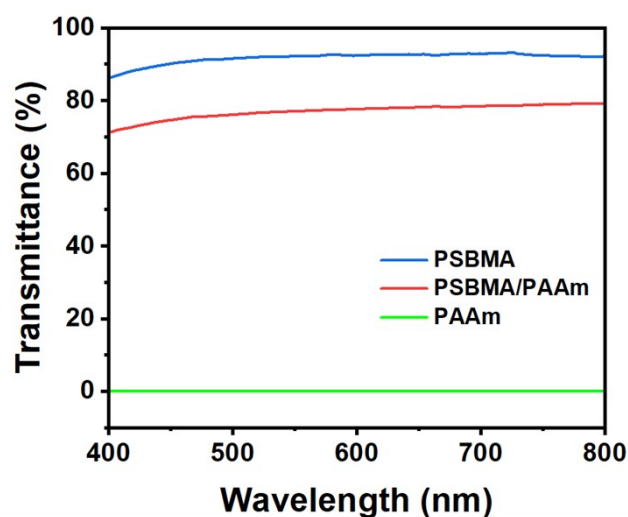


Figure S1 UV-vis spectra of the PSBMA, PSBMA/PAAm and PAAm ionogels.

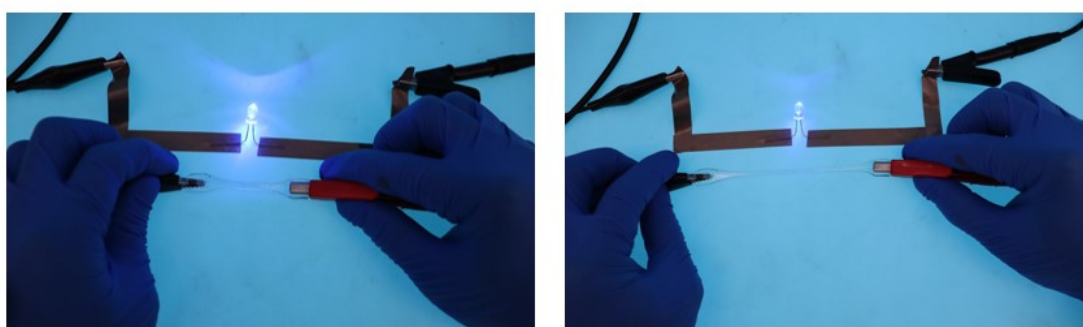


Figure S2 Photographs of the conductive behavior of a dumbbell-shaped PSBMA/PAAm ionogel.

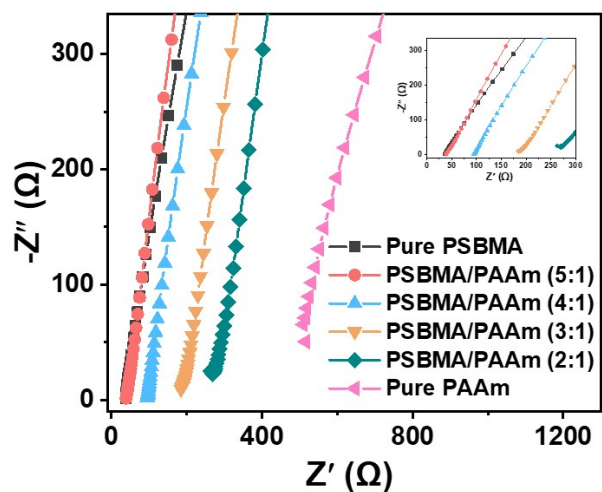


Figure S3 EIS plots of the ionogels in the frequency range of 1 MHz to 0.1 Hz.

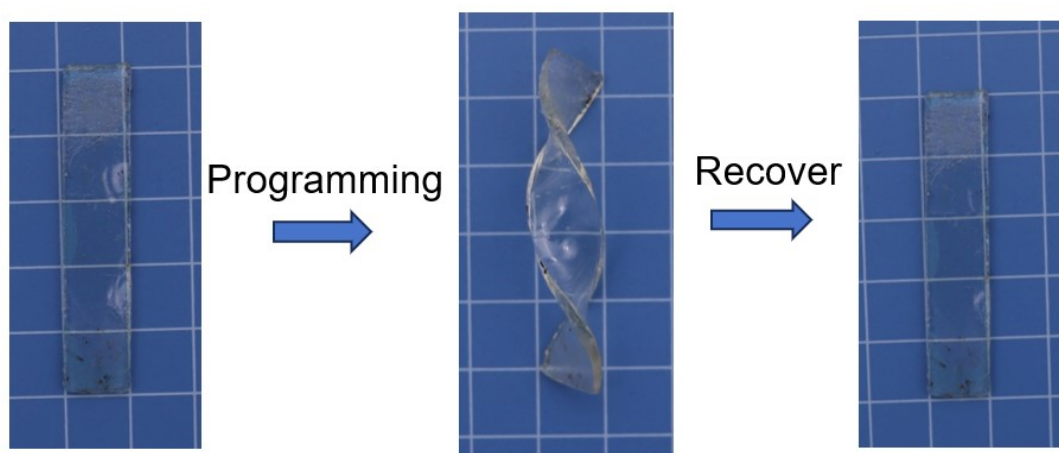


Figure S4 Heating-induced shape-memory behavior of a spiral shape.

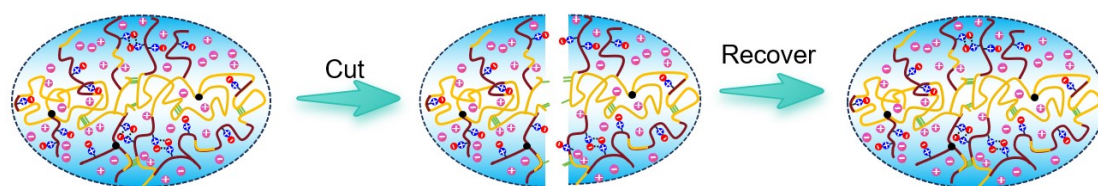


Figure S5 Schematic illustration of the self-healing mechanism of the PSBMA/PAAm ionogel.

Table S1: The exact compositions of the ionogels.

	SBMA (g)	AAm (g)	MBA (mg)	2959 (mg)	EMIES (ml)
PSBMA	3	0	1.7	2.4	5

PSBMA/PAAm (5:1)	2.5	0.5	1.4	3.6	5
PSBMA/PAAm (4:1)	2.4	0.6	2.6	3.8	5
PSBMA/PAAm (3:1)	2.25	0.75	2.9	4.2	5
PSBMA/PAAm (2:1)	2	1	3.3	4.8	5
PAAm	0	3	6.5	9.5	5

Table S2 Comparison of this work to reported ionogels on various parameters

Materials	Stress (MPa)	Strain (%)	Conductivity (mS/cm)	Transparency	Self-healing	Shape-memory	Ref.
P(AA-co-MEA)	0.29	500	3.4	opaque	no	no	<i>Macromolecules</i> 2022, 55, 24, 10950-10959
P(DMAAm-r-AAc)	0.32	400	1.2	transparent	yes	no	<i>Adv. Mater.</i> 2018, 1802792
PVC organic-ionogel	184	364	1.17*10 <sup>-3</sup>	opaque	no	no	<i>Nano Energy</i> 113 (2023) 108535
SIGE	2.46	169	1.2*10 <sup>-4</sup>	transparent	no	no	<i>Adv. Energy Mater.</i> 2019, 1900257
PACMO	1	1000	1*10 <sup>-4</sup>	transparent	yes	no	<i>Adv. Funct. Mater.</i> 2023, 33, 2307367
Agarose/PHEA	0.37	700	0.12	transparent	yes	no	<i>ACS Appl. Mater. Interfaces</i> 2020, 12, 12, 14272-14279
PACG-MBAA	0.156	65	4	transparent	no	no	<i>ACS Appl. Mater. Interfaces</i> 2024, 16, 3, 4035-4044

Poly (MPC-co- SBVI)	0.151	100	0.7	transparent	yes	no	<i>Chem. Mater.</i> 2019, 31, 8, 2913- 2922
PSBMA/ PAAm	1.11	465	1.3	transparent	yes	yes	This work