Supporting Information

Quasi-solid Conductive Gels with High Thermoelectric Properties and High Mechanical Stretchability Consisted of a Low Cost and Green Deep Eutectic Solvent

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Table S1. Thermoelectric properties of ionogels and eutectogels and the toxicity and cost of the liquid phase of these gels. PVDF-HFP: poly(vinylidene fluoride-co-hexafluoropropylene); PEG: polyethylene glycol; WPU: waterborne polyurethane; BC: bacterial cellulose; σ_i: ionic conductivity; α_i: ionic thermopower; RH: relative humidity.

Gelator	Liquid	Toxicity	Cost	α_i (mV K^{-1})	σ_i (mS cm^{-1})	RH
WPU	**ChCl:EG**	**No**	**Low**	**19.5**	**8.4**	**90%**
PVDF-HFP	EMIM:DCA	Yes	High	26.1	6.7	72%[1]
PVDF-HFP/PEG	EMIM:TFSI	Yes	High	14	0.8	N.A.[2]
WPU	EMIM:DCA	Yes	High	34.5	8.4	90%[3]
BC	EMIM:DCA	Yes	High	18.04	28.8	N.A.[4]
SiO_2	EMIM:DCA	Yes	High	14.8	47.5	72%[5]

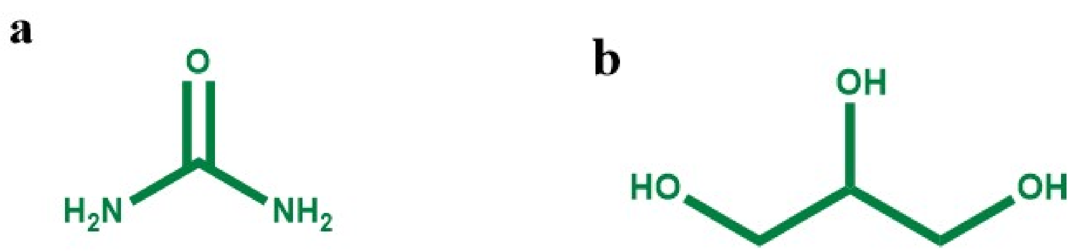

Fig. S1 Chemical structures of a) urea and b) glycerol.

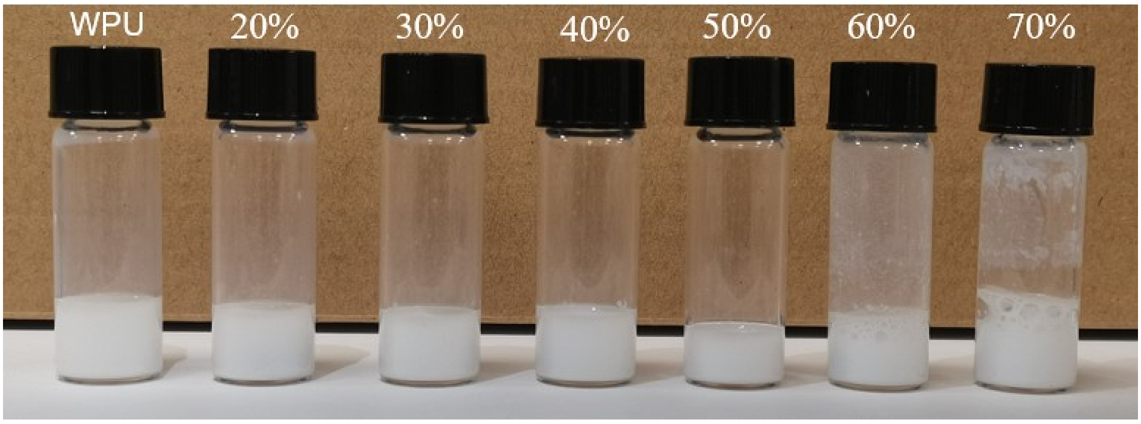

Fig. S2 Digital photos of WPU/ChCl:EG-*x* dispersions. The ChCl:EG loading (*x*) is the percentage of the ChCl:EG weight with respect to the total weight of ChCl:EG and WPU.

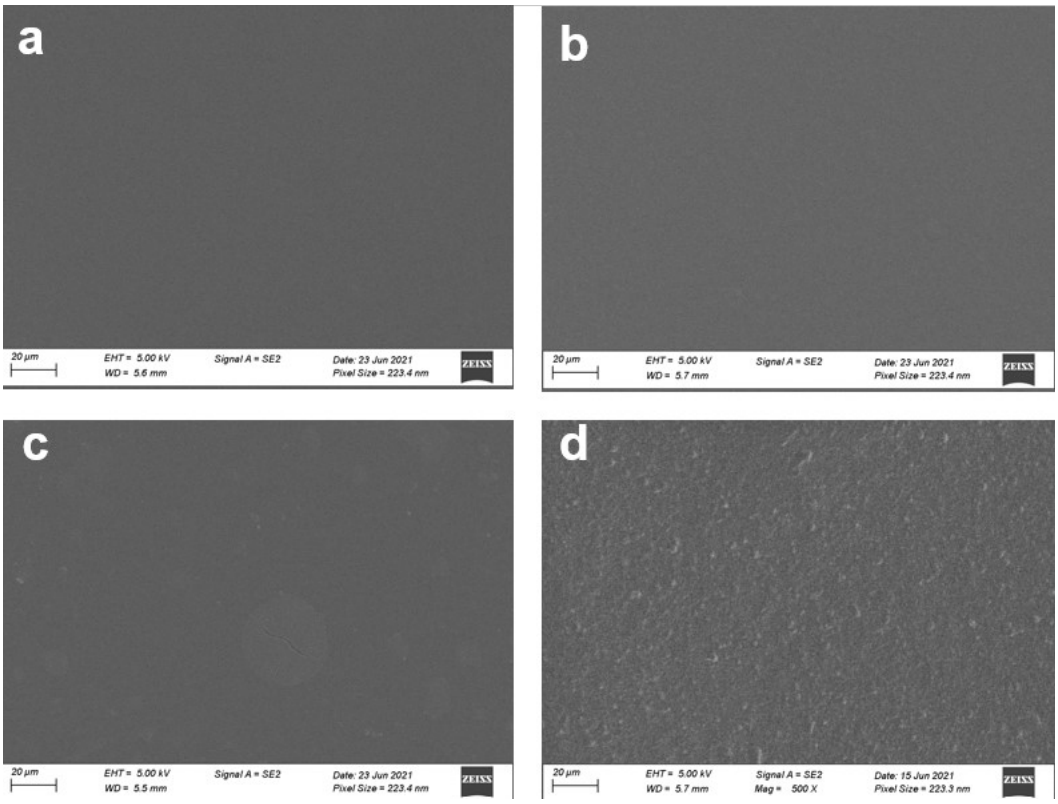

Fig. S3 SEM images of (a) a WPU film, (b) WPU/ChCl:EG-20% eutectogel, (c) WPU/ChCl:EG-50% eutectogel and (d) WPU/ChCl:EG-70% eutectogel.

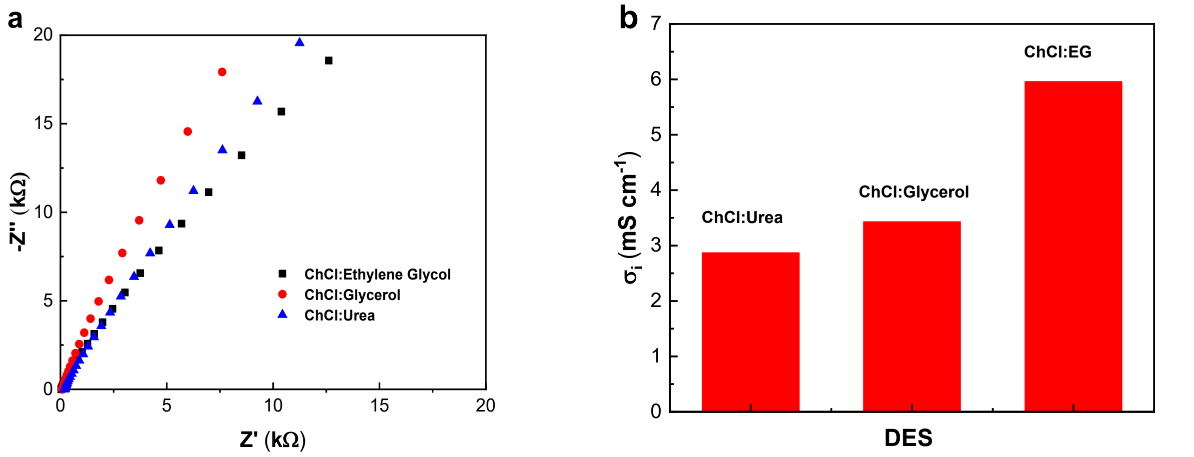

Fig. S4 (a) Nyquist plots of WPU/DES-50% eutectogels with different hydrogen bond donors (HBDs). (b) Ionic conductivities of WPU/DES-50% eutectogels with different HBDs at the relative humidity of 70%.

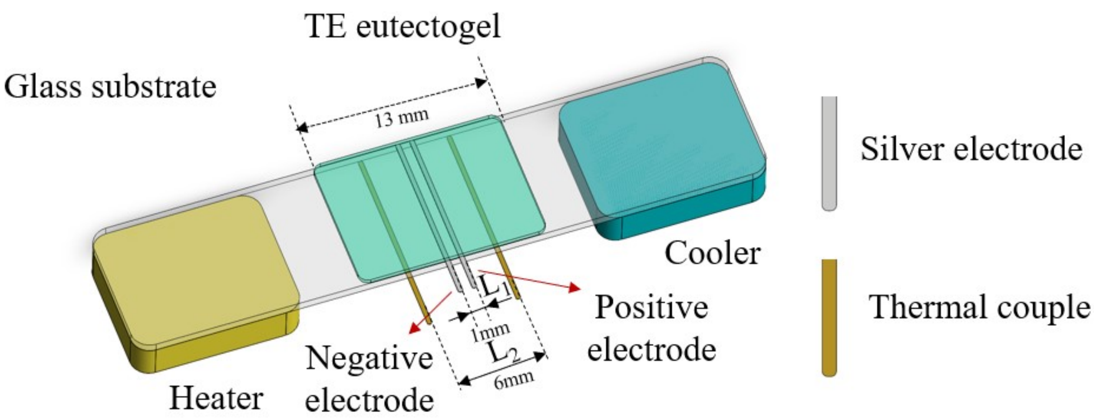

Fig. S5 Schematic illustration of the setup for the ionic thermovoltage measurement.

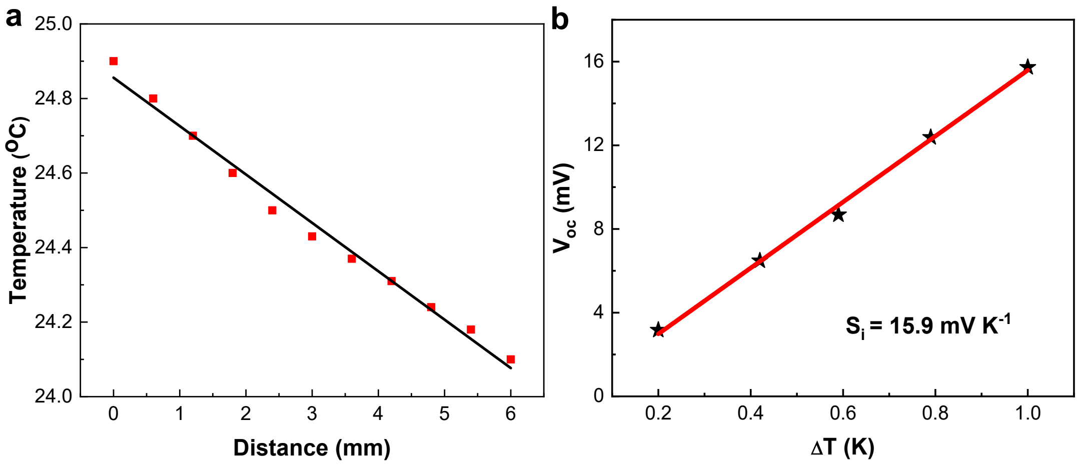

Fig. S6 (a)Variation of the temperature with the distance from the high temperature leg of the thermal couple. (b)Variation of the open-circuit thermovoltage (V_{oc}) of a eutectogel with the temperature gradient (ΔT). The ionic Seebeck coefficient (S_i) was obtained by linearly fitting the V_{oc}-ΔT results.

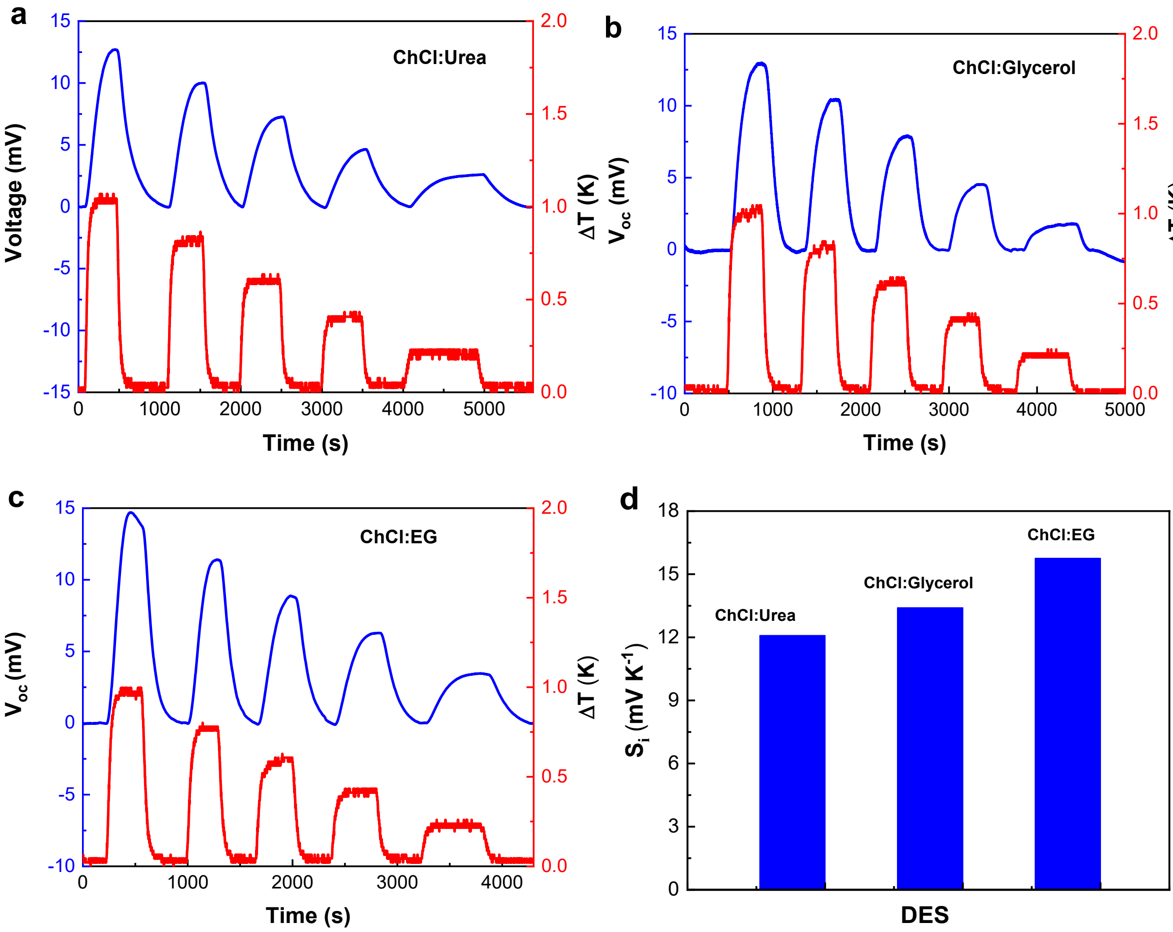

Fig. S7 (a-c) Open-circuit voltage profiles (top, blue line) at different temperature gradients (bottom, red line) of WPU/DES-50% eutectogels with different HBDs at the relative humidity of 70%. (d) Ionic Seebeck coefficient and ionic conductivities of WPU/DES-50% eutectogels with different HBDs at the relative humidity of 70%.

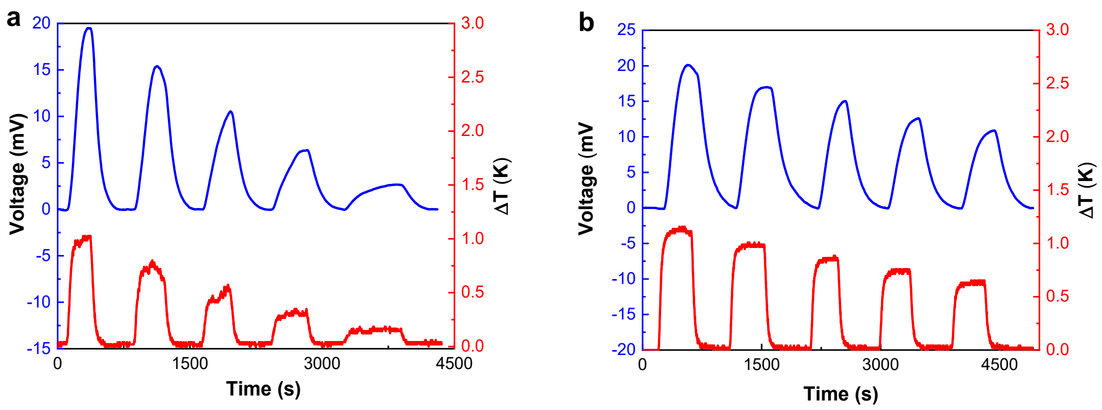

Fig. S8 Open-circuit voltage profiles of a WPU/ChCl:EG-50% eutectogel (a) freshly prepared and (b) stored for one month after the preparation. The relative humidity was 90%.

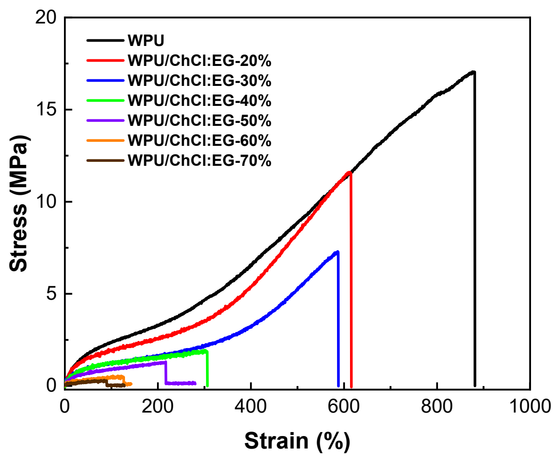

Fig. S9 Stress–strain curves of a WPU film and WPU/ChCl:EG-*x* eutectogels with different ChCl:EG loadings.

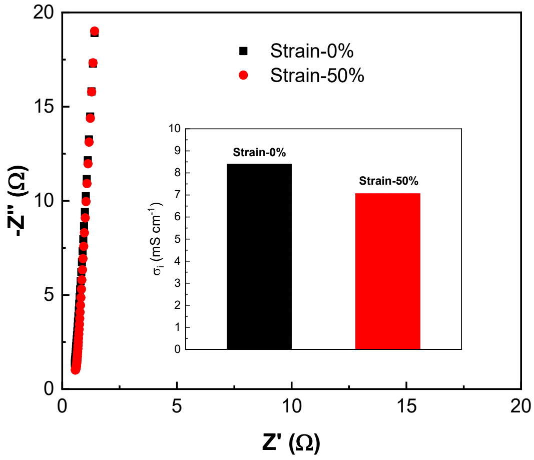

Fig. S10 Nyquist plots of WPU/ChCl:EG-50% eutectogels at relax or under a tensile strain of 50%. The inset shows the ionic conductivities of WPU/DES-50% eutectogels at relax or under a tensile strain of 50%. The relative humidity was 90%.

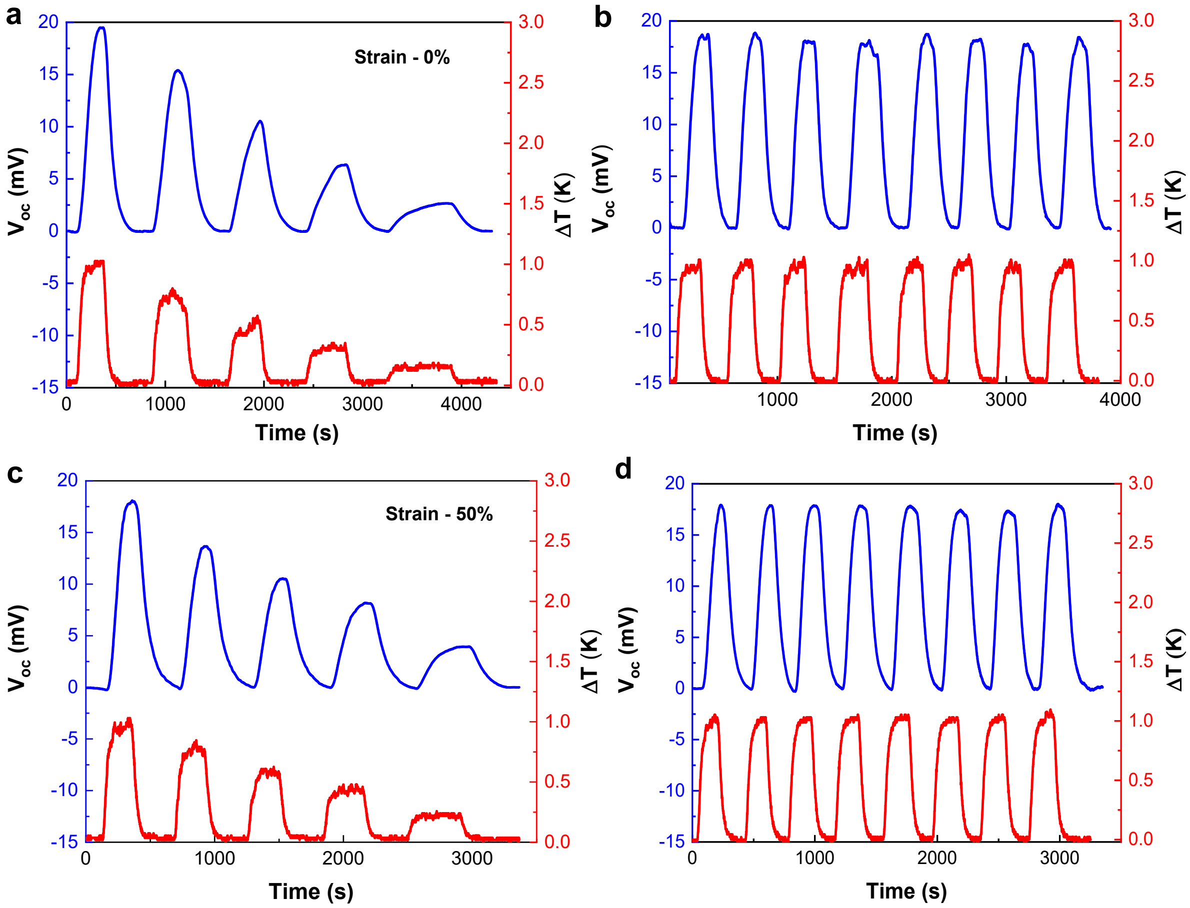

Fig. S11 Open-circuit voltage profiles of a WPU/ChCl:EG-50% eutectogel at relax under (a) various temperature gradients or (b) a constant temperature gradient. Open-circuit voltage profiles of a WPU/ChCl:EG-50% eutectogel at the tensile strain of 50% under (c) various temperature gradients or (d) a constant temperature gradient. The relative humidity was 90%.

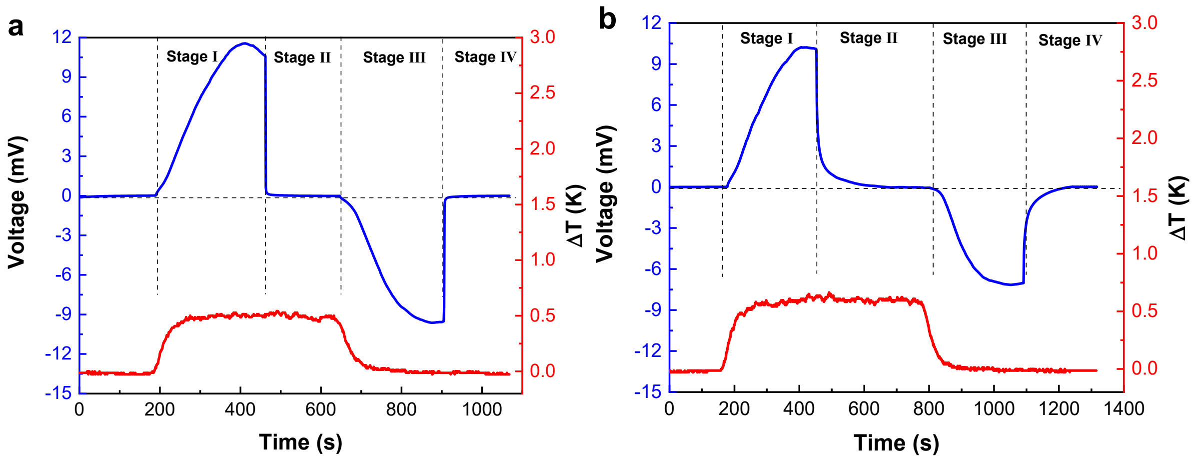

Fig. S12 Voltage profiles on an external load with the resistances of (a) 1 kΩ and (b) 20 kΩ connected to an ITEC with WPU/ ChCl:EG -50%. The ionogel was in the relaxed state.

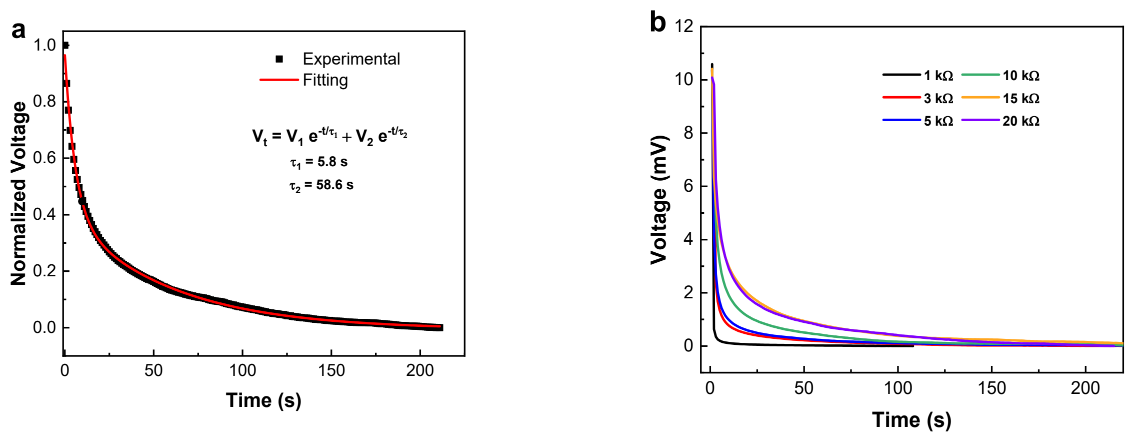

Fig. S13 (a) Fitting of the voltage profile on an external load with the resistance of 20 kΩ during the stage II. (b) The voltage profiles during the stage II of an external load with different resistances connected to an ITEC.

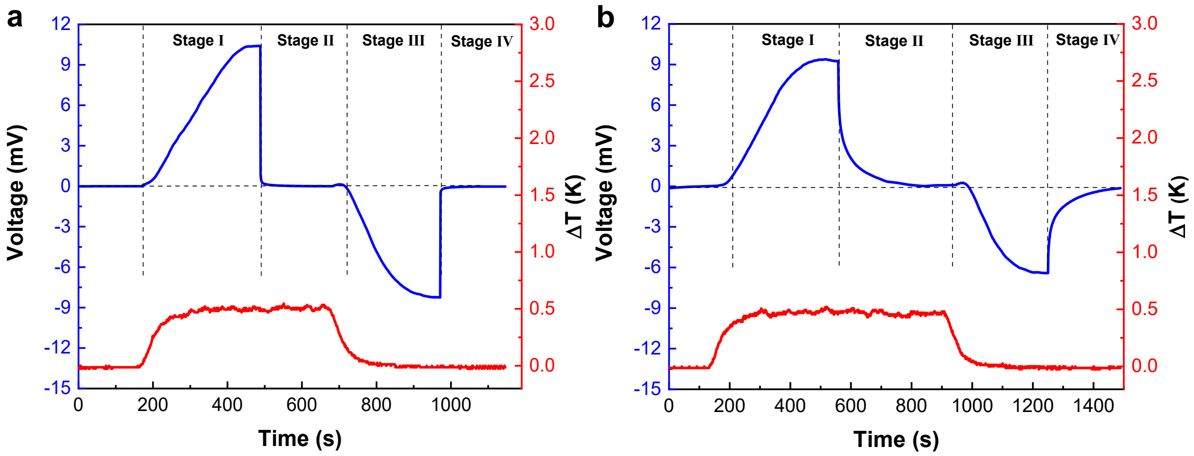

Fig. S14 Voltage profiles on an external load with the resistances of (a) 1 kΩ and (b) 20 kΩ connected to an ITEC with WPU/ChCl:EG-50%. The ionogel was under a strain of 50%.

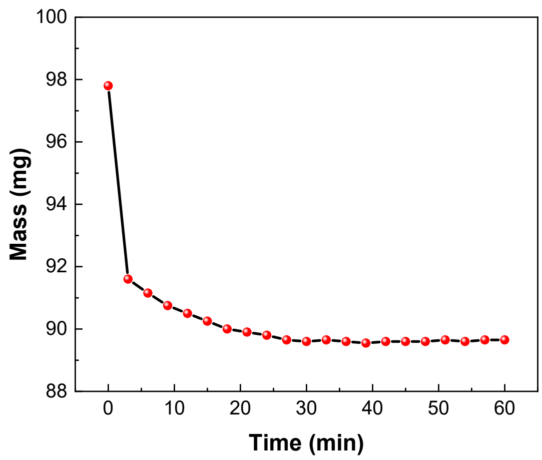

Fig. S15 Variation of the mass with time dried at 60°C.

References

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