Supplementary Information (SI) for Materials Horizons.
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Supporting Information

Mass Production of Robust Hydrogel Electrolytes for High-Performance Zinc-ion Battery

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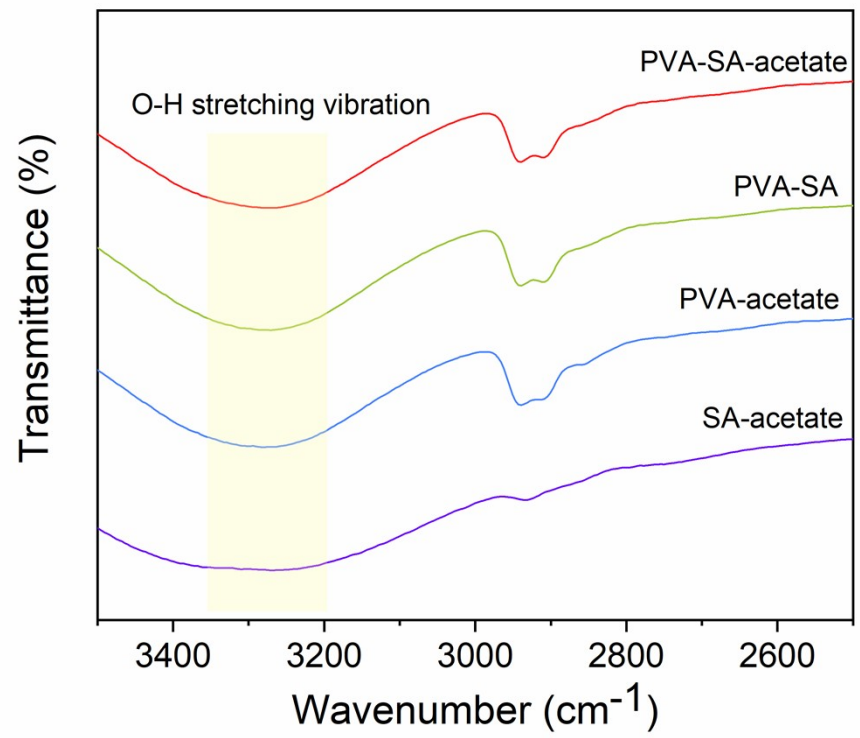

Fig. S1. FTIR spectra of the O-H bond of the PVA-SA-acetate, PVA-SA, PVA-acetate and SA-acetate.

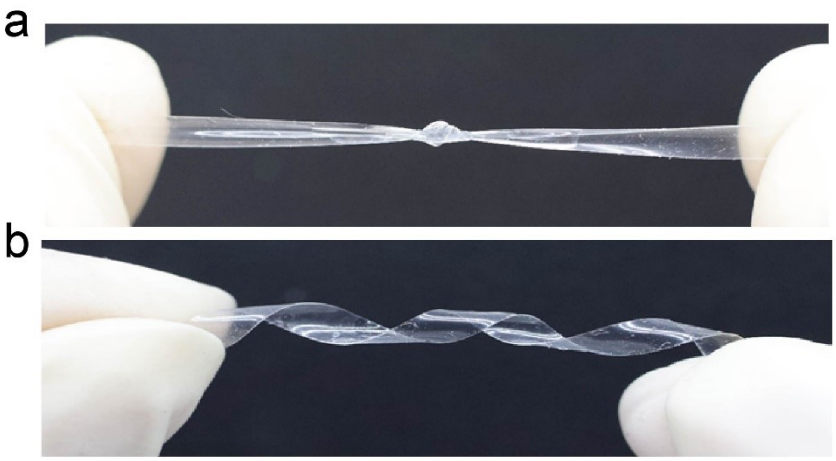

Fig. S2. The photographs of knotting and twisting of PVA-SA-acetate.

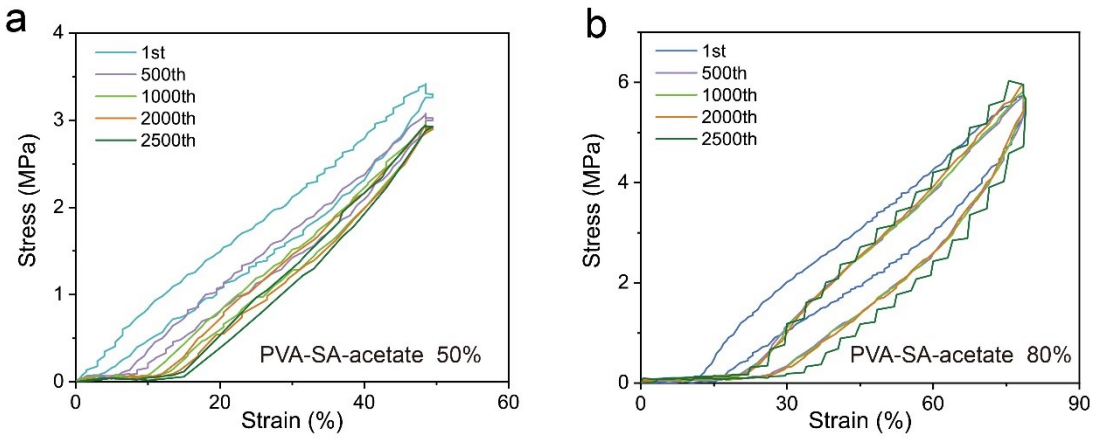

Fig. S3. Stress-strain curves of successive compression cycles under (a) 50% strain and (b) 80% strain for PVA-SA-acetate.

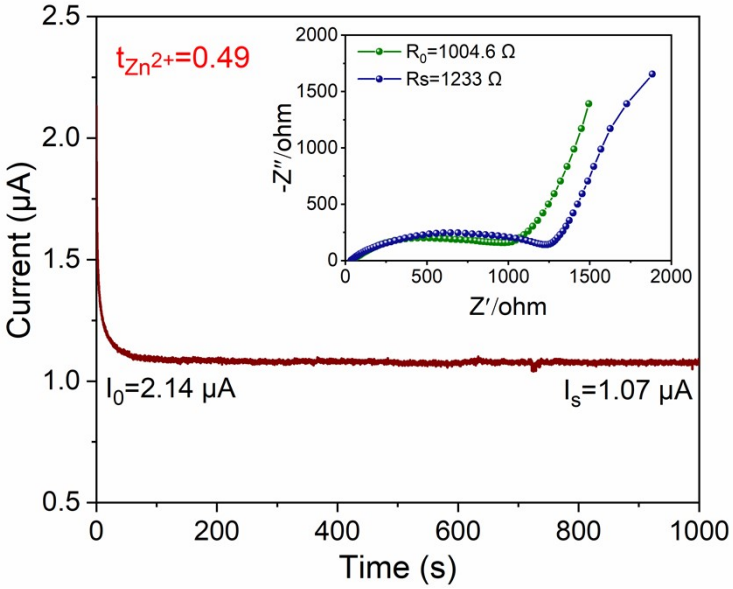

Fig. S4. The Zn^{2+} transference number of liquid electrolyte.

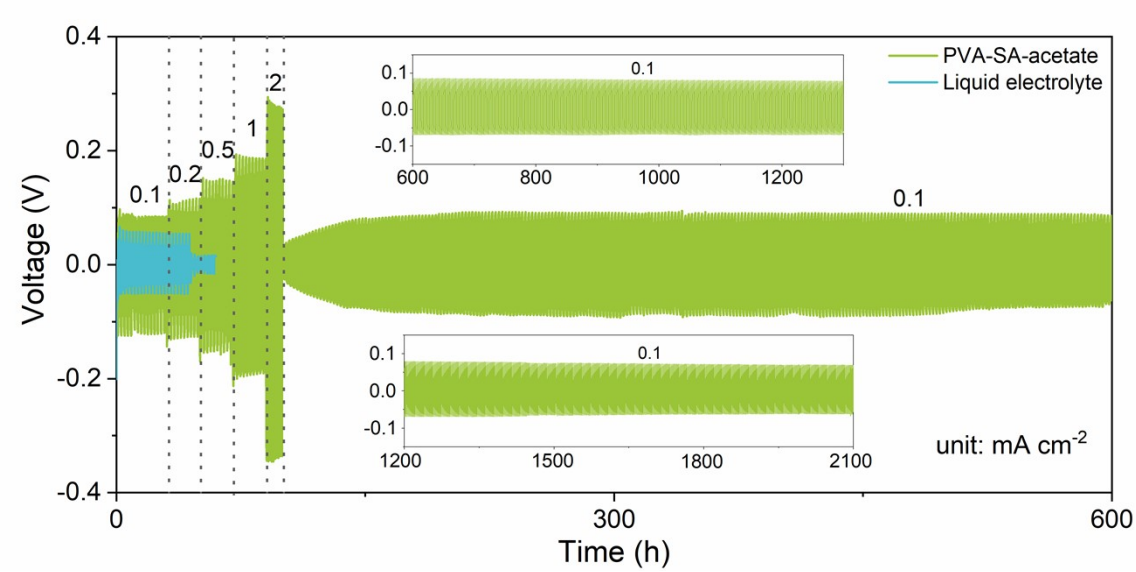

Fig. S5. Rate performance of the symmetric cells based on PVA-SA-acetate at current densities from 0.1 to 2 mA cm^{-2}.

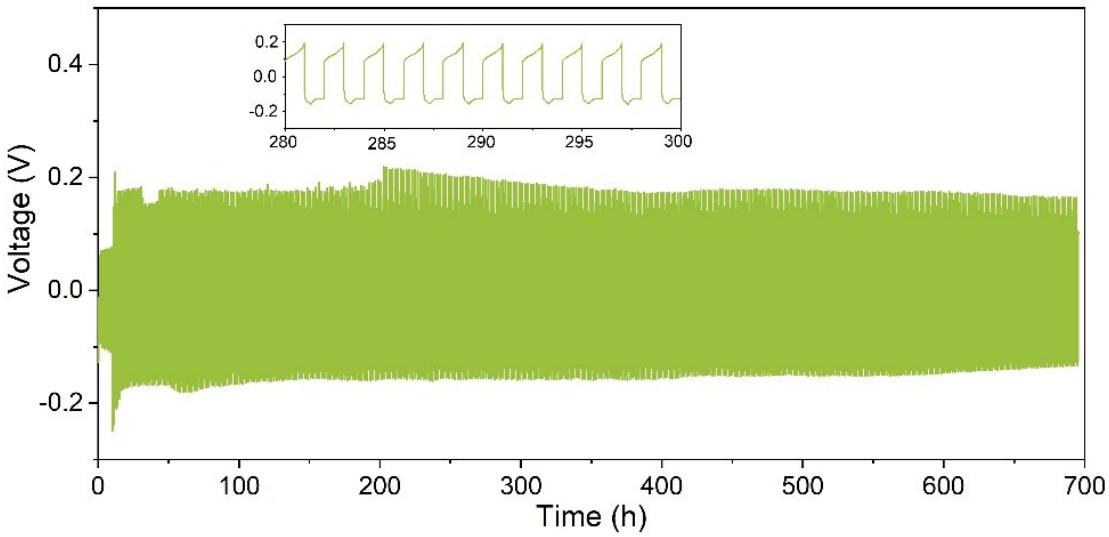

Fig. S6. Voltage profiles of symmetric cells based on PVA-SA-acetate at 2 mA cm^{-2}, 2 mAh cm^{-2}.

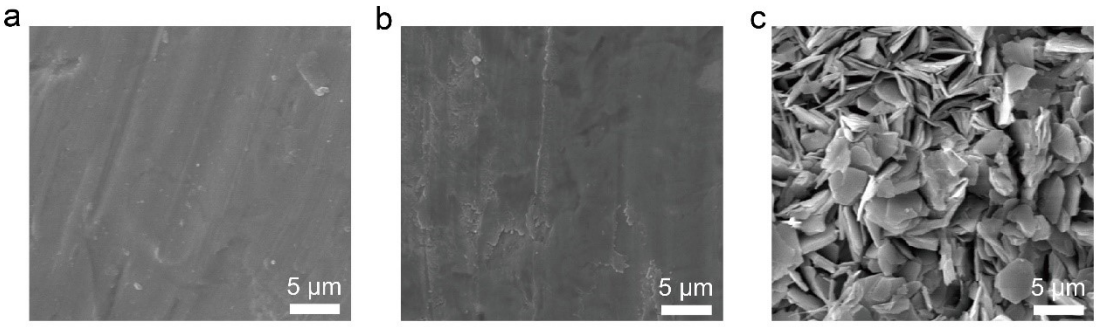

Fig. S7. The SEM of Zn metal anode, (a) the original state of Zn, (b) the SEM of Zn with PVA-SA-acetate hydrogel electrolyte after 100 cycles and (c) the SEM of Zn with liquid electrolyte after 100 cycles.

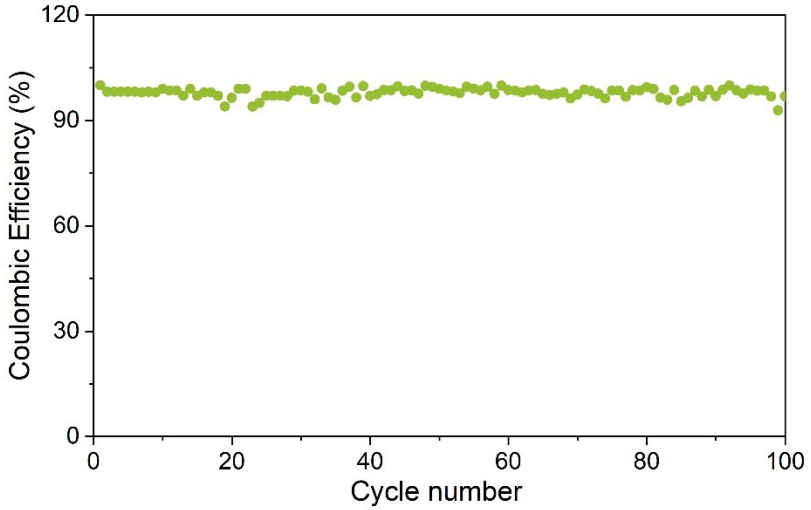

Fig. S8. The Zn||PVA-SA-acetate||Ti asymmetric cell.

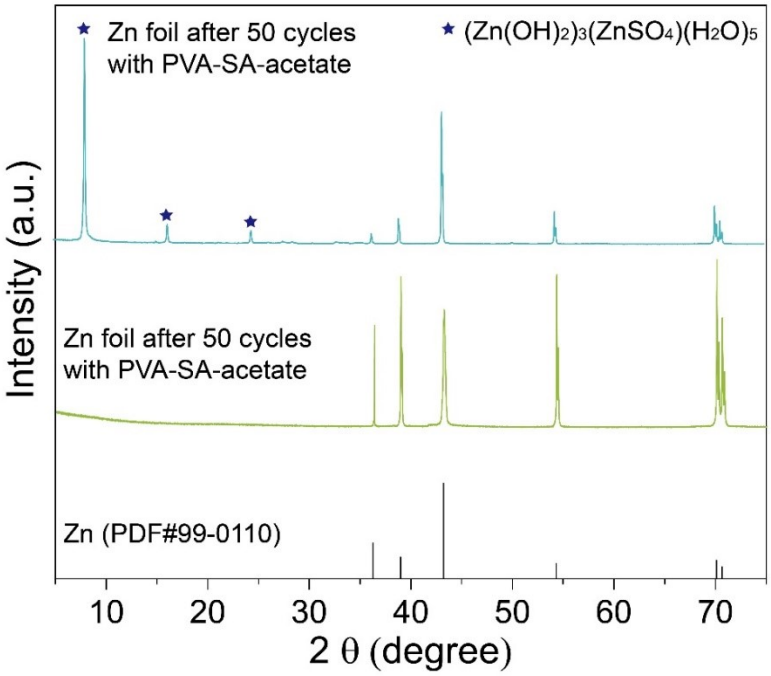

Fig. S9. XRD patterns of Zn foils at the pristine state and the deposited states after cycling in the Zn||Zn cell for 50 cycles with liquid electrolyte and PVA-SA-acetate.

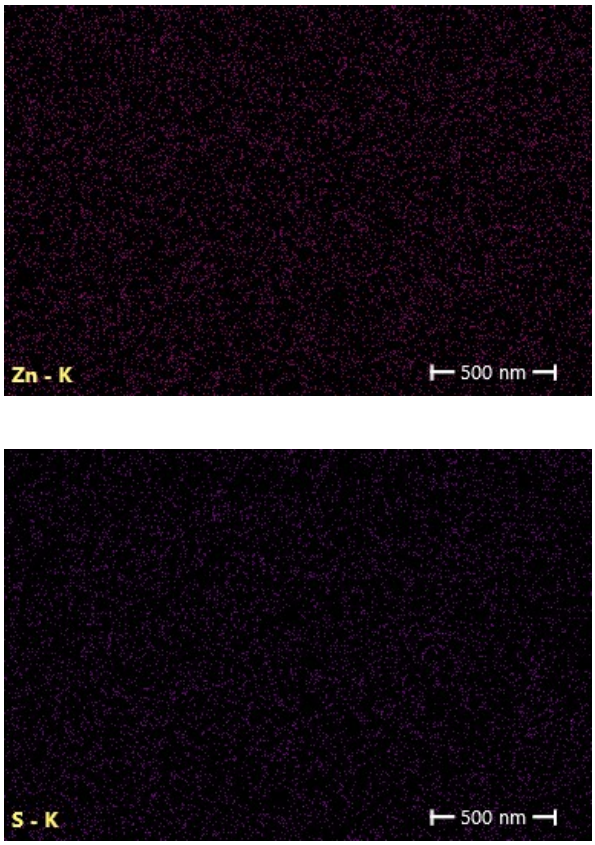

Fig. S10. EDS mapping image of liquid electrolyte after cycling in the Zn||Zn cell for 50 cycles.

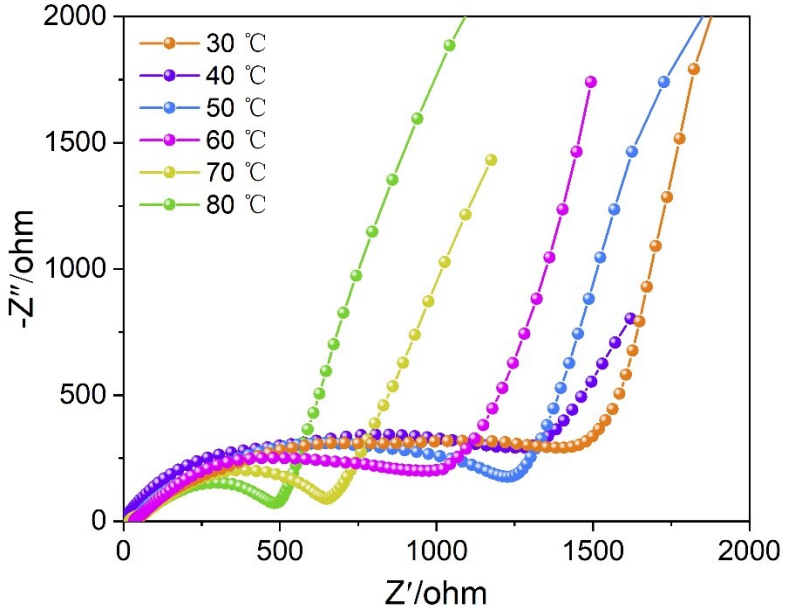

Fig. S11. Nyquist plots at different temperatures of PVA-SA-acetate.

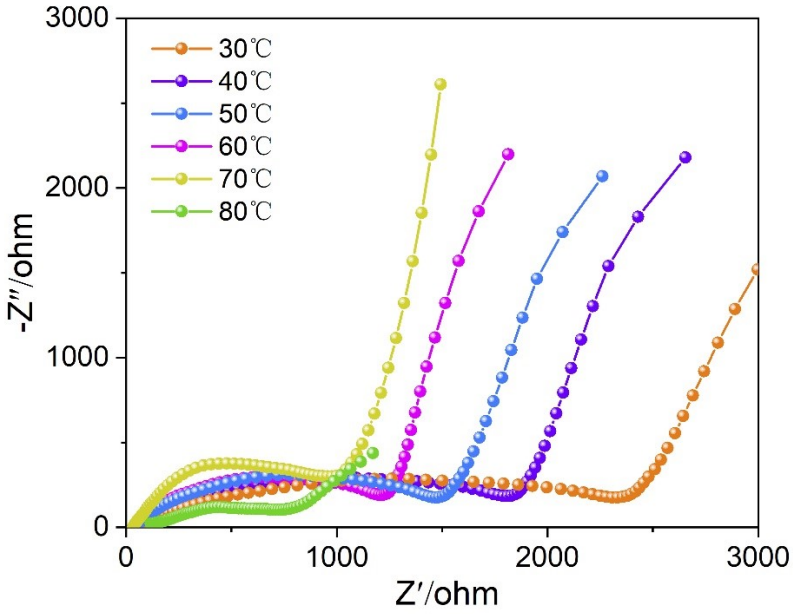

Fig. S12. Nyquist plots at different temperatures of liquid electrolyte.

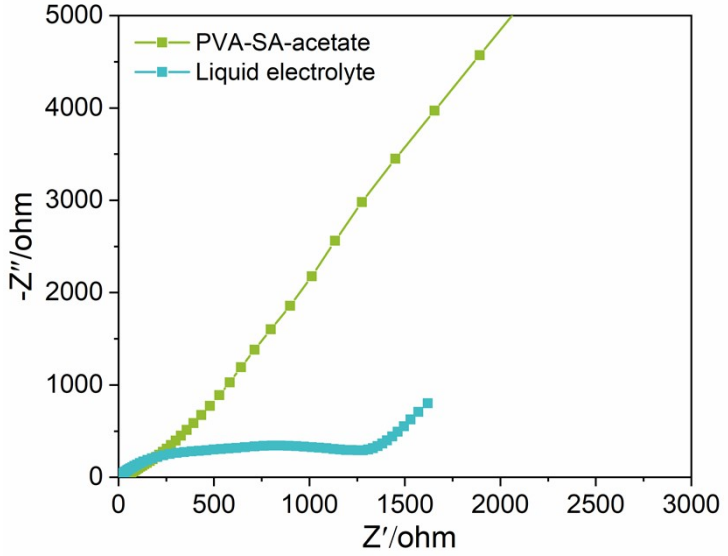

Fig. S13. Nyquist plots of PVA-SA-acetate and liquid electrolyte.

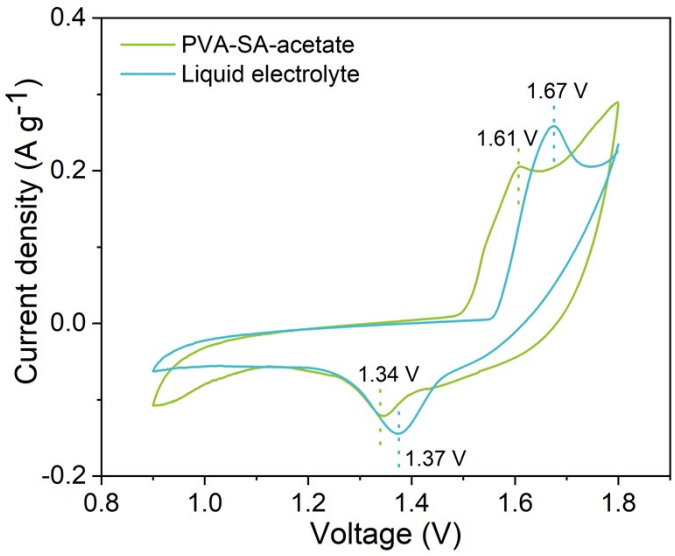

Fig. S14. The CV curves of Zn||MnO_2 full cell with PVA-SA-acetate and liquid electrolyte.

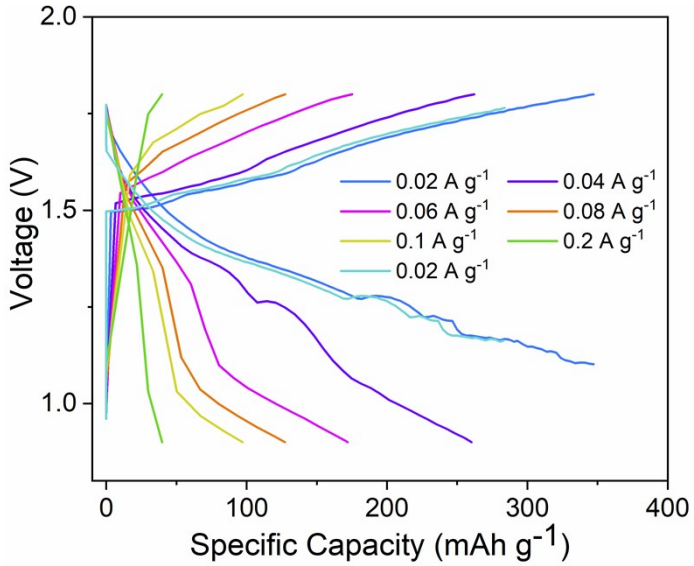

Fig. S15. The galvanostatic charge-discharge of Zn||PVA-SA-acetate||MnO_2 full cell at different current densities.

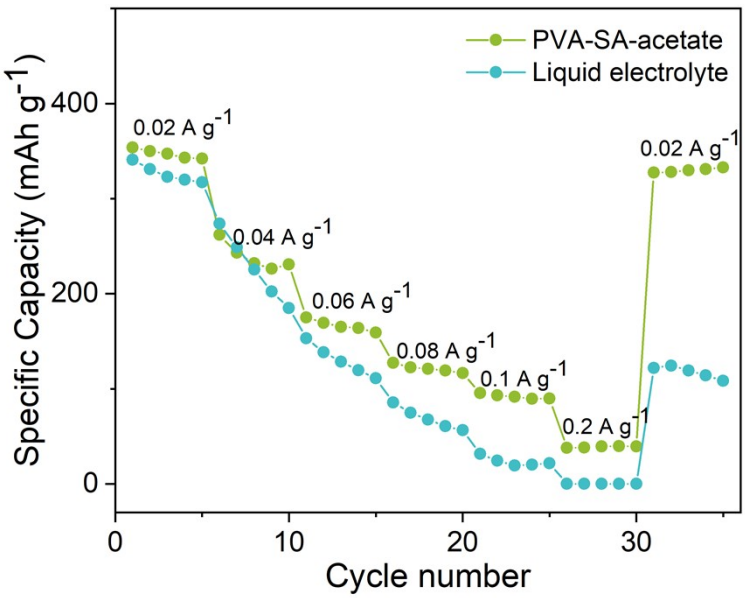

Fig. S16. Rate capabilities of Zn||PVA-SA-acetate||MnO_2 full cell at various current densities from 0.1 to 2 A g^{-1}.

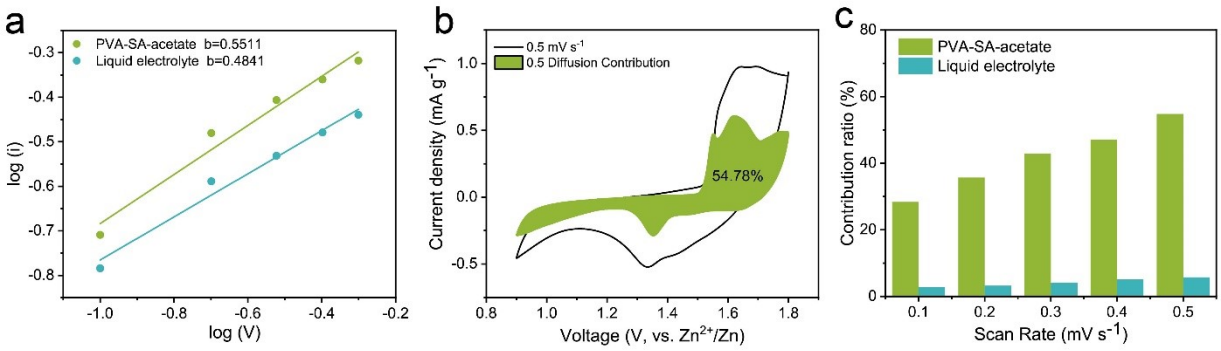

Fig. S17. (a) b value. (b) Diffusion contribution at 0.5 mV s^{-1}. (c) Normalized capacity contributions at different scan rates from 0.1 to 0.5 mV s^{-1}.

Fig. S18. Pouch cells based on PVA-SA-acetate with pristine voltage.

Fig. S19. Pouch cells based on PVA-SA-acetate under the cutting state with barely any voltage change.

Fig. S20. Large pouch cells based on PVA-SA-acetate (length is 12 cm, width is 10 cm).

Table S1. The comparison of stress and strain of this work and other reported hydrogels electrolytes.

Materials	Strength / MPa	Strain (%)
PVA/DESs [1]	20.2	550
PVA/DMSO [2]	11.2	1879
PVA/PMEA [3]	34.8	1500
PVA/PAA [4]	1.4	750
PVA/PAM-co-PAA [5]	7.8	700
PVA/SA/TC [6]	0.3	530
PVA/CNFs [7]	8.3	650
FDA-SNF/PVA [8]	13.7	250
AgNSs/PVA [9]	1.3	400
PVA/CMC [10]	1.8	740
PVA/$Zn(Ac)_2$ [11]	4.2	160

Table S2. The comparison of toughness and strength of this work and other reported hydrogels electrolytes.

Materials	Strength / MPa	Toughness / MJ m^{-3}
PVA/DESs [1]	20.2	62.7
PVA/DMSO [2]	11.2	82.3
PVA/PMEA [3]	34.8	214.2
PVA/PAA [4]	1.4	5.4
PVA/PAM-co-PAA [5]	7.8	28.1
PVA/SA/TC [6]	0.3	0.7
PVA/PI [12]	3.5	8.2
PVA/CNFs [8]	8.3	23.8
PVA/DES [13]	6.8	122.3
FDA-SNF/PVA [10]	13.7	9.9

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