Supporting Information

Suppression of extensive ice formation in hydrogel electrolytes enabling low-temperature aqueous Zn batteries

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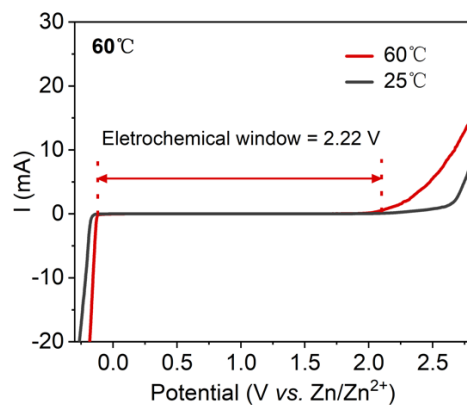[*]Corresponding author: Huilin Pan (panhuilin@zju.edu.cn)

Fig. S1 The electrochemical voltage windows of PVA-0.5SL at 60°C.
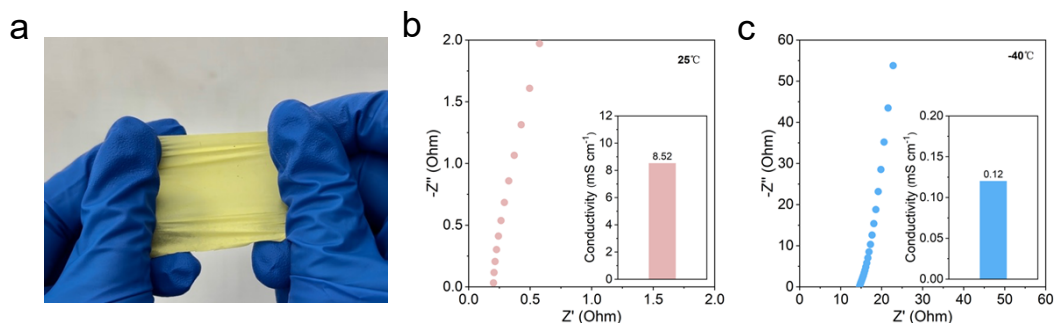

Fig. S2 (a) Digital photo of PVA-0.5SL embedded in a porous polyimide membrane. Ionic conductivity of PVA-0.5SL embedded in a polyimide membrane at 25°C (b) and -40°C (c).
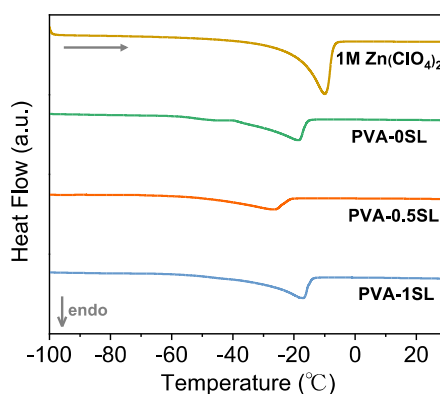

Fig. S3 DSC curves for 1 M $Zn(ClO_4)_2$ and different PVA-based hydrogel electrolytes during the heating process from -100 to 30°C.
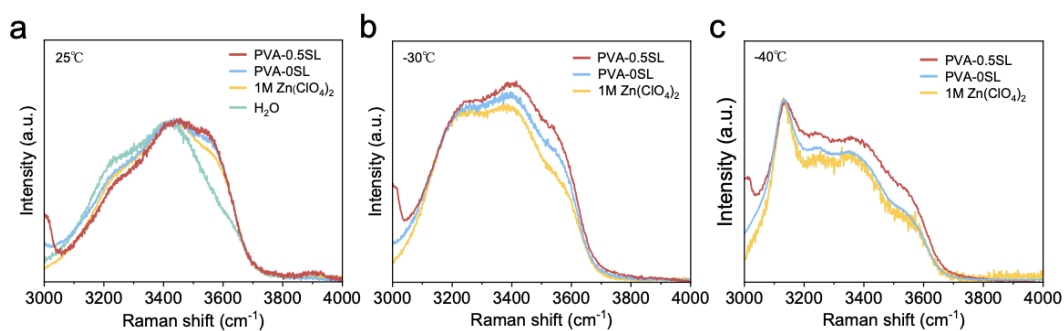
Fig. S4 Ramn spectra of the O-H stretching vibrations for H_2O molecules in different electrolytes at the temperature of 25°C (a), -30°C (b), and -40°C (c)
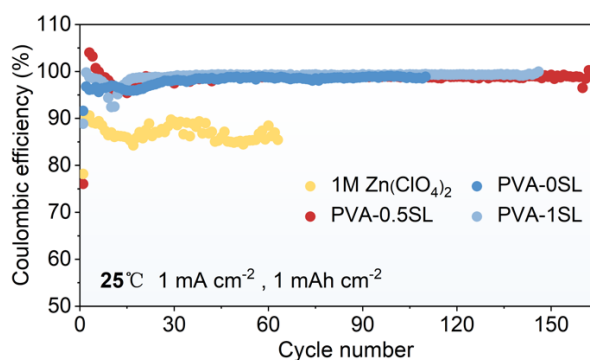

Fig. S5 Coulombic efficiency for Zn deposition in different electrolyte using Zn‖Cu cells under 1 mA cm^{-2} and 1 mAh cm^{-2}.
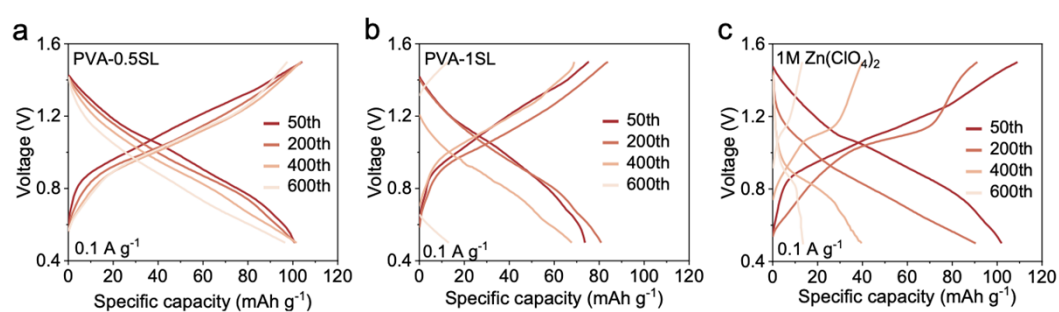

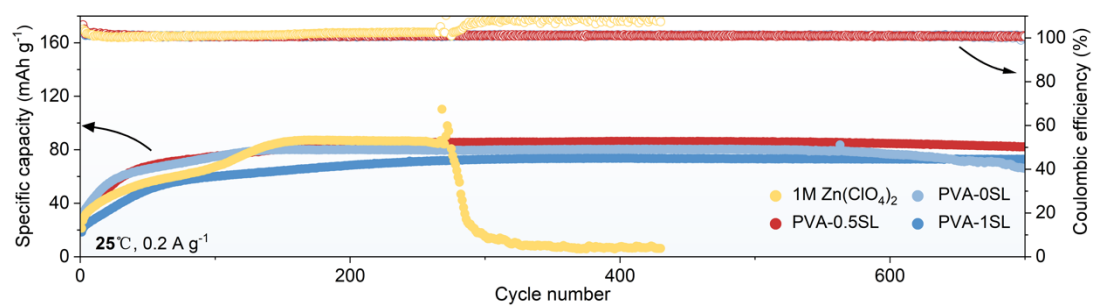**Fig. S6** Charge-discharge voltage curves of Zn‖PANI full cells with different electrolytes at different cycles.

Fig. S7 Cycling stability of Zn‖PANI full cells with different electrolytes at 0.2 A g^{-1} and 25°C.