Supplementary Material

Stable zinc anode by regulating solvated shell and electrode-electrolyte interface with sodium tartrate additive

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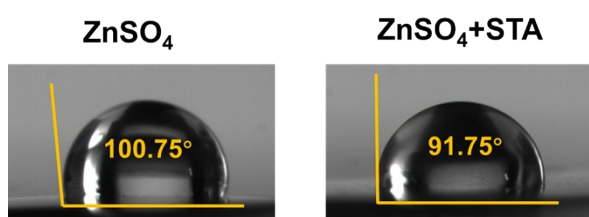**Fig. S1** 1 mol L^{-1} ZnSO$_4$ containing different concentration of STA.

Fig. S2 Contact angle measurement on Zn foil in the 1 mol L^{-1} ZnSO$_4$ with/without STA.
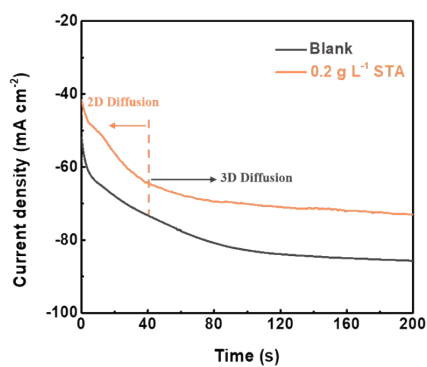

Fig. S3 Chronoamperometry curves indicating Zn^{2+} diffusion process of Zn electrode under different electrolyte system.
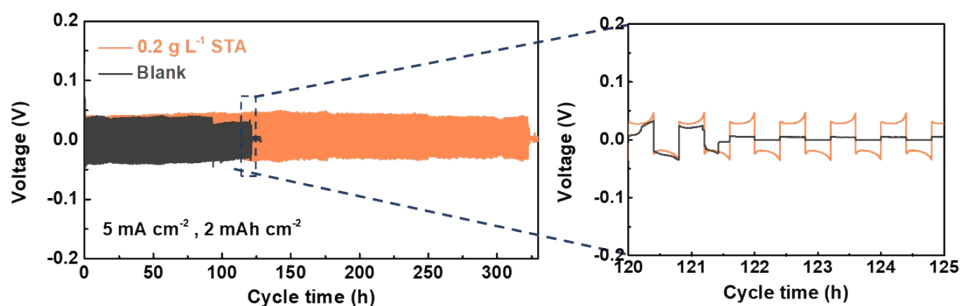
Fig. S4 Voltage-time profiles of Zn‖Zn symmetric cells in 1 mol L^{-1} ZnSO$_4$ with/without STA at 5 mA cm^{-2} with capacity of 2 mAh cm^{-2}.

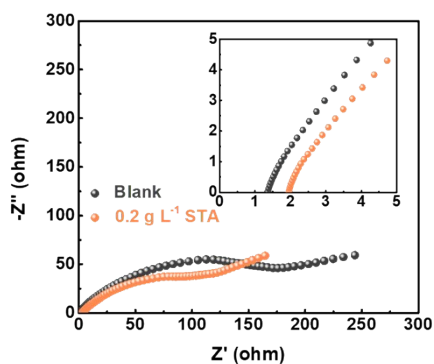**Fig. S5** The electrochemical impedance spectroscopy (EIS) plots of the Zn‖Zn symmetric cells in 1 mol L^{-1} ZnSO$_4$ with/without STA.
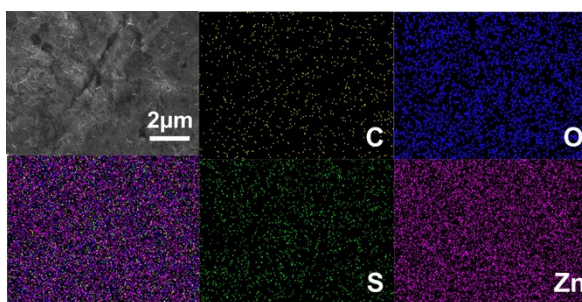

Fig. S6 EDS analysis of Zn anodes after 10 cycles at a current density of 10 mA cm^{-2} and 2 mAh cm^{-2} in Zn‖Zn symmetric cells with STA additives.
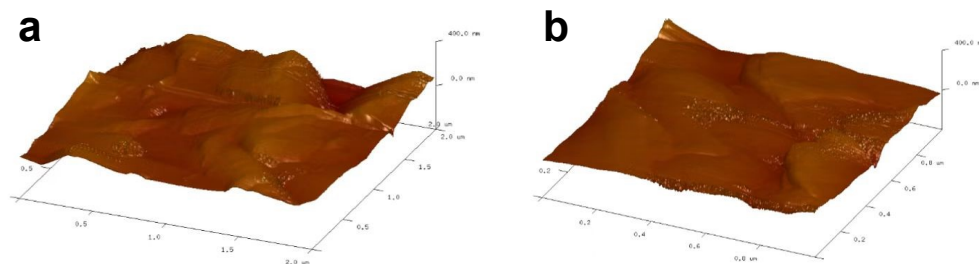
Fig. S7 AFM images of Zn anodes after 10 cycles at 10 mA cm^{-2} with capacity of 2 mAh cm^{-2} in (a) blank electrolyte and (b) electrolyte with STA.
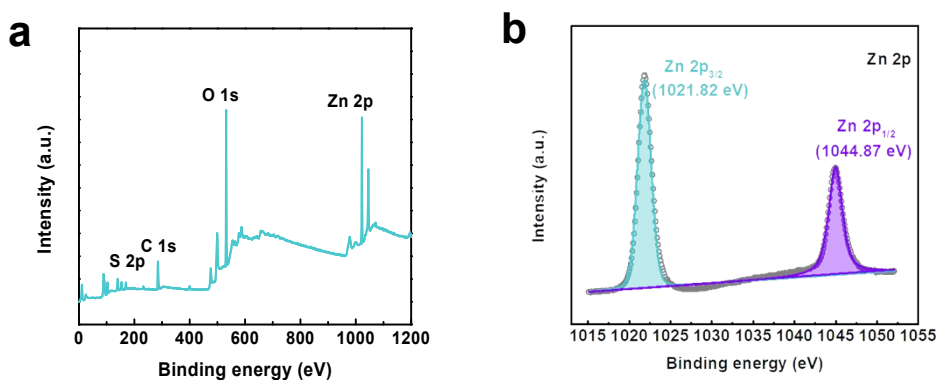

Fig. S8 XPS spectra of (a) the total spectrum and (b) Zn 2p spectrum of Zn anode after 10 cycles with 0.2 g L^{-1} STA.
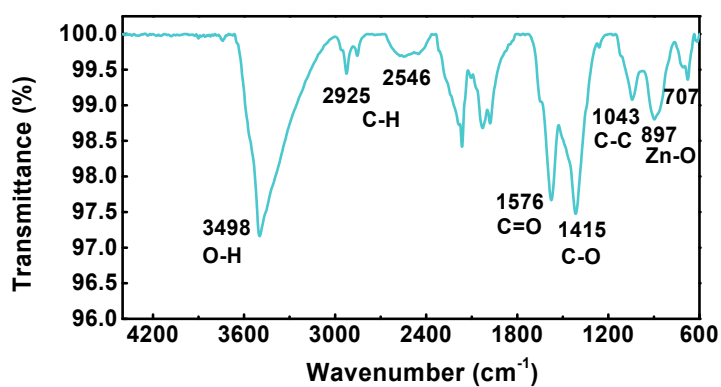

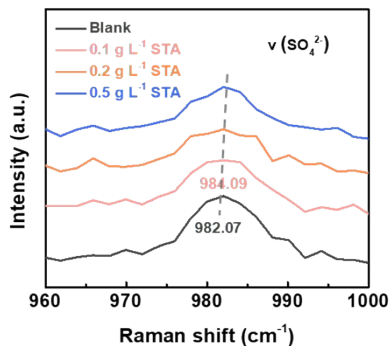**Fig. S9** IR spectra of STA adsorbed on the Zn foil.

Fig. S10 Raman spectra of pure ZnSO$_4$ and electrolytes containing different concentrations STA.
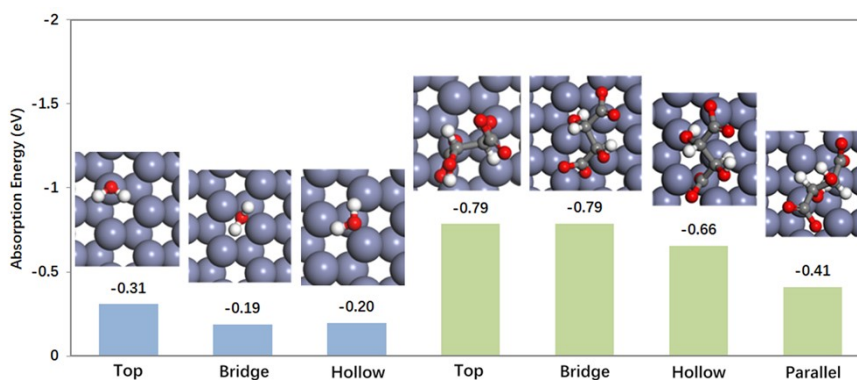

Fig. S11 Absorption energy comparison of H$_2$O and STA on Zn (002) crystal plane, insets show the corresponding absorbed models for different situations.

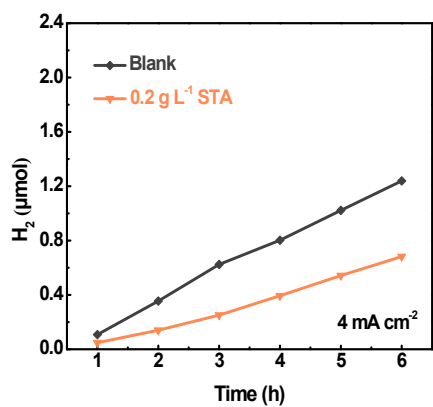**Fig. S12** Schematic diagram of hydrogen evolution device.

Fig. S13 Graph of hydrogen precipitated content with time in different electrolytes at the current density of 4 mA cm^{-2}.
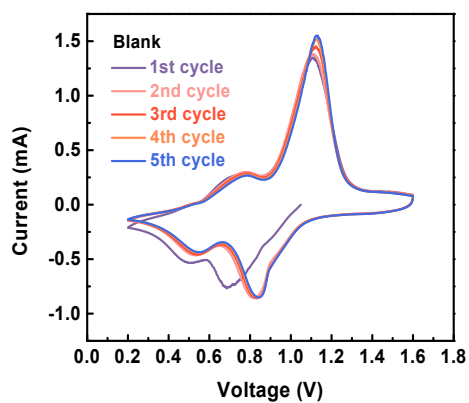

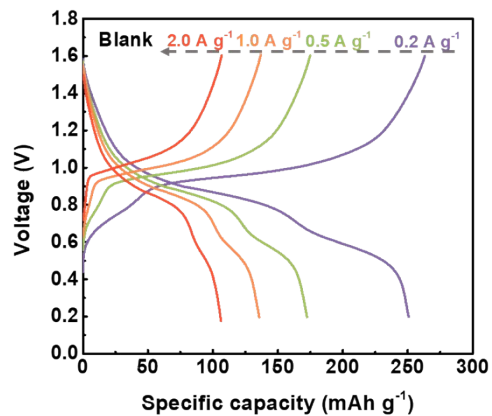**Fig. S14** The CV curves of the Zn||V$_2$O$_5$ cells using blank electrolyte at the scan rate of 1 mV s^{-1}.

Fig. S15 The discharge/charge curves of Zn||V$_2$O$_5$ cells from 0.2 A g^{-1} to 2 A g^{-1} using blank electrolyte.
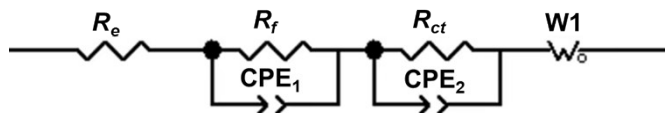
Fig. S16 The equivalent circuits corresponding to Fig. 6d.

	0.2 g L^{-1} STA	Error (%)	Blank	Error (%)
R_e	2.817	1.1583	2.624	1.1583
R_f	3.168	4.8084	9.221	4.8084
R_{ct}	25.51	5.8726	31.83	5.8726
Sum	31.495		43.675	

Table S1 The fitting results of the simulated equivalent circuit.

Fig. S17 Long-term cycling performance of the Zn||V_2O_5 cells in the electrolyte with/without the STA additive at 2 A g^{-1} at 10°C.

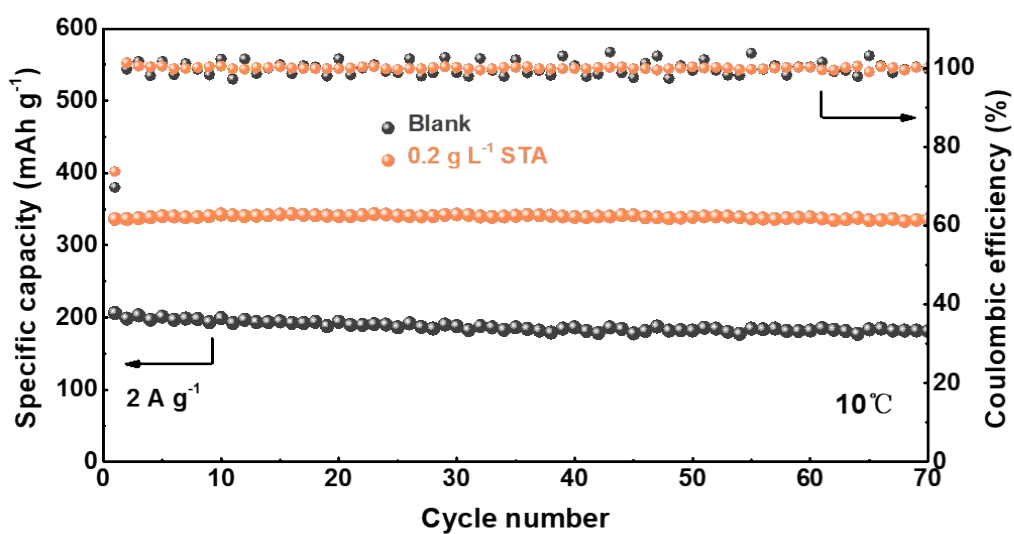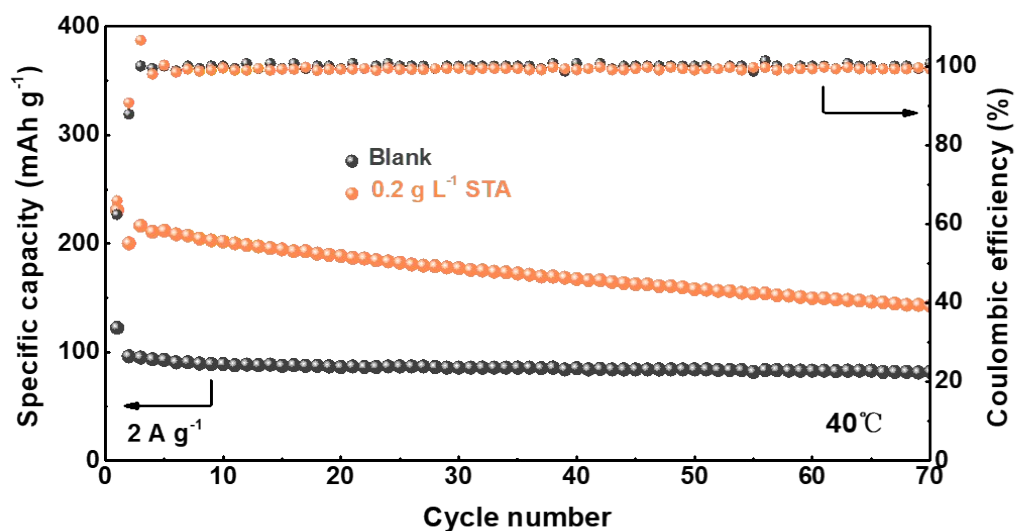**Fig. S18** Long-term cycling performance of the Zn||V_2O_5 cells in the electrolyte with/without the STA additive at 2 A g^{-1} at 40°C.