Supporting Information for

Sugar additive with halogen group enabling highly reversible and dendrite-free Zn anode

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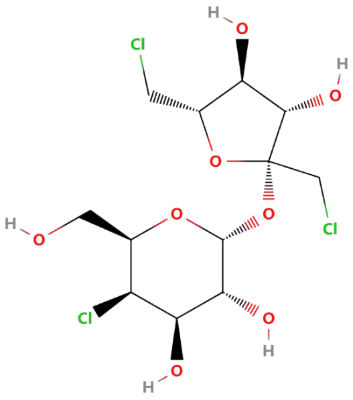

Fig. S1. Schematic diagram of the molecular structure of sucralose.

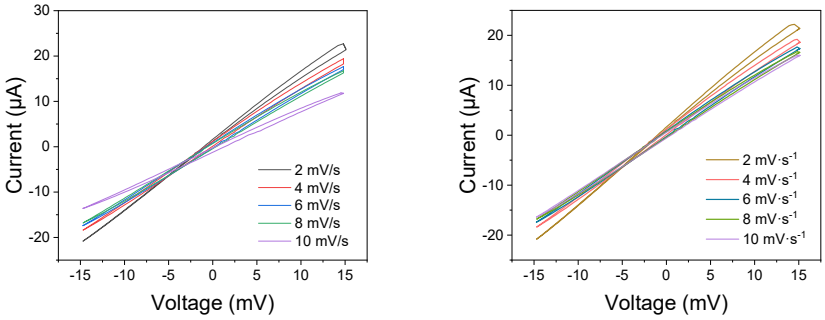

Fig. S2. CV curves of Zn//Zn symmetric cells in ZSO electrolyte (left) and SRL electrolyte (right) at different scan rate.

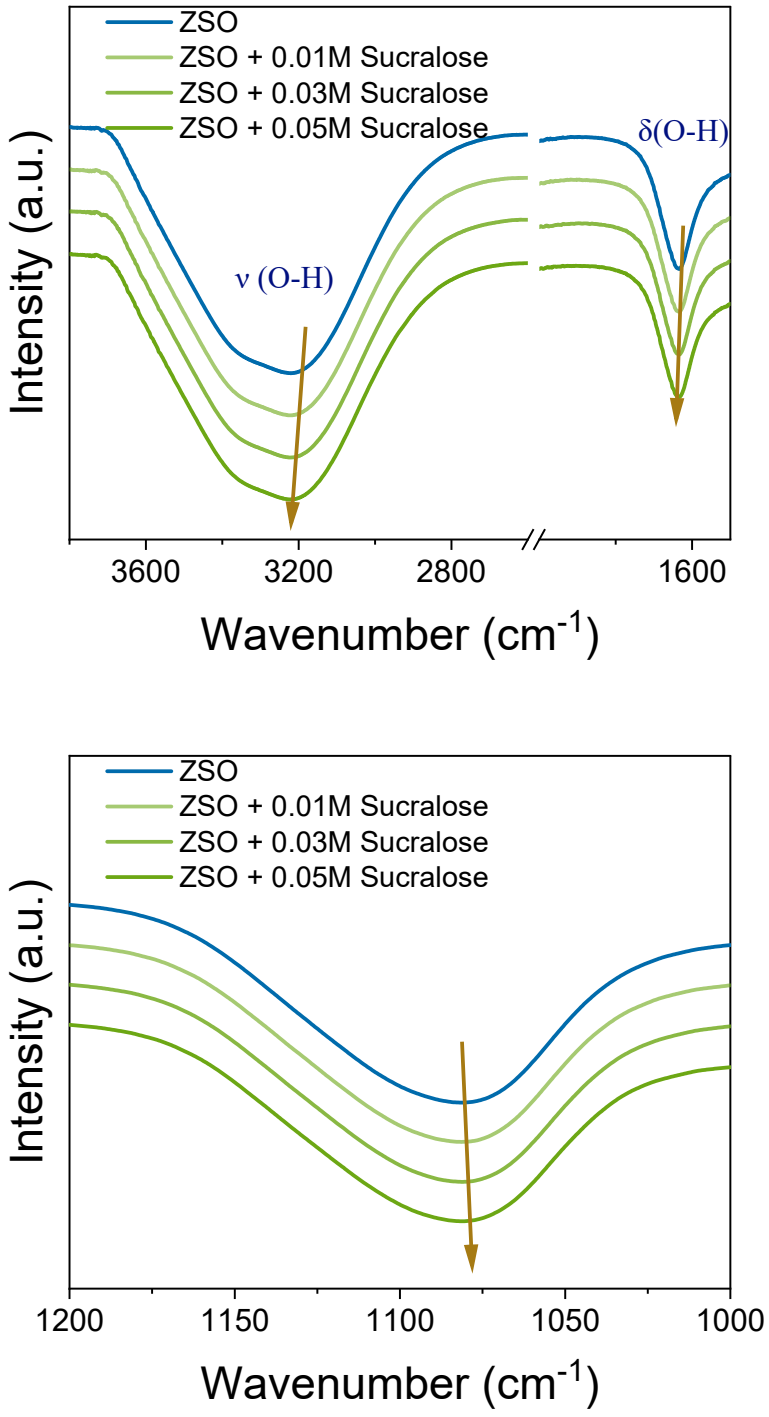

Fig. S3. FTIR spectra for different electrolytes: O-H stretching; O-H bending; and SO_4^{2-} vibration.

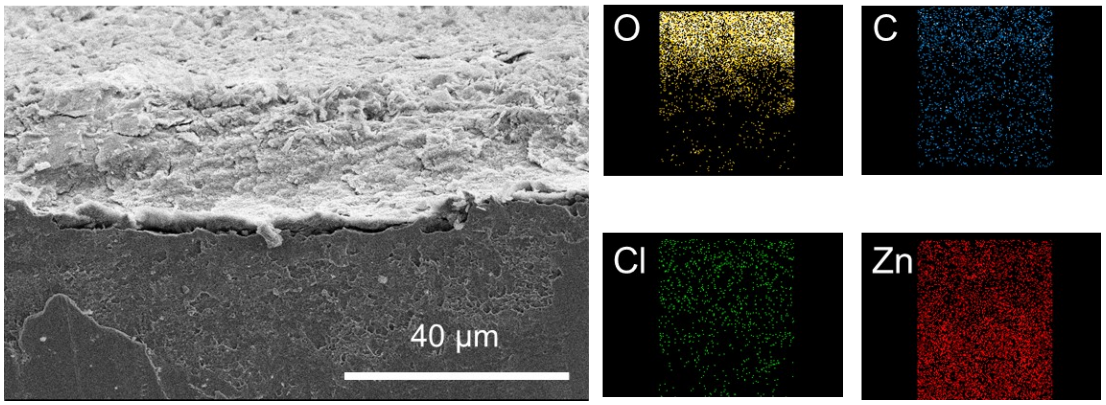

Fig. S4. SEM and EDS images of Zn anodes after cycling in SRL electrolyte.

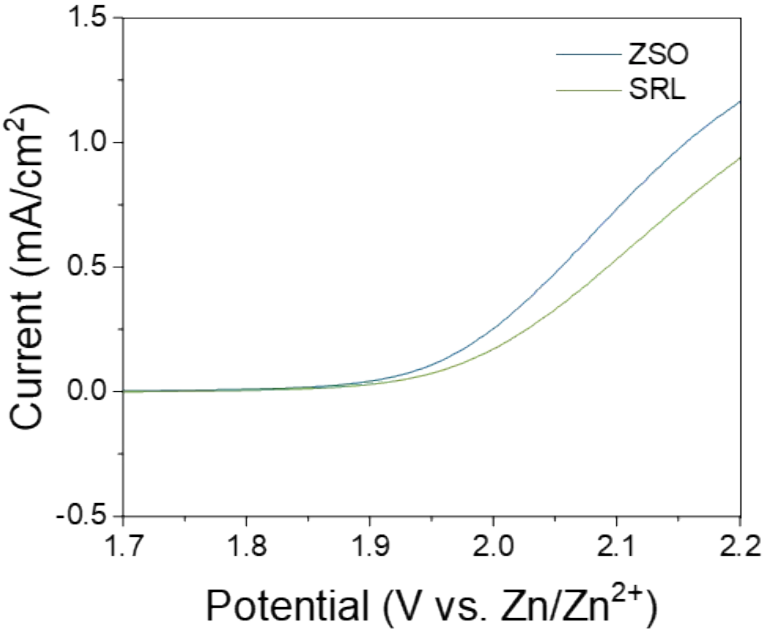

Fig. S5. Linear polarization curves measured in ZSO and SRL electrolytes.

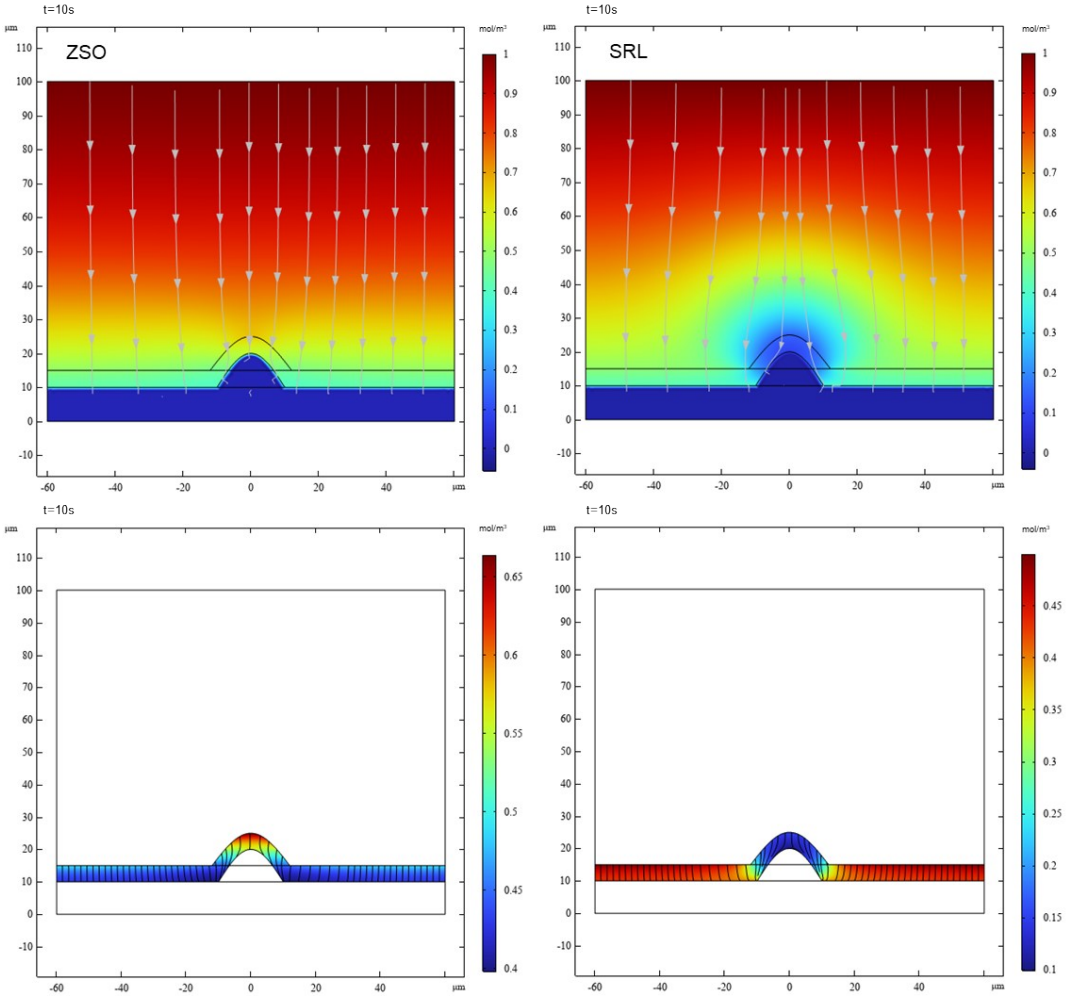

Fig. S6. COMSOL simulation of Zn electrode with or without sucralose during plating.

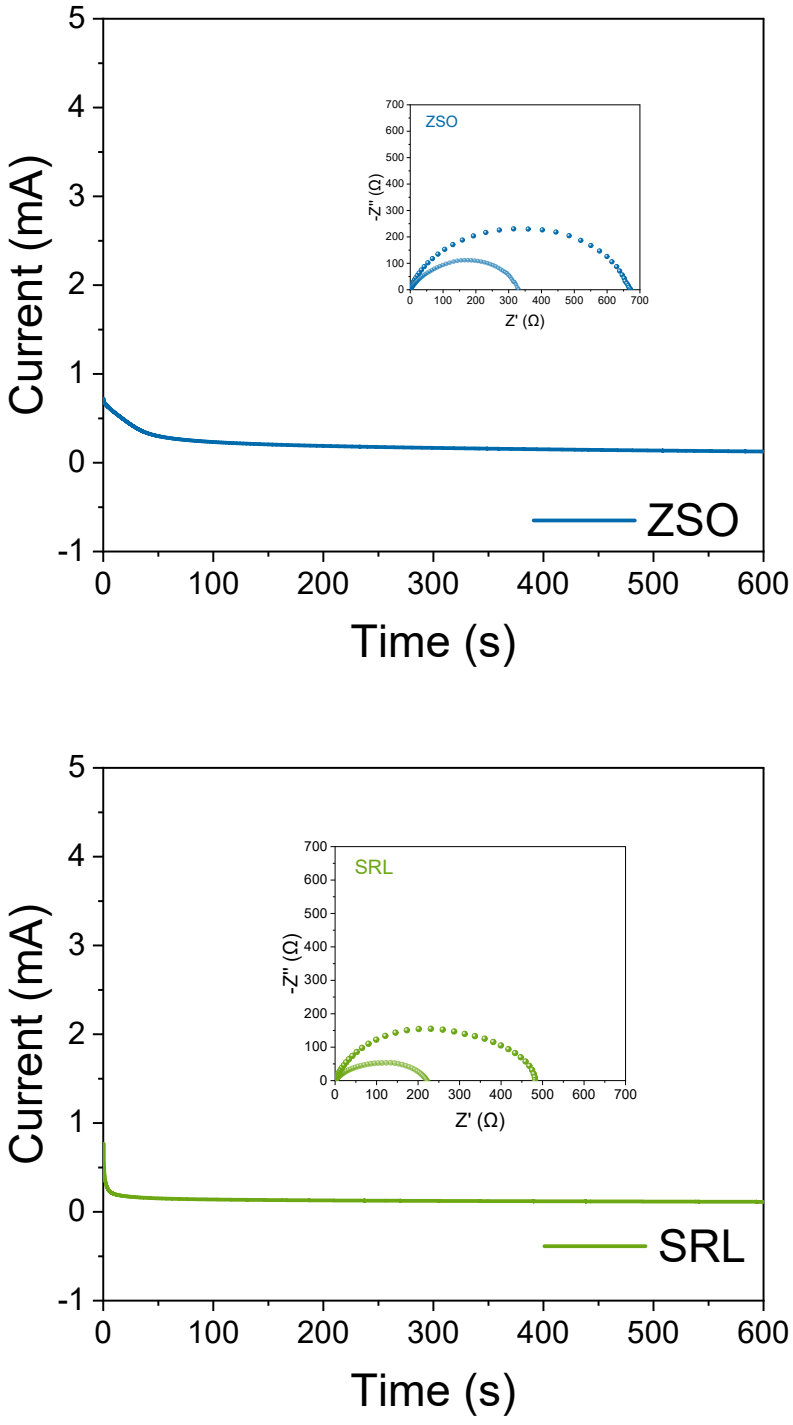

Fig. S7 CA curves of Zn||Zn cells without Et additive in electrolyte (the inset show corresponding Nyquist plots at the initial and steady states).

The Zn^{2+} transference number (t_{Zn}^{2+}) was determined by following the classic electrochemical measurement. First, Zn||Zn battery was assembled. Second, electrochemical impedance spectroscopy was conducted to measure the initial resistance (Ro) with a frequency range from 0.01 Hz to 100 KHz with an amplitude of -150 mV. The open-circuit potential was set as the initial voltage. Then, chronoamperometry was carried out with an overpotential of -150 mV for 600 s. The initial current (Io) and steady-state current (Is) were recorded. Lastly, electrochemical impedance

spectroscopy was conducted again to obtain the steady-state resistance (Rs) under the same conditions. t_{Zn}^{2+} was determined by the following equation:

$$t_{Zn^{2+}} = \frac{I_s(\Delta V - I_O R_O)}{I_O(\Delta V - I_s R_s)}$$

where ΔV is the applied voltage (10 mV); Io and RO are the initial current and resistance, respectively; and Is and Rs are the steady-state current and resistance, respectively. For glass fiber separator in ZSO, with Io = 0.765 mA, RO = 330 Ω; and Is = 0.113 mA, Rs = 670 Ω. Thus, t_{Zn}^{2+} = 0.53. However, for glass fiber separator in SRL, with Io = 0.721 mA, RO = 220 Ω; and Is = -0.126 mA, Rs = 481 Ω. Thus, t_{Zn}^{2+} = 0.57

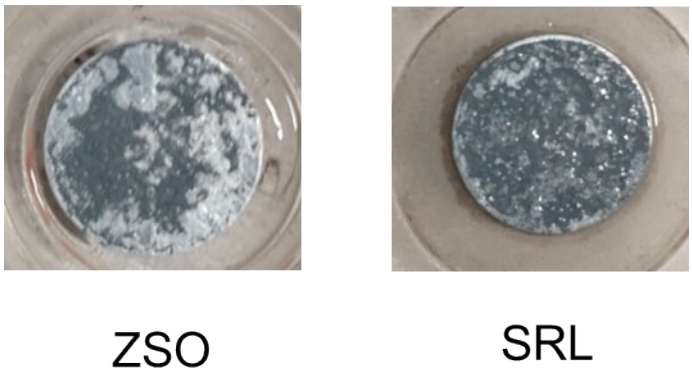

Fig. S8. Optical images of Zn anodes of Zn//Zn symmetric cell after cycling in ZSO and SRL electrolytes.

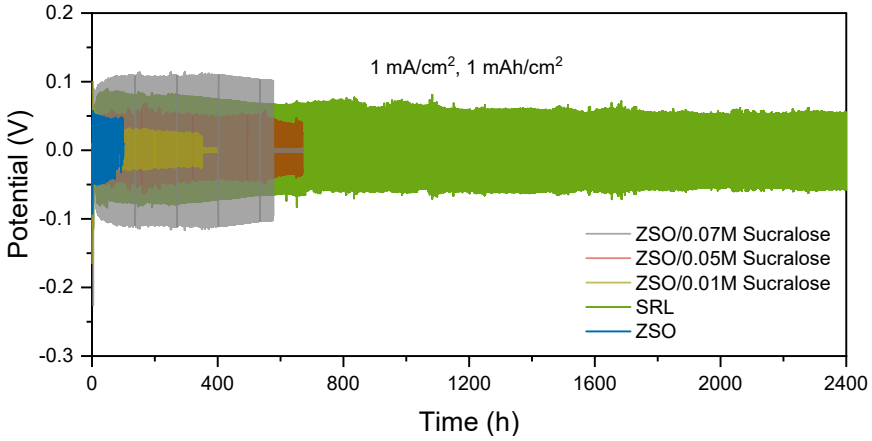

Fig. S9. Cycling performance of Zn//Zn symmetric cell in different concentration of SRL electrolyte at 1 mA cm^{-2} and 1 mAh cm^{-2}.

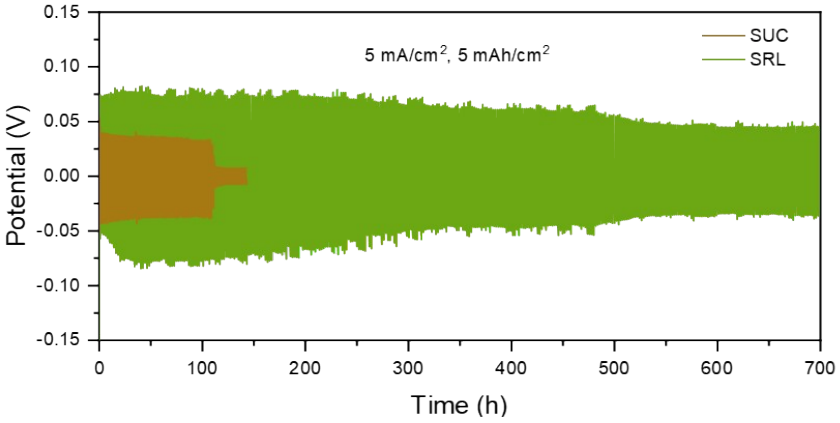

Fig. S10. Cycling performance of Zn//Zn symmetric cell in SUC electrolyte and SRL electrolyte at 5 mA cm^{-2} and 5 mAh cm^{-2}.

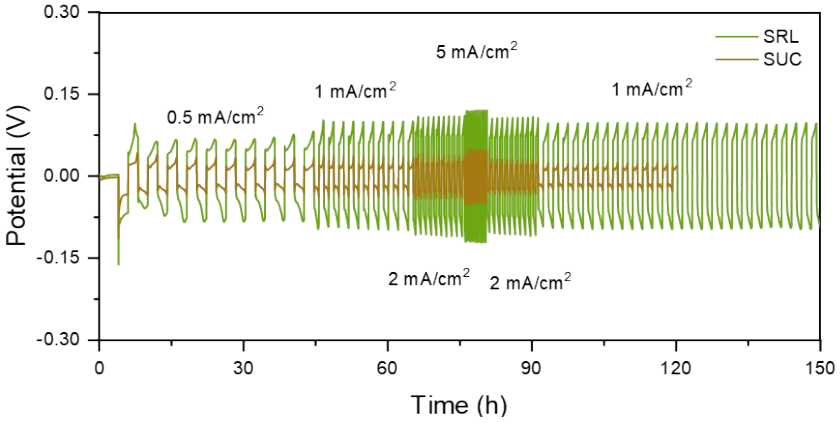

Fig. S11. The symmetric cell's rate performance in ZSO and SRL electrolytes.

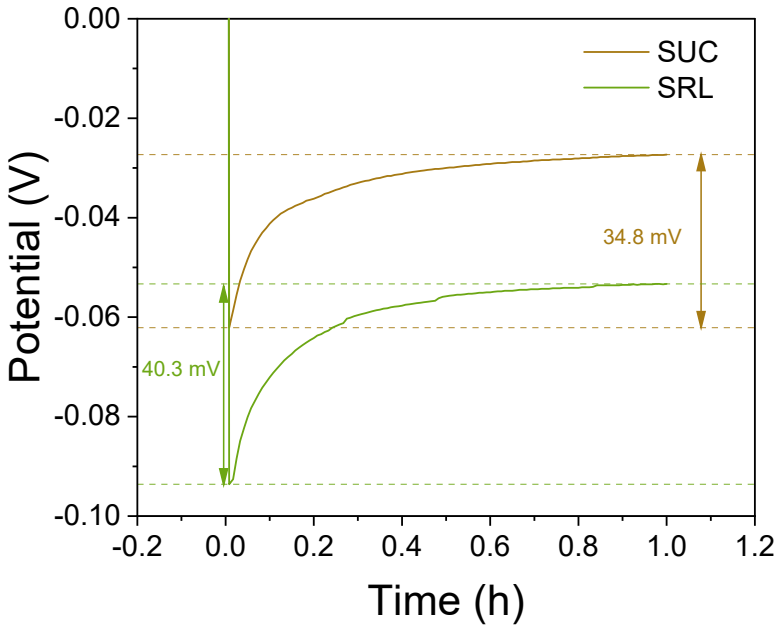

Fig. S12. The nucleation overpotential tested in SUC and SRL electrolyte using Zn//Cu cell at 1 mA cm^{-2} and 0.5 mAh cm^{-2}.

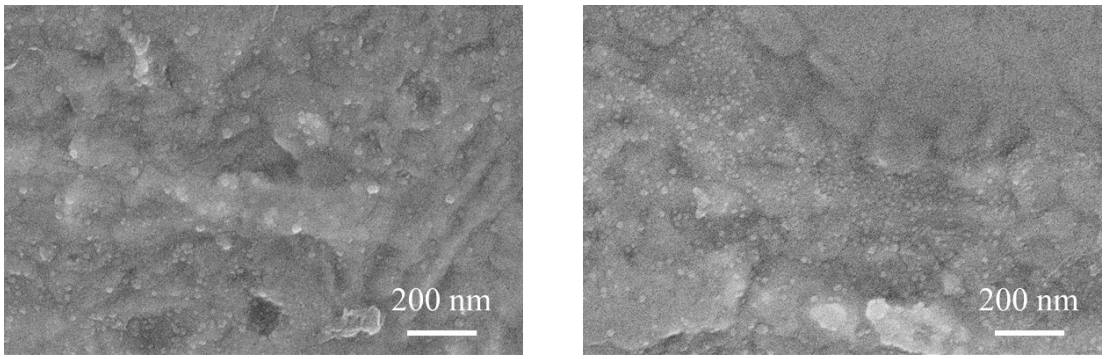

Fig. S13. SEM image of Zn^{2+} nucleation.

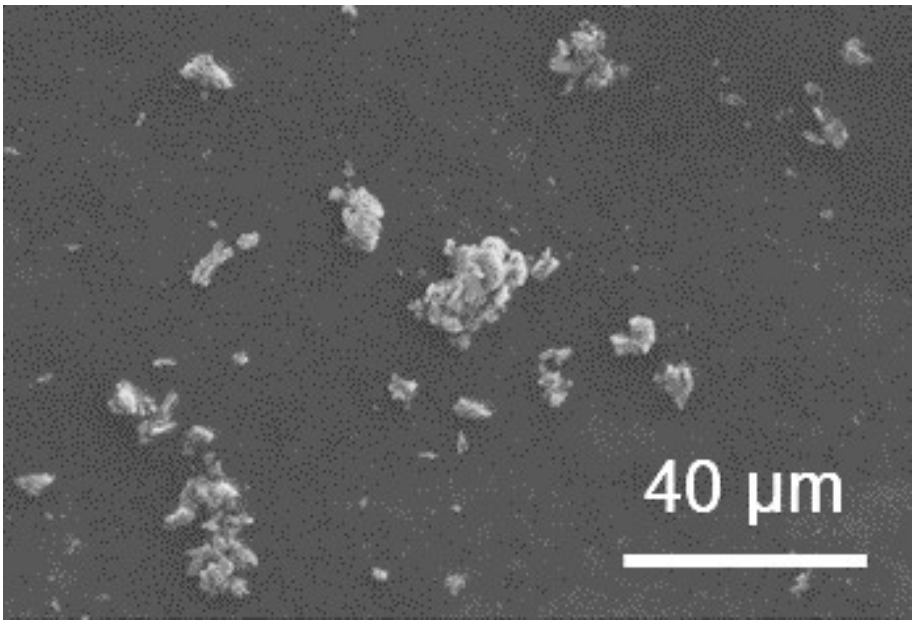

Fig. S14. SEM image of V_2O_5 powder.

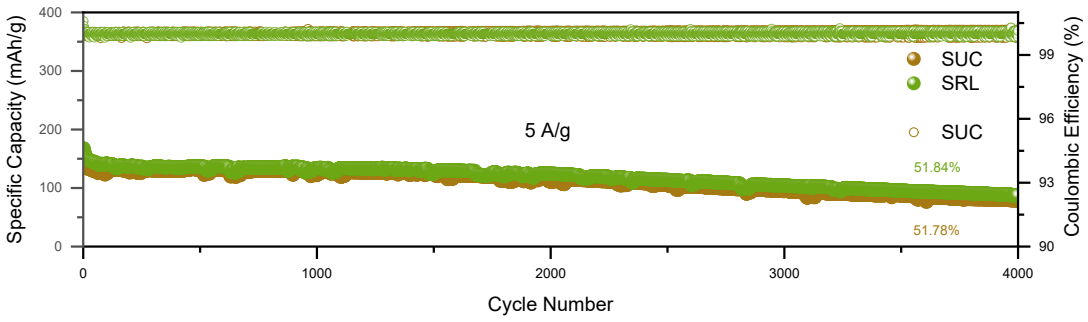

Fig. S15. Cycling performance at current density of 5 A/g of the Zn//V_2O_5 full cell in SUC electrolyte and SRL electrolyte.

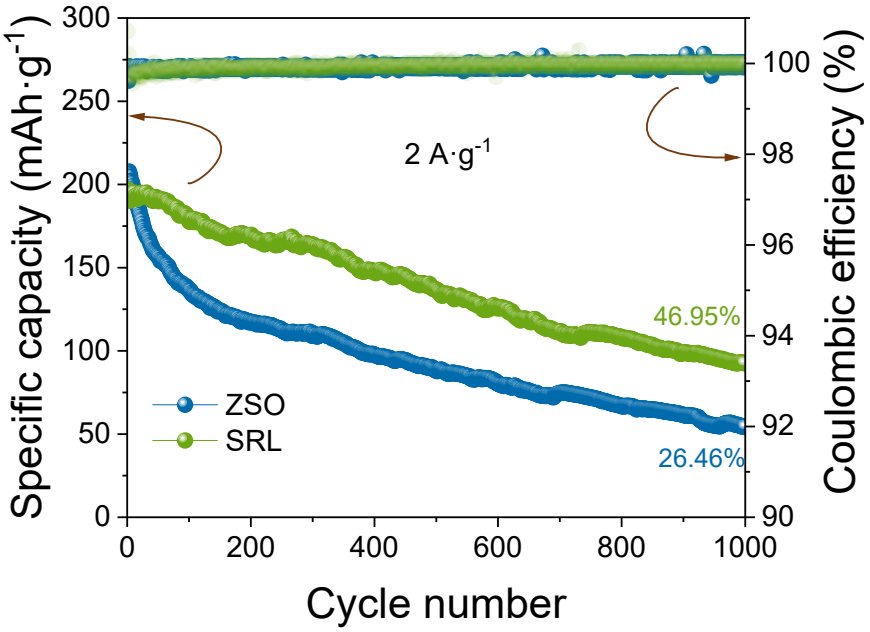

Fig. S16. Cycling performance at current density of 2 A/g of the Zn//V_2O_5 full cell in ZSO electrolyte and SRL electrolyte.