Electronic Supplementary Material (ESI) for Energy Advances.

Supporting Information

Protecting Zn Anode by Atomic Layer Deposition of ZrO_2 to Extend the Lifetime of Aqueous Zn-ion Batteries

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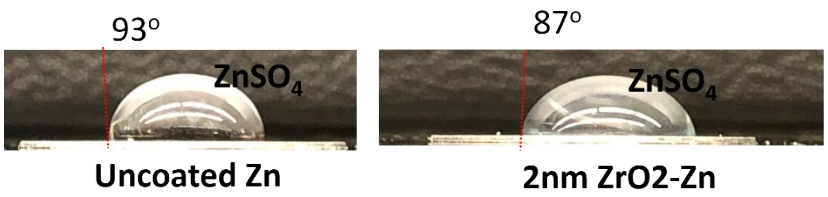

Figure S1. Contact angle of 2 M $ZnSO_4$ on zinc foil with no coating and 2nm by ALD-ZrO_2

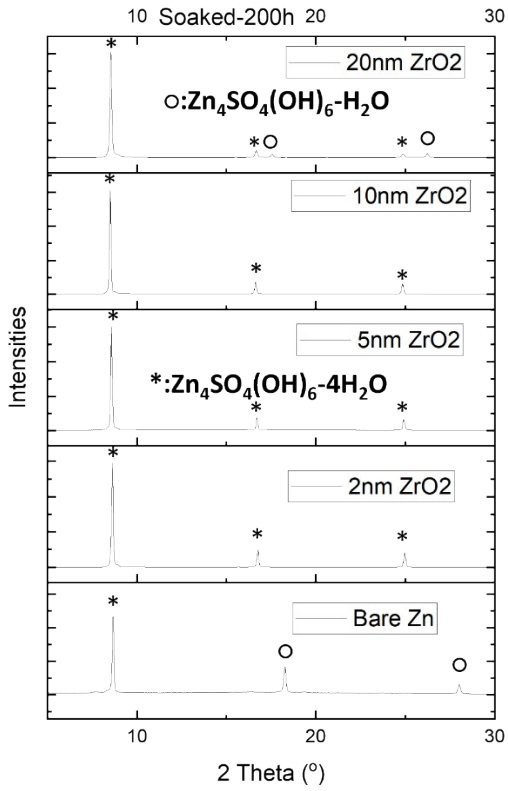

Figure S2. XRD of zinc foils after soaking in 2 M $ZnSO_4$ for 200h with no coating, 2 to 20nm ALD-ZrO_2 coatings, respectively.

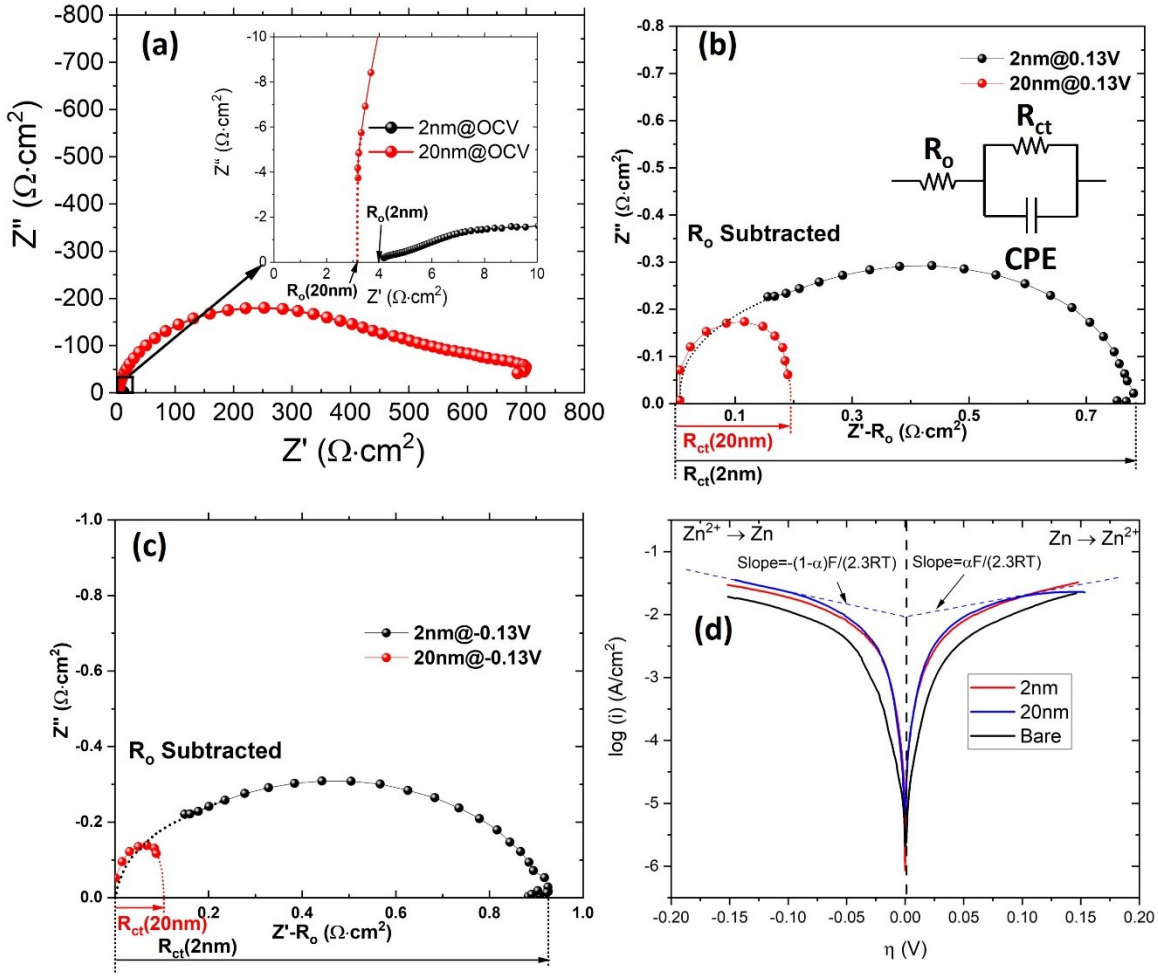

Figure S3. EIS spectra under (a) OCV, (b) 0.13V bias and (c) -0.13V bias and (d) Tafel plots from potential dynamics of 3-electrode cell using uncoated and ALD-ZrO_2@Zn as WE. ALD-ZrO_2 thickness: 2 and 20 nm.

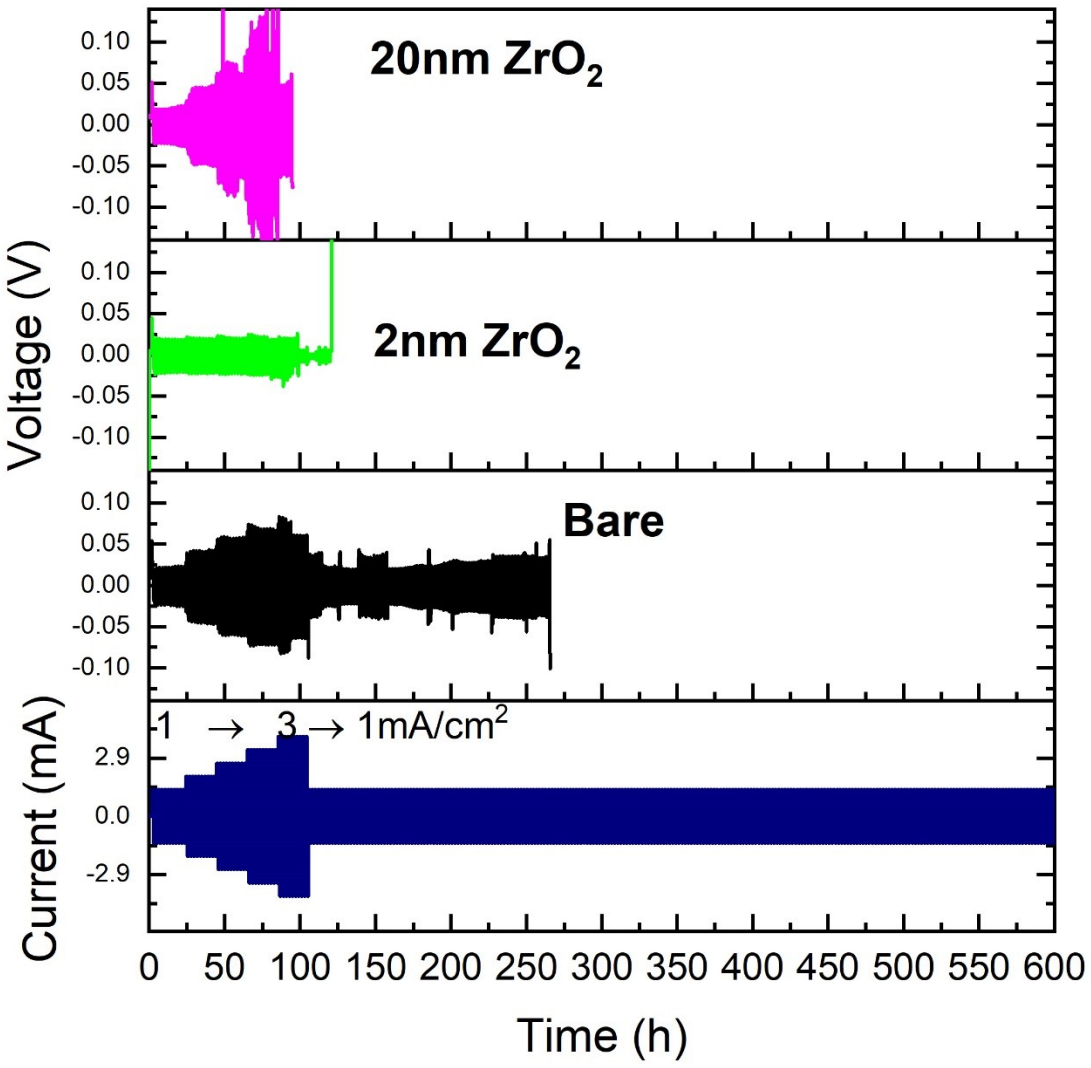

Figure S4. Cycling stability of symmetrical coin cells at ±1 to ±3 mA/cm^2 with 2 M $ZnSO_4$/glass fiber separator as electrolyte and Zn and 2&20 nmALD-ZrO_2@Zn as electrodes.

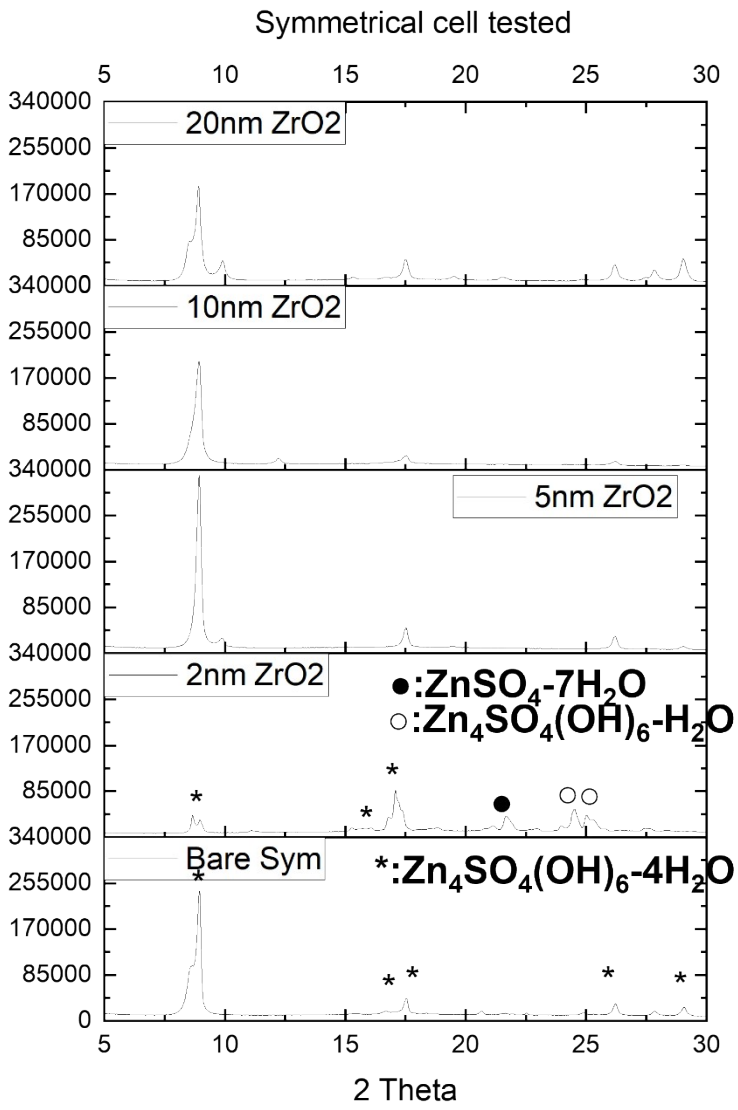

Figure S5. XRD of Zn electrode after symmetrical cell tests with different thickness of ALD-ZrO_2 coating.

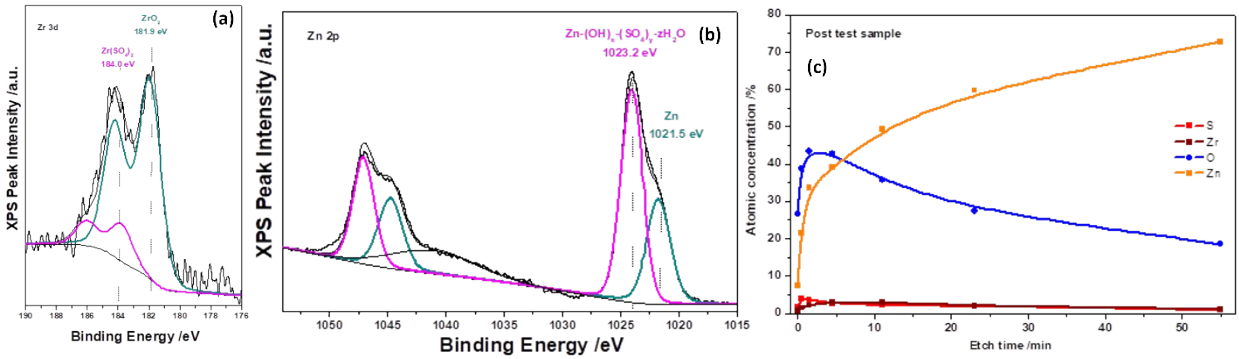

Figure S6. XPS spectra of Zr 3d, Zn 2p and depth profile of 10nm ALD-ZrO_2@Zn after symmetrical cell test.

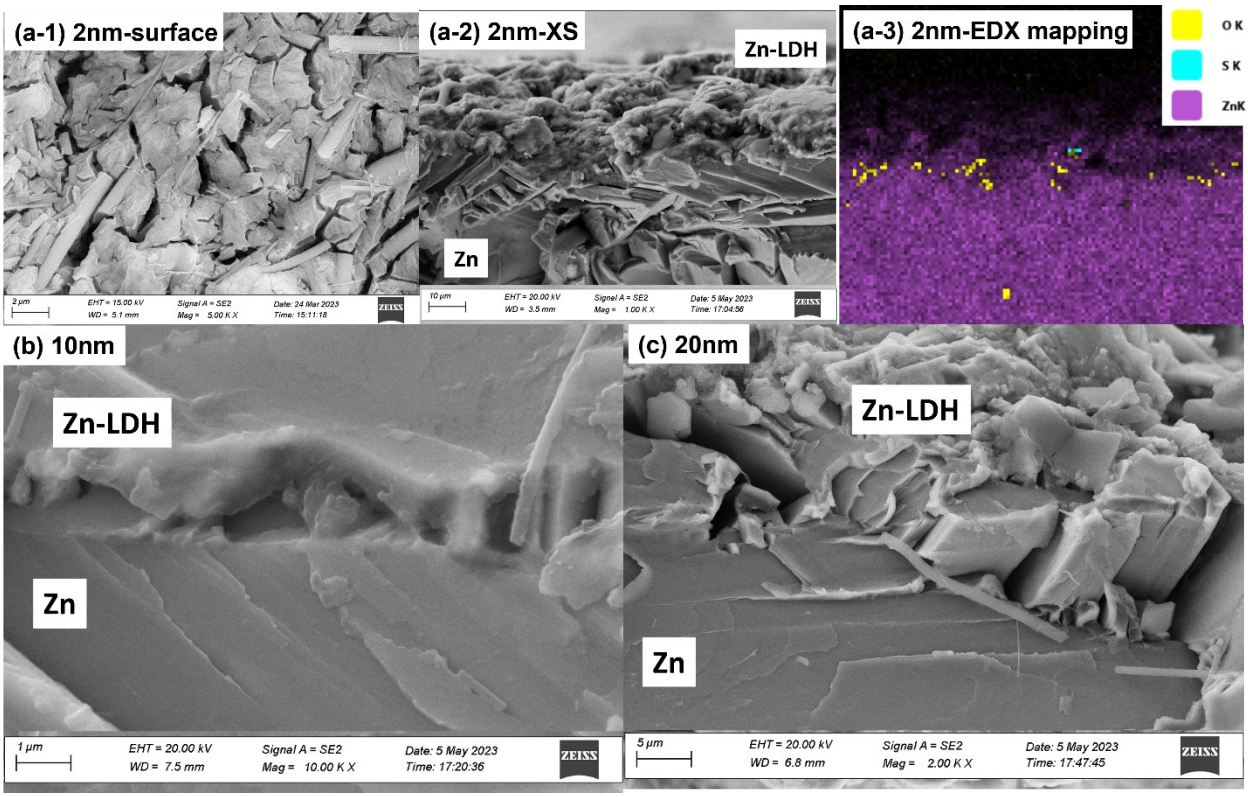

Figure S7. Zn electrode after symmetrical cell tests: SEM images of surface, cross-section, and EDX mapping of the cross-section of 2 nm ALD-ZrO_2@Zn and cross-section views of 10 and 20 nm ALD-ZrO_2@Zn.

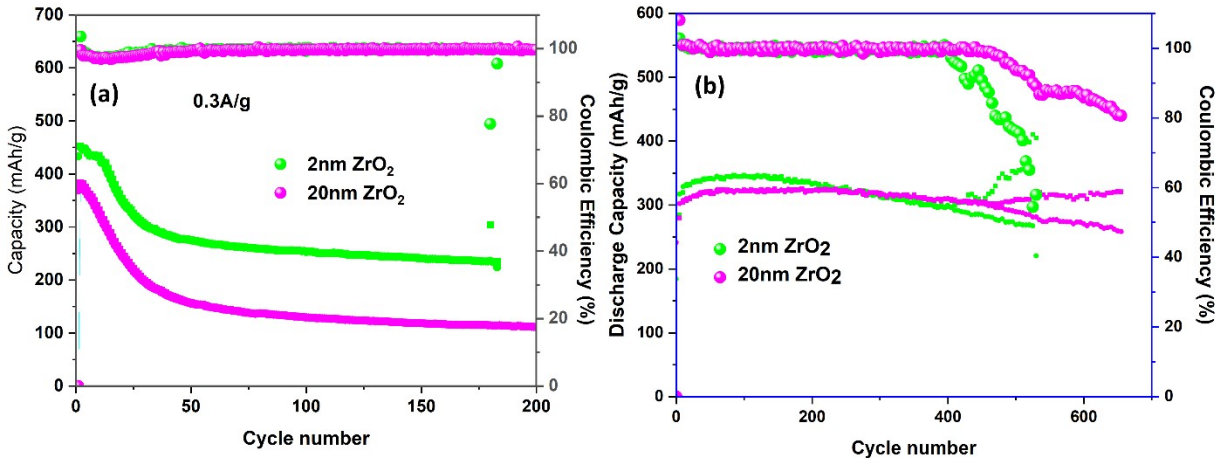

Figure S8. Discharge capacities for batteries with (a) 2 and 20 nm ALD-ZrO_2 @Zn as anode at rate of 0.3A/g, and (b) 2 nm and 20 nm ALD-ZrO_2@ Zn as anode at rate of 2A/g.

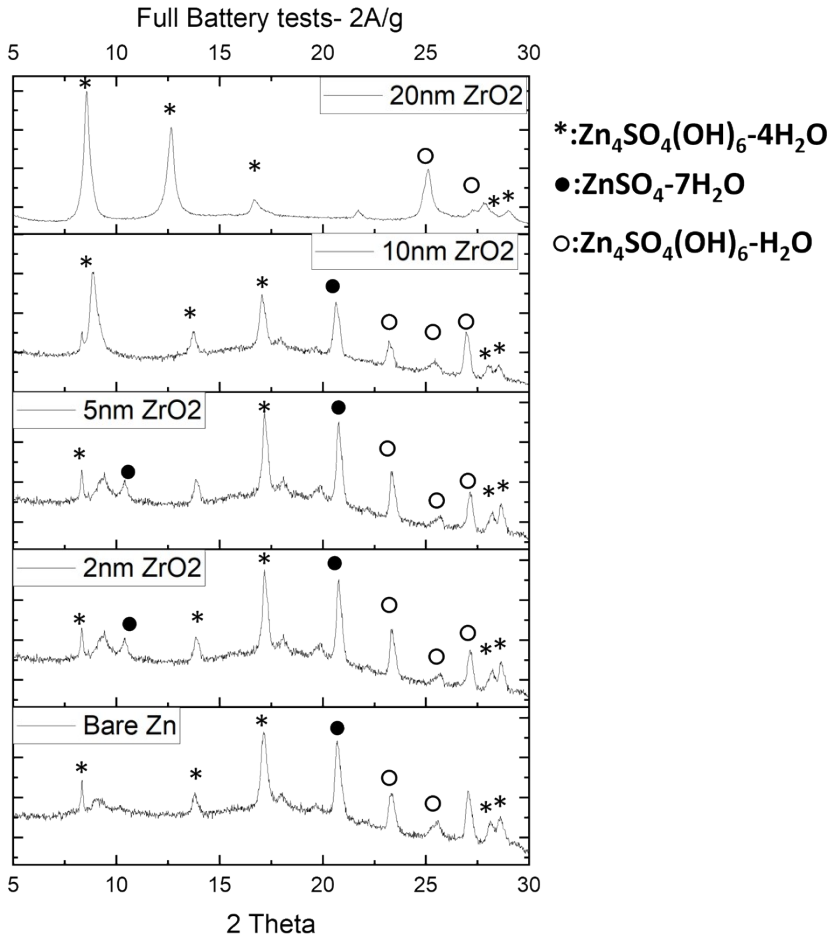

Figure S9. XRD of Zn anode after full batteries tests at 2 A/g without/with ALD-ZrO_2 coating.

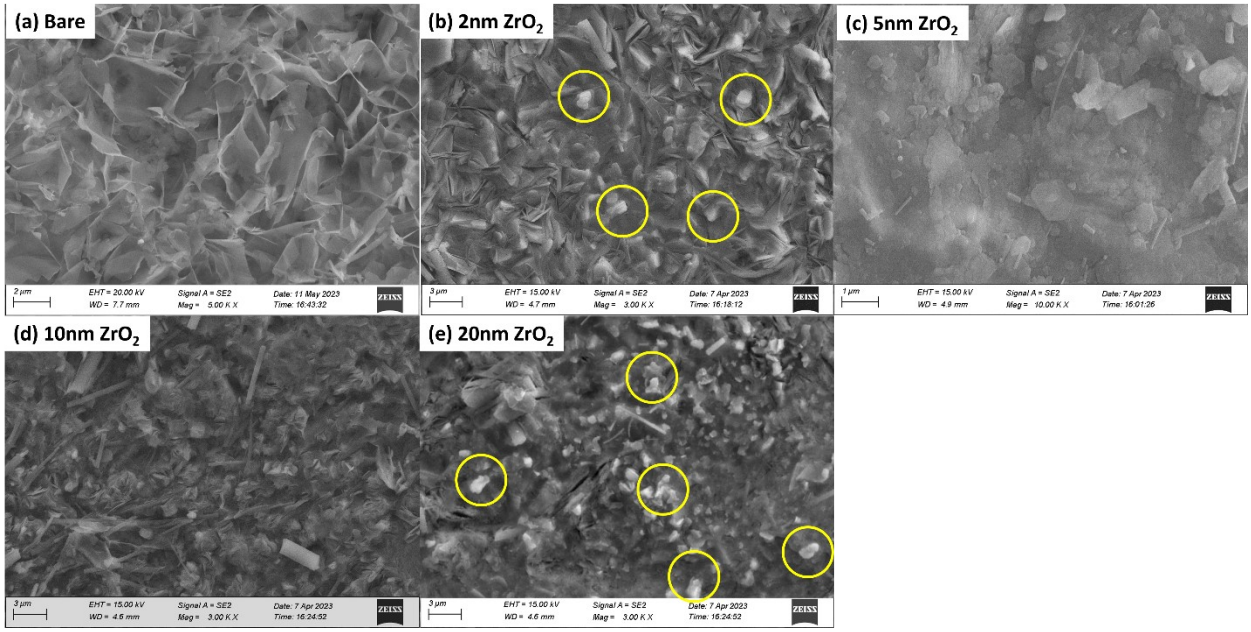

Figure S10. SEM images of the surface of Zn anodes after full battery testing at 2A/g; nucleation sites are labeled with yellow circles.

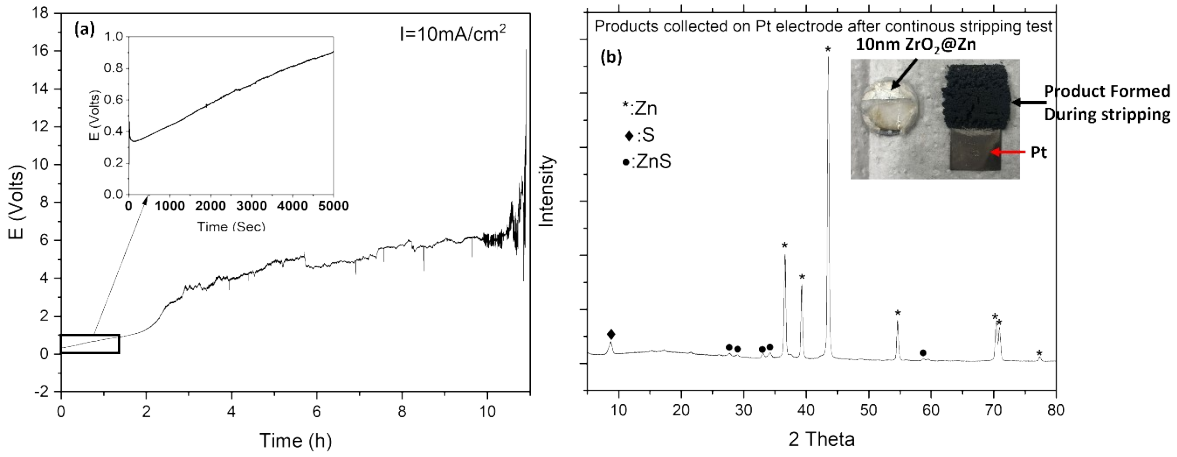

Figure S11. (a) Voltage vs. time plot under continuous stripping of zinc at constant current of 10mA/cm^2 using 3-eletrode setup with 10 nmZrO_2@Zn as WE, Ag/AgCl. as RE and Pt as CE, and (b) XRD pattern of formed products and optical image of 10 nmZrO_2@Zn plate and Pt plate after continuous stripping.