Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information for：

Nicotinic Acid Additive with the Double Regulating Mechanism for High-Performance Aqueous Zinc Ion Batteries

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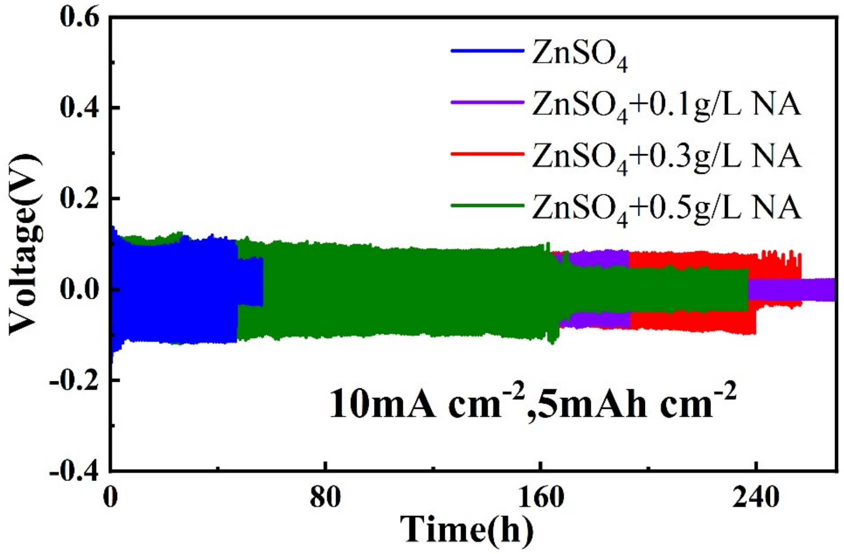

Figure S1. Long-term galvanostatic cycling performance of Zn||Zn symmetrical cells in electrolytes with different concentrations of NA.

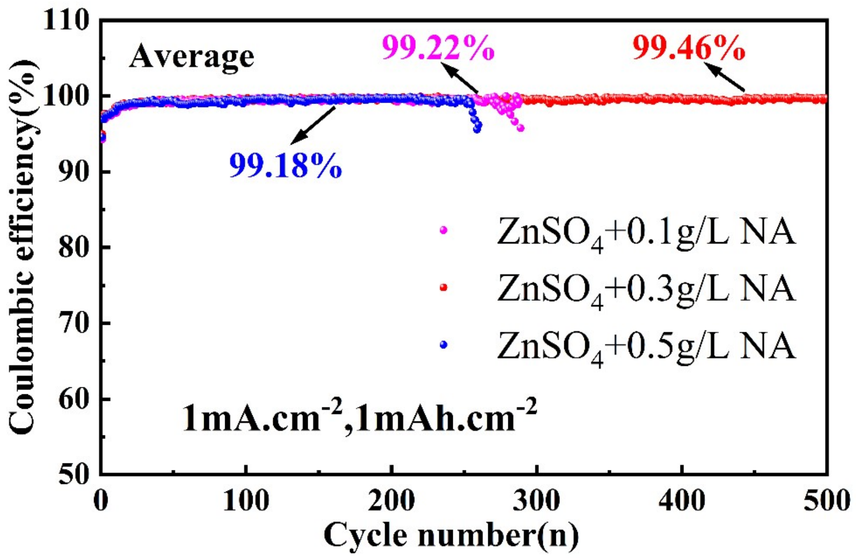

Figure S2. Coulombic efficiencies of Zn||Ti asymmetric cells in electrolytes with different concentrations of NA.

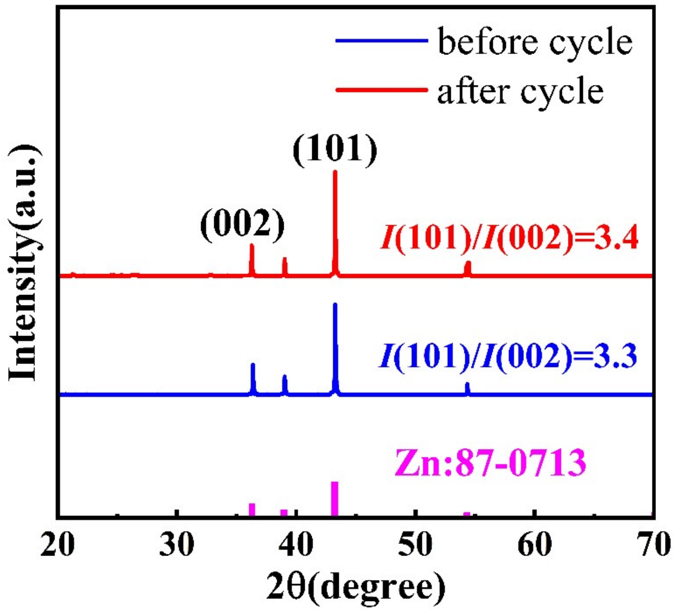

Figure S3. Zn||Zn symmetric cells with $ZnSO_4$+NA electrolytes XRD of zinc anode surface before and after 50 cycles.

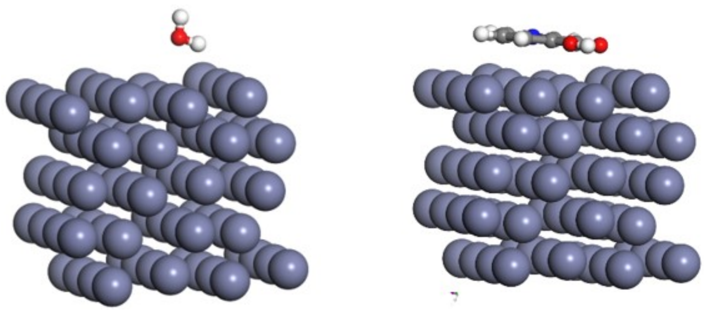

Figure S4. The corresponding absorbed models for different situations(101).

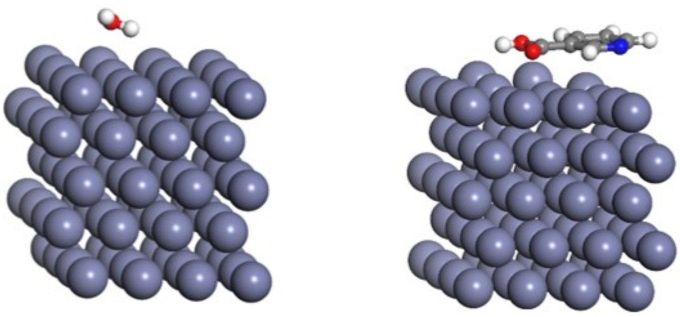

Figure S5. The corresponding absorbed models for different situations(002).

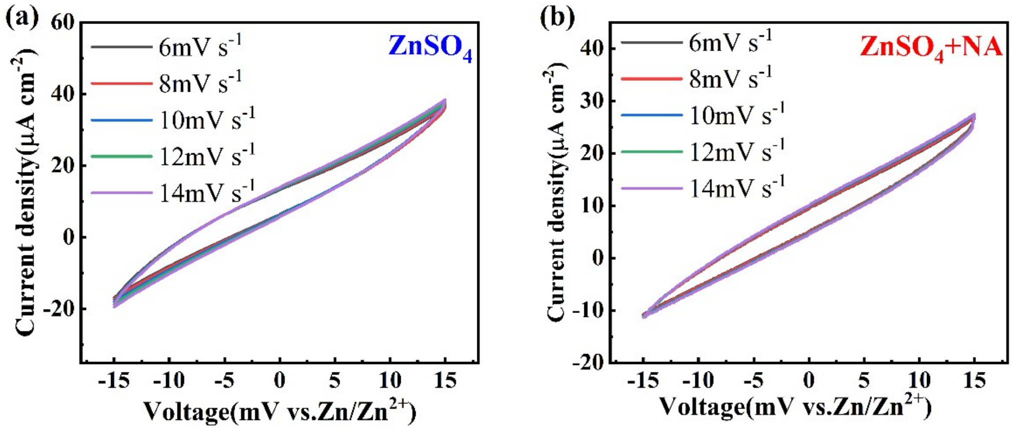

Figure S6. Cyclic voltammogram curves for Zn||Zn symmetric cells with (a) $ZnSO_4$ electrolytes and (b) $ZnSO_4$+NA electrolytes.

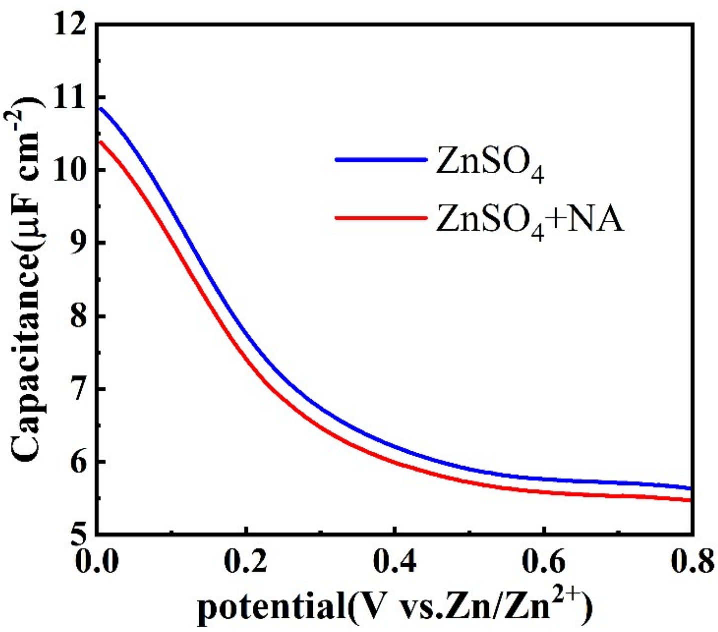

Figure S7. The alternating current voltammetry(ACV) measurement for Zn||Ti asymmetric cells in electrolytes with/without NA.

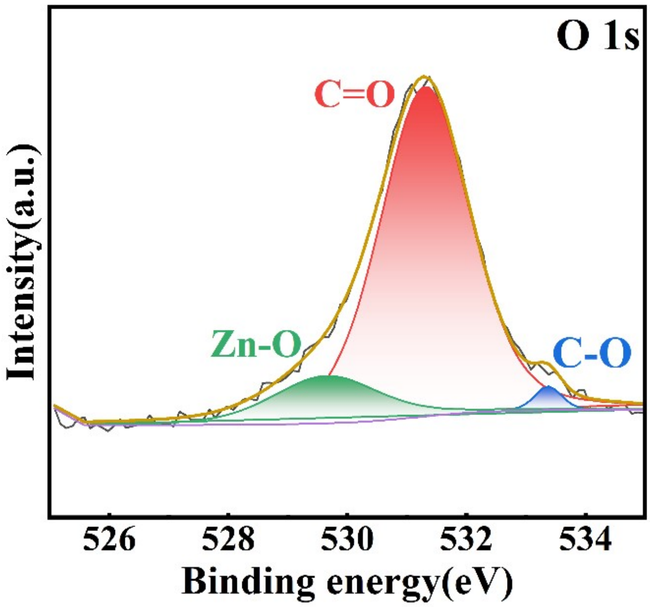

Figure S8. O 1s spectra after 10 cycles at 1.0 mA cm^{-2} (1.0 mAh cm^{-2}) for $ZnSO_4$+NA electrolytes.

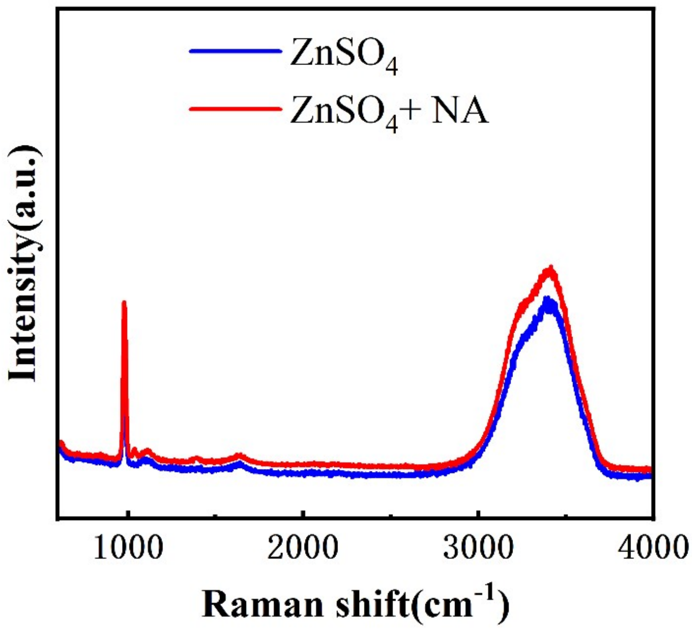

Figure S9. The Raman spectra of the electrolytes with/without NA.

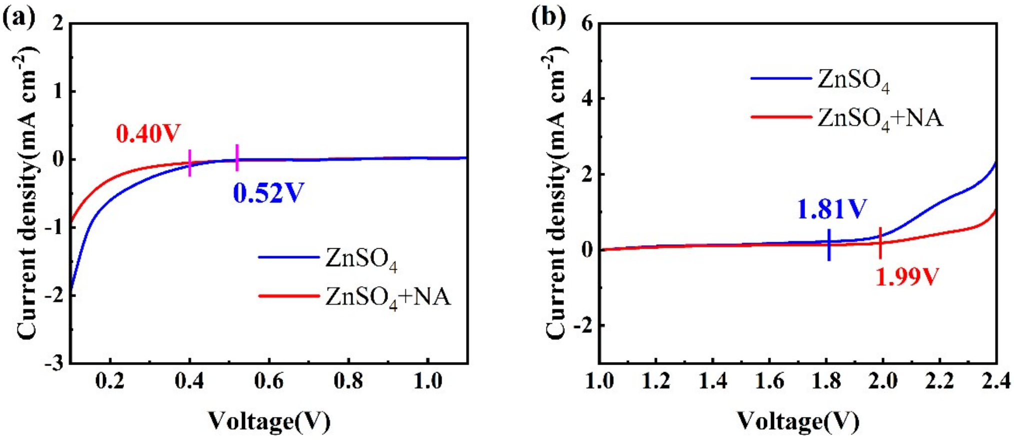

Figure S10. LSV curves of Zn anode presenting (a) HER and (b) OER in $ZnSO_4$ electrolytes with/without NA

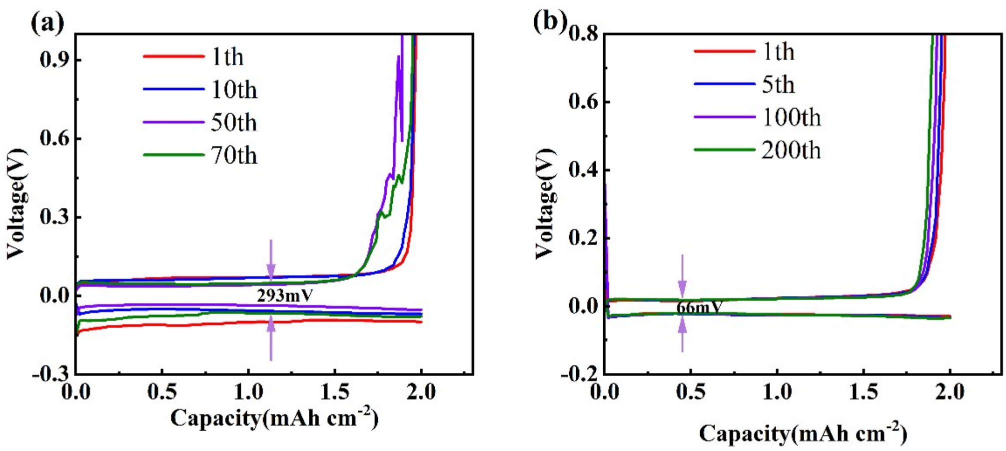

Figure S11. Corresponding GCD curves of the Zn||Ti cells at various cycles with (a) $ZnSO_4$ electrolytes and (b)$ZnSO_4$+NA electrolytes.

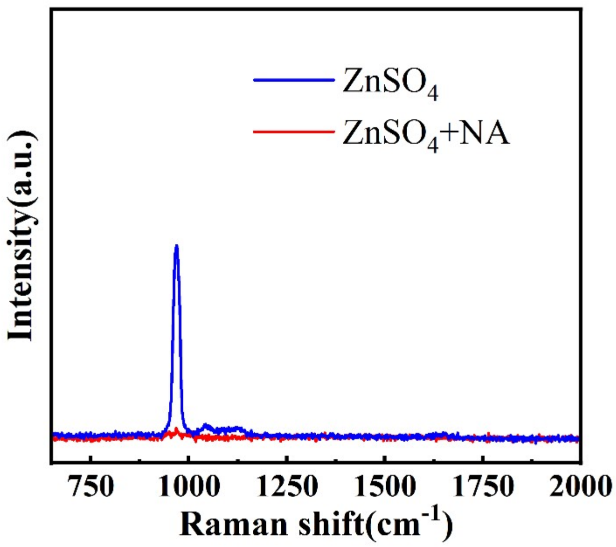

Figure S12. The Raman spectra of Zn deposits on Ti substrate in electrolytes with/without NA.

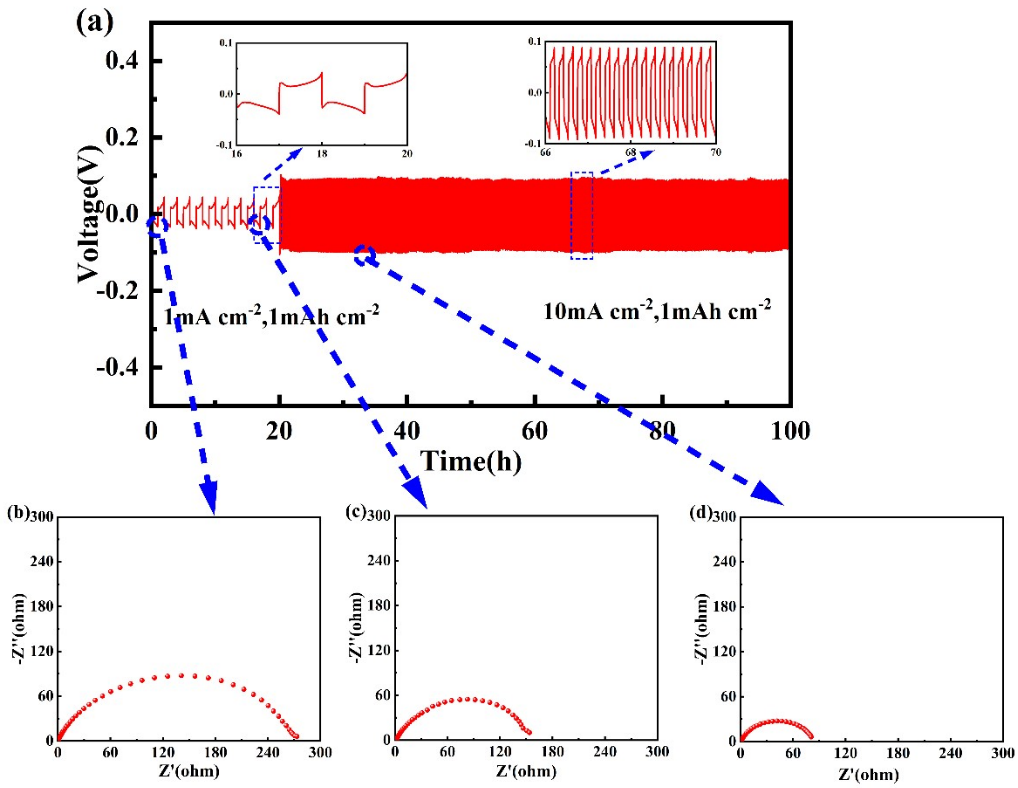

Figure S13. (a) The voltage profile of pre-cycles ($ZnSO_4$+NA) at 1 mA cm^{-2} (1 mAh cm^{-2}) followed by 10 mA cm^{-2} (1 mAh cm^{-2}), insets show the amplified profile at different cycles. The corresponding impedance spectra of the positions in (a): (b) before test, (c) after 16 h at 1 mA cm^{-2} (1 mAh cm^{-2}), (d) after 15 h at 10 mA cm^{-2} (1 mA h cm^{-2}).

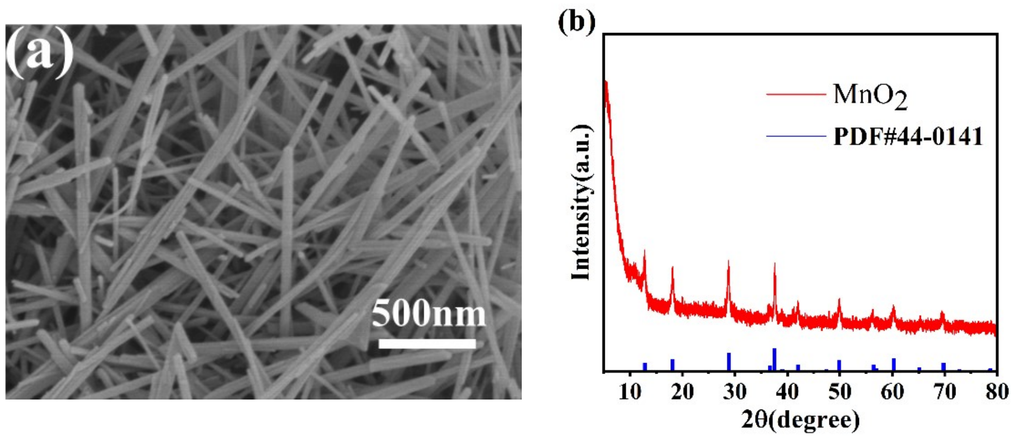

Figure S14. nanowire MnO_2 (a)SEM and (b)XRD.

Table S1. Calculated energies of different solvation species obtained from DFT calculations.

	E_Z(Hartree)	E_S(Hartree)	E_C(Hartree)	E_B(Hartree)	E_B(kcal/mol)
H_2O	-1819.788673	-80.456587	-1900.40954	-0.16428	-103.0873428
NA	-1819.788673	-462.579237	-2282.645045	-0.277134	-173.90436

Table S2. Fitting results for Zn||Zn symmetric cells at different temperatures.

Symmetrical cells	Res	298.15	303.15	308.15	313.15
$ZnSO_4$ electrolyte	Rct(Ω)	1152	860	635.4	471.96
$ZnSO_4$+NA electrolyte	Rct(Ω)	263.3	224	191	162

Table S3. Performance comparison of Zn symmetric cell using $ZnSO_4$+NA electrolyte with other reported literatures.

No.	Electrolyte	Current density ($mA\ cm^{-2}$)	Capacity ($mAh\ cm^{-2}$)	Cycle time (hour)	Ref.
1	$ZnSO_4$+NA	1	1	5200	
		2	2	1650	This work
		5	2.5	1500	
		5	5	450	
2	$ZnSO_4$+SL	0.5	0.5	600	[1]
3	$ZnSO_4$+Urea	1	1	700	[2]
4	$ZnSO_4$+TBA^+	2	2	300	[3]
5	$ZnSO_4$+CH_3COONH_4	2	1	2400	[4]
6	$Zn(OTF)_2$+TMS	5	5	300	[5]
7	$ZnSO_4$+GO	1	0.5	650	[6]
8	$ZnSO_4$+HTCN-x	1	1	1000	[7]
9	$ZnSO_4$+NMP	1	1	540	[8]
10	$ZnSO_4$+PVDF	0.25	0.05	2000	[9]
11	$ZnSO_4$+h-BN@PDA	0.5	0.5	1700	[10]
12	$ZnSO_4$+LAA	1	1	1200	[11]
13	$ZnSO_4$+ AQS	5	0.5	1200	[12]
14	$ZnSO_4$+ $NH_3 \cdot H_2O$	5	5	250	[13]
15	$ZnSO_4$+ TA-Na	0.5	0.25	1700	[14]
16	$ZnSO_4$+GA	1	1	2500	[15]

References

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