Supplementary Information (SI) for Journal of Materials Chemistry A.
This journal is © The Royal Society of Chemistry 2025

Supplementary information

A biomimetic pyrimidine derivative for stabilizing zinc anode evidenced by zinc ions deposition kinetics and in-situ optical imaging

Jiangwei Tan, Lu Yang, Xue Yi, Shengtao Zhang, Hongru Li*, Zhiyong Wang*, Fang Gao*

College of Chemistry and Chemical Engineering, Chongqing University, China

*Corresponding authors, Emails, hrli@cqu.edu.cn, zwang@cqu.edu.cn, fgao@cqu.edu.cn

Contents

Figures S1-S5

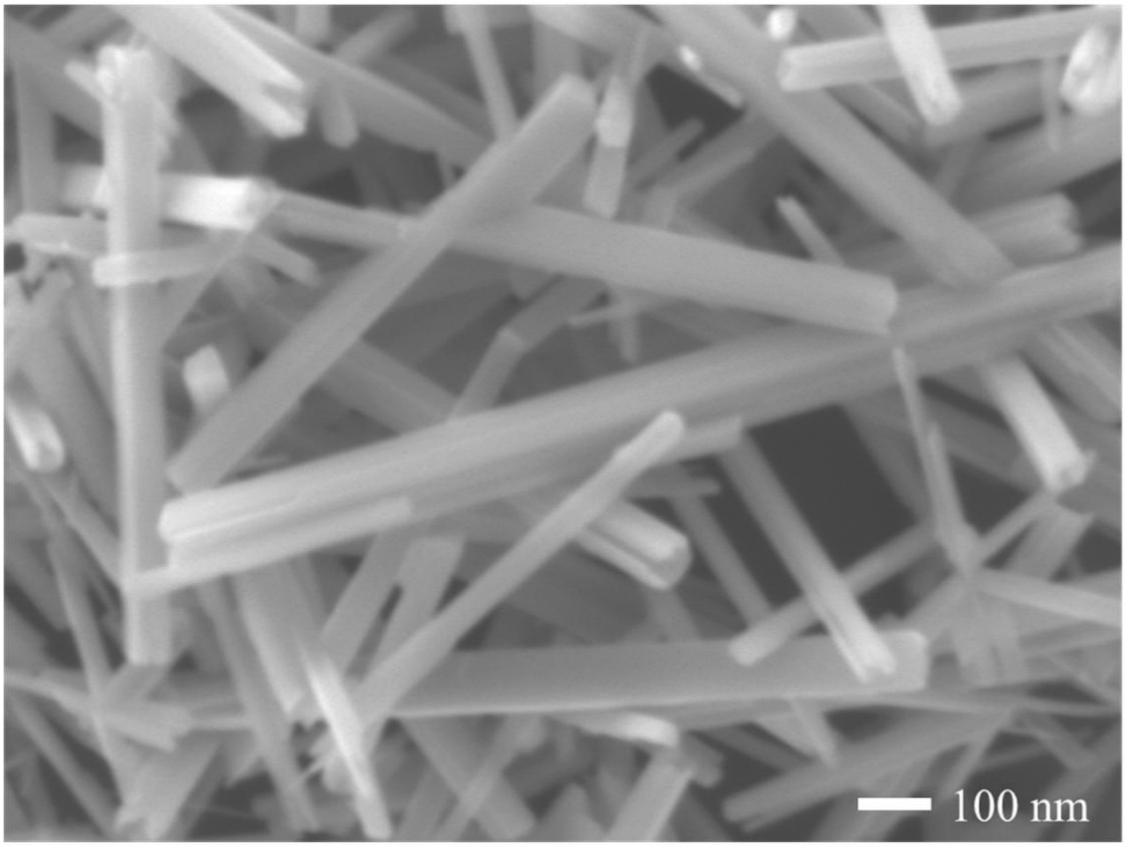

Figure S1 SEM image of the synthesized nano MnO_2

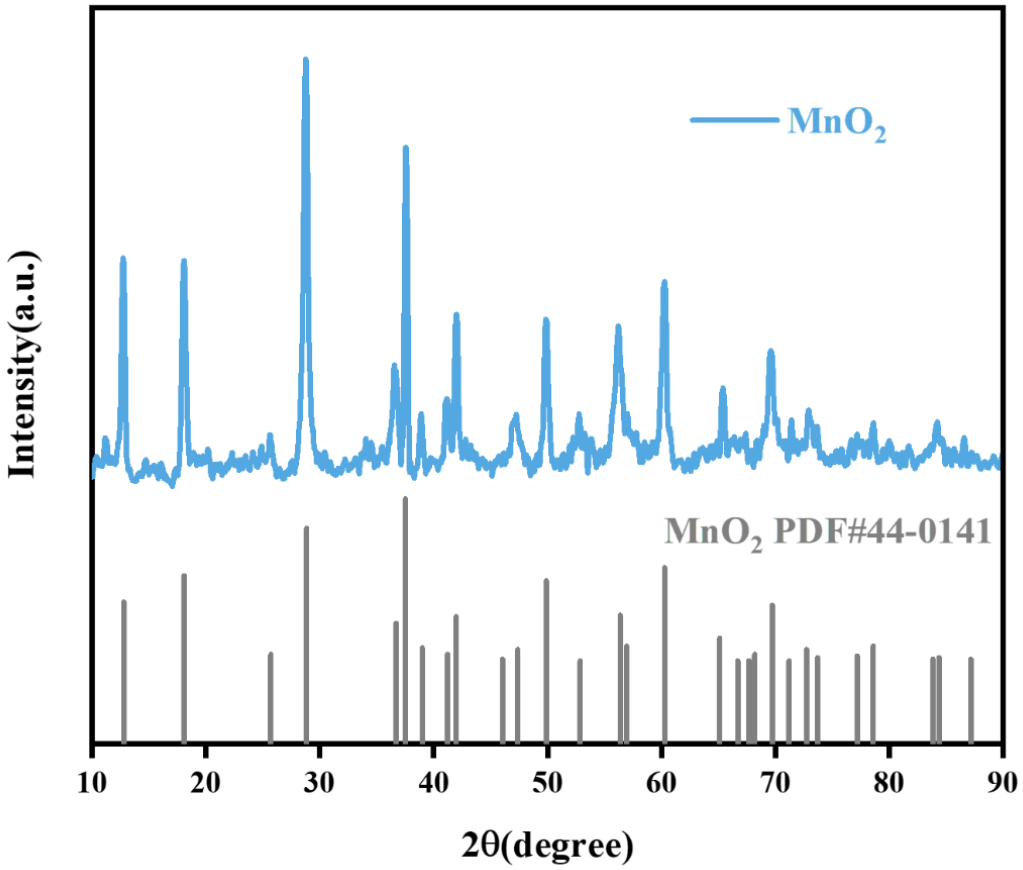

Figure S2 XRD graphs of the synthesized nano MnO_2

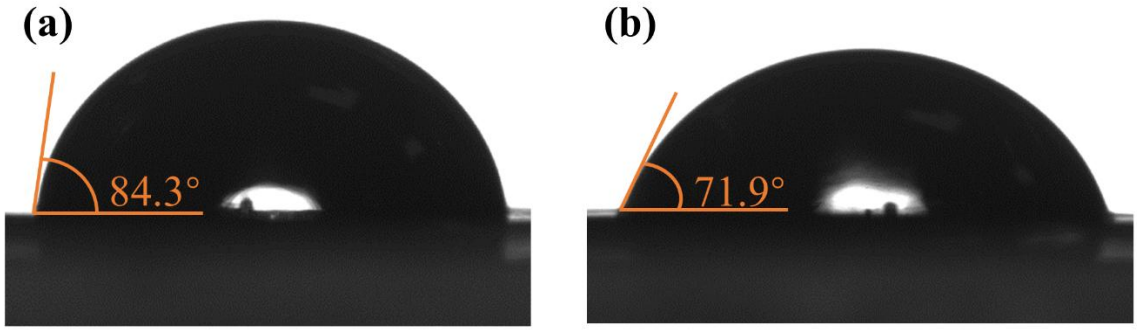

Figure S3 Contact angle of electrolyte on zinc electrode, (**a**) Blank $ZnSO_4$, (**b**) $ZnSO_4$ electrolyte containing the **PCA**

Figure S4 Thickness of Zn||Zn symmetric batteries before and after 200 cycles of charging and discharging, (**a**, **c**) based on the blank $ZnSO_4$ electrolyte, (**b**, **d**) based on the **PCA**/$ZnSO_4$ electrolyte, wherein, the concentrations of the **PCA**, 10 mM, $ZnSO_4$, 2 M at 298 K

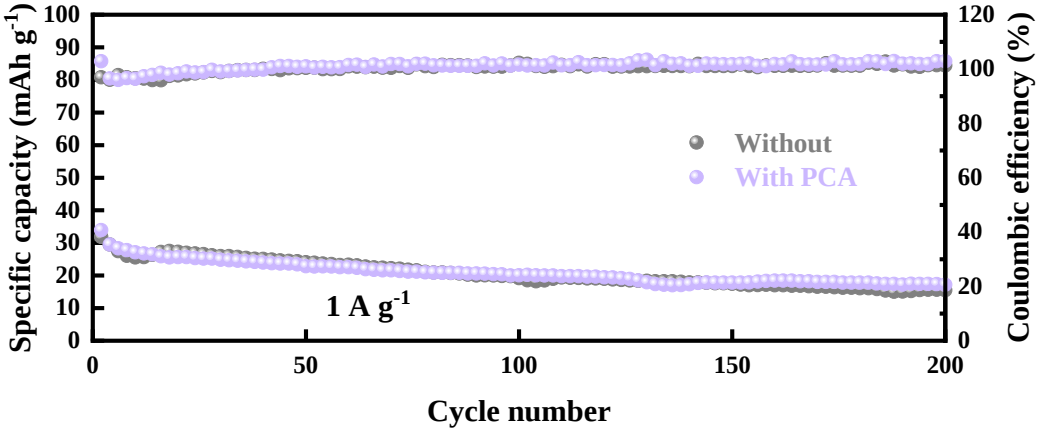

Figure S5 Effect of PCA on Full Battery Performance at High Temperature of 333K

Tables S1-S5

Table S1 The electrochemical parameters of the Tafel curves

Additives	E_{corr} (V/SCE)	i_{corr} (mA cm^{-2})
Without	-1.0413	2.093
With PCA	-1.0081	0.5288

Table S2 De-convolution parameters of Zn 2p XPS spectra peaks obtained from the pristine Zn after 200 cycles in symmetric Zn||Zn cells with PCA/$ZnSO_4$ electrolyte

Samples	Chemistry states	Binging energies (eV)	FWHMs(eV)
Zn-Bare	Zn(I)	1044.8	1.7
	Zn(II)	1021.9	1.8
Zn-PCA	Zn(I)	1044.7	2.2
	Zn(II)	1021.4	2.6

Table S3 De-convolution parameters of C 1S XPS spectra peaks obtained from the pristine Zn after 200 cycles in symmetric Zn‖Zn cells with PCA/$ZnSO_4$ electrolyte

Samples	Chemistry states	Binging energies (eV)	FWHMs(eV)
Zn-Bare	C-C	284.8	1.3
	C-O-C	285.5	1.4
	O-C=O	289.6	3.5
Zn-PCA	C-C	284.8	1.5
	C-N	286.1	1.7

Table S4 De-convolution parameters of O 1S XPS spectra peaks obtained from the pristine Zn after 200 cycles in symmetric Zn‖Zn cells with PCA/$ZnSO_4$ electrolyte

Samples	Chemistry states	Binging energies (eV)	FWHMs(eV)
Zn-Bare	Zn-O	531.6	1.6
	O-C=O	5.2.1	2.7
Zn-PCA	C-O	531.2	1.7
	C=O	532.7	1.9

Table S5 De-convolution parameters of N 1S XPS spectra peaks obtained from the pristine Zn after 200 cycles in symmetric Zn‖Zn cells with PCA/$ZnSO_4$ electrolyte

Samples	Chemistry states	Binging energies (eV)	FWHMs(eV)
Zn-SPD	Zn-N	398.2	1.5
	C=N	401.7	1.6