Supporting information

Uniform Zn Deposition Achieved by Ag coating for Improved Aqueous Zinc Ion Batteries

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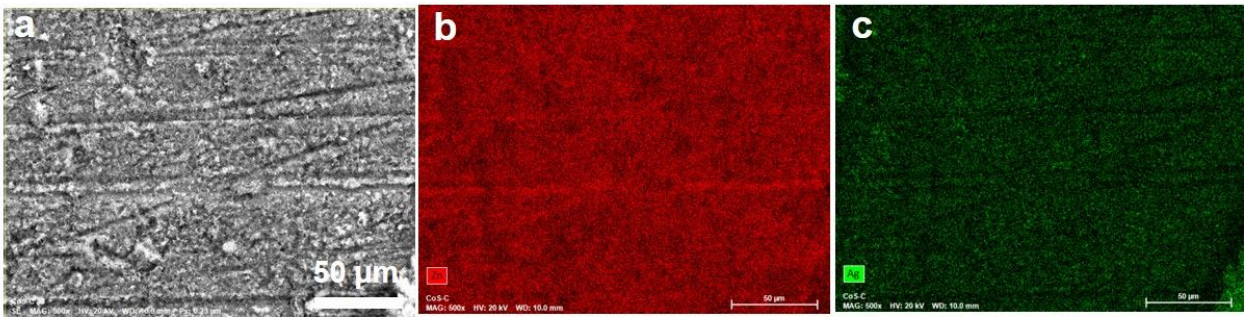

Figure S1. a) SEM image of Ag-Zn; b) Zn and c) Ag elemental mapping of the Ag-Zn electrode.

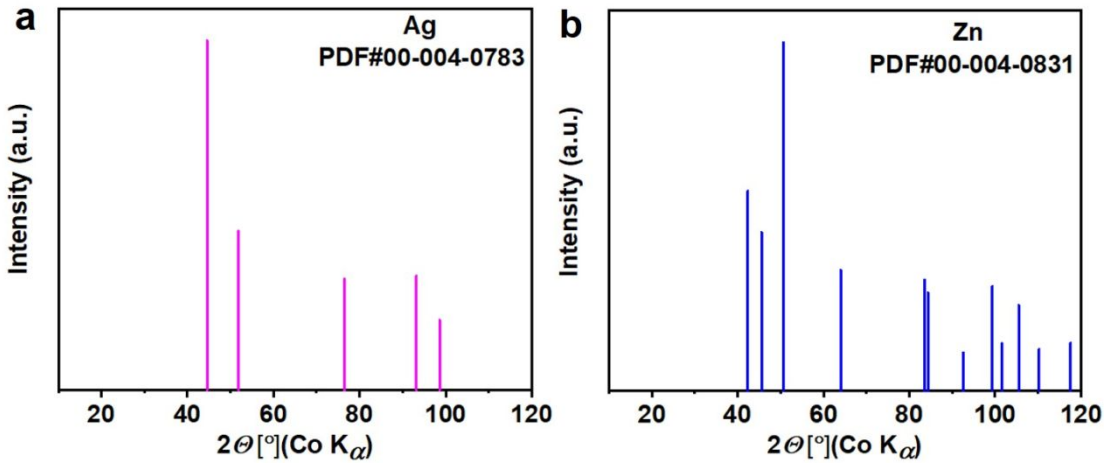

Figure S2. Reference XRD patterns of a) Zn and b) Ag.

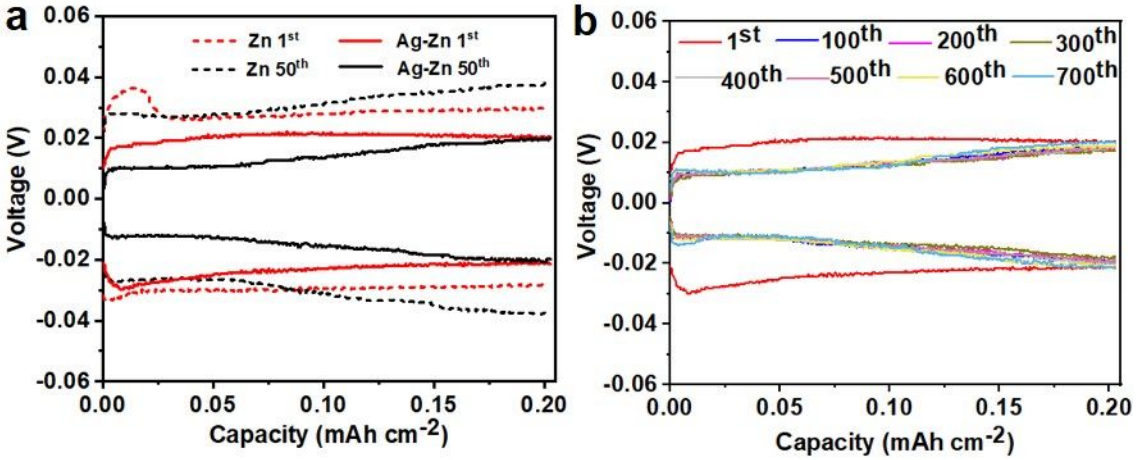

Figure S3. a) Discharge/charge curves of Zn plating/stripping for untreated Zn and Ag-Zn at 1st and 50th cycle at 0.2 mA cm^{-2}. b) Discharge/charge curves of Zn plating/stripping for Ag-Zn at different cycles at 0.2 mA cm^{-2}.

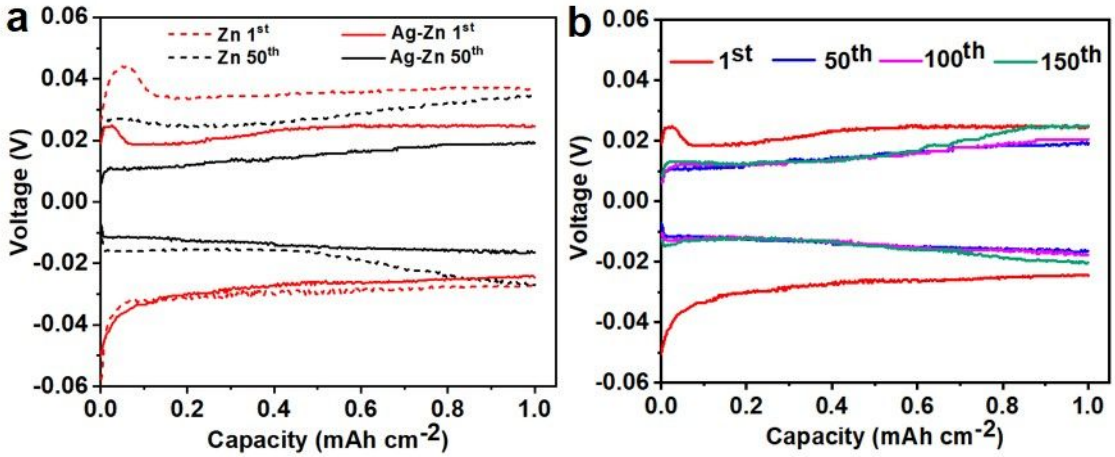

Figure S4. a) Discharge/charge curves of Zn plating/stripping for untreated Zn and Ag-Zn at 1st and 50th cycle at 1 mA cm^{-2}. b) Discharge/charge curves of Zn plating/stripping for Ag-Zn at different cycles at 1 mA cm^{-2}.

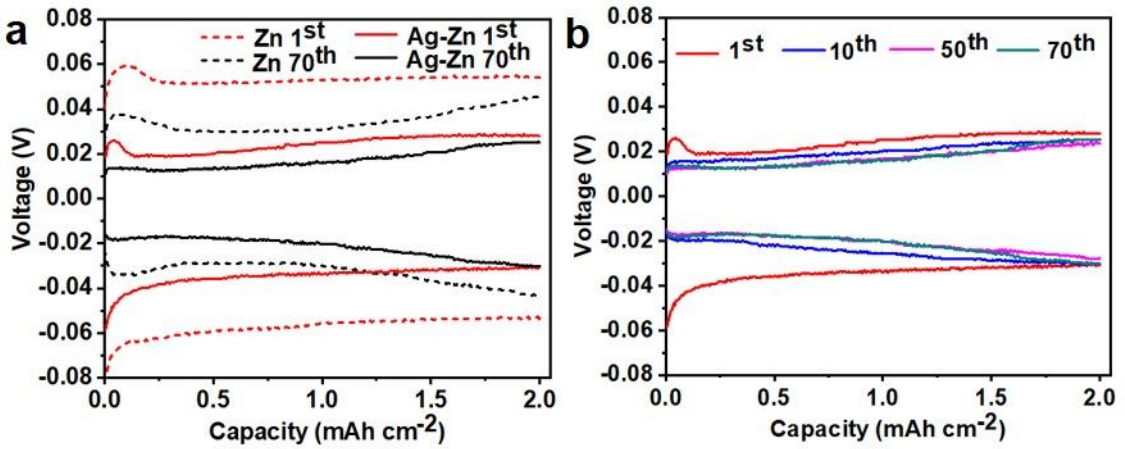

Figure S5. a) Discharge/charge curves of Zn plating/stripping for untreated Zn and Ag-Zn at 1st and 70th cycle at 2 mA cm^{-2}. b) Discharge/charge curves of Zn plating/stripping for Ag-Zn at different cycles at 2 mA cm^{-2}.

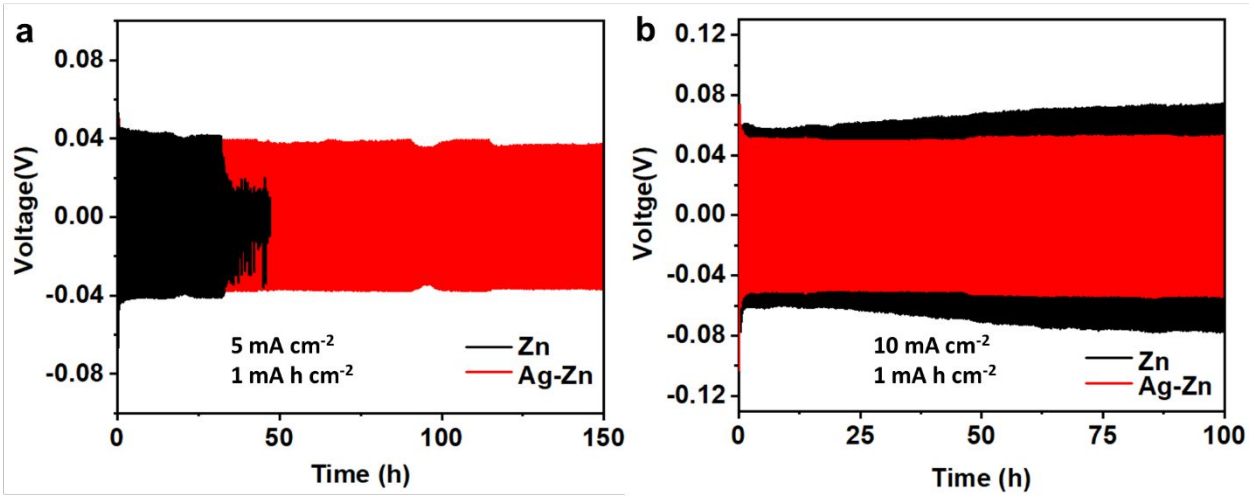

Figure S6. Cycling performance of symmetric cells at current density of a) 5 mA cm^{-2} b) 10 mA cm^{-2} with a capacity of 1 mA h cm^{-2}.

Table S1. Comparison of the performance of symmetric cells with recent literature works on various Zn metal protective strategies.

Protective layers	Current density (mA cm^{-2})	Capacity (mAh cm^{-2})	Overpotential (mV)	Life (h)	Reference
Ag coating	0.2	0.2	~19	1450	This work
	1	1	~23	350	
	2	2	~26	150	
	5	1	~36	150	
	10	1	~50	100	
mxene	0.2	0.2	~23	800	Angew. Chem. Int. Ed. 2020, 59, 1-6.[1]
$CaCO_3$ coating	0.25	0.05	~40	840	Adv. Energy Mater. 2018, 8, 1801090.[2]
TiO_2 coating	1	1	~52	150	Adv. Mater. Interfaces 2018, 5, 1800848.[3]
Sc_2O_3	1	1	~35	200	Journal of Energy Chemistry 2021, 55, 549-556.[4]
Carbon	1	1	~20	400	*Adv. Energy Mater.* 2020, *10*, 1904215.[5]
Al_2O_3	1	1	36.5	500	J. Mater. Chem. A, 2020, 8, 7836-7846.[6]
In coating	0.2	0.2	~27	1500	Small 2020, 16, 2001736.[7]
Au coating	0.25	0.05	~106	2000	ACS Applied Energy Mater. 2019, 2, 6490-6496.[8]
Cu coating	1	0.5	~30	1500	Energy Storage Mater. 2020, 27, 205-211.[9]
C_3N_4	2	2	~50	500	*Chem. Eng. J.* 2021, *403*, 126425.[10]
Kaolin coating	4.4	1.1	~70	800	Adv. Funct. Mater. 2020, 30, 2000599.[11]
rGO coating	1	2	~60	200	ACS Appl Mater Interfaces 2018, 10, 25446-25453.[12]
MOF(UiO-66)-PVDF coating	1	0.5	~41	500	ACS Appl. Mater. Interfaces 2019, 11, 32046-3205.[13]

Poly (vinyl buyral)	0.5	0.5	~50	2200	Adv. Funct. Mater. 2020, 30, 2001263.[14]
Polyamide coating	0.5	0.25	~100	8000	Energy Environ. Sci. 2019, 12, 1938-1949.[15]
TiO_2/PVDF	0.885	0.885	~50	2000	Adv. Funct. Mater. 2020, 2001867.[16]
ZnO-3D coating	5	1.25	~43	500	Energy Environ. Sci. 2020, 13, 503-510.[17]

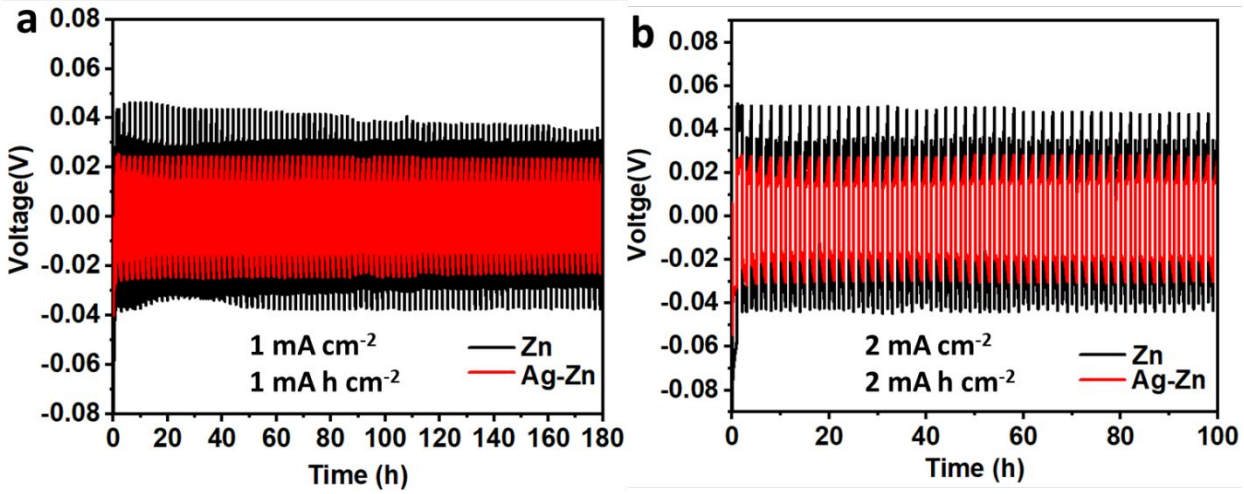

Figure S7. Cycling performance of symmetric cells based on Zn foil with 25μm thickness at current density of a) 1 mA cm^{-2} with a capacity of 1 mA h cm^{-2} and b) 2 mA cm^{-2} with a capacity of 2 mA h cm^{-2}.

Table S2. Depth of discharge levels of symmetric cells.

Current density (mA cm^{-2})	Areal capacity (mA h cm^{-2})	Zn thickness (μm)	Depth of discharge (%)
2	2	25	14
1	1	25	7
2	2	125	2.8
1	1	125	1.4
0.2	0.2	125	0.28

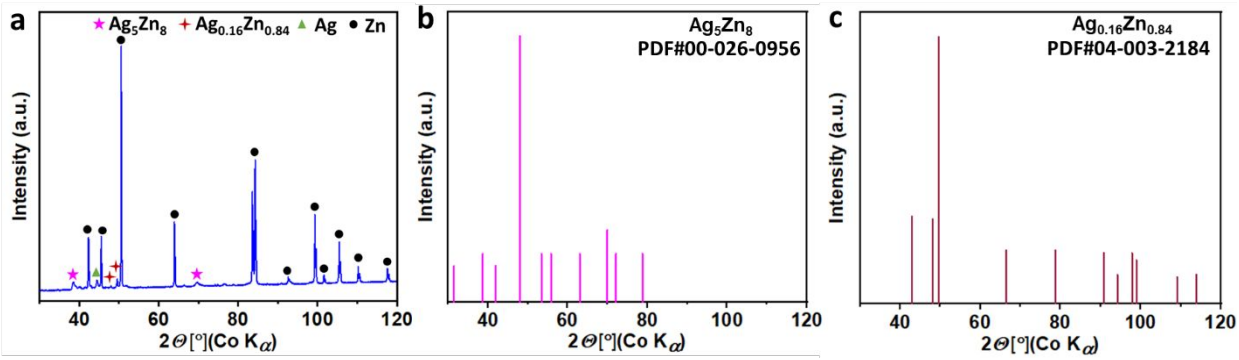

Figure S8. a) XRD pattern of Ag-Zn after 1 cycle at a current density of 0.5 mA cm^{-2} with a capacity of 0.25 mA cm^{-2}. Reference XRD patterns of b) Ag_5Zn_8 and c) $Ag_{0.16}Zn_{0.84}$.

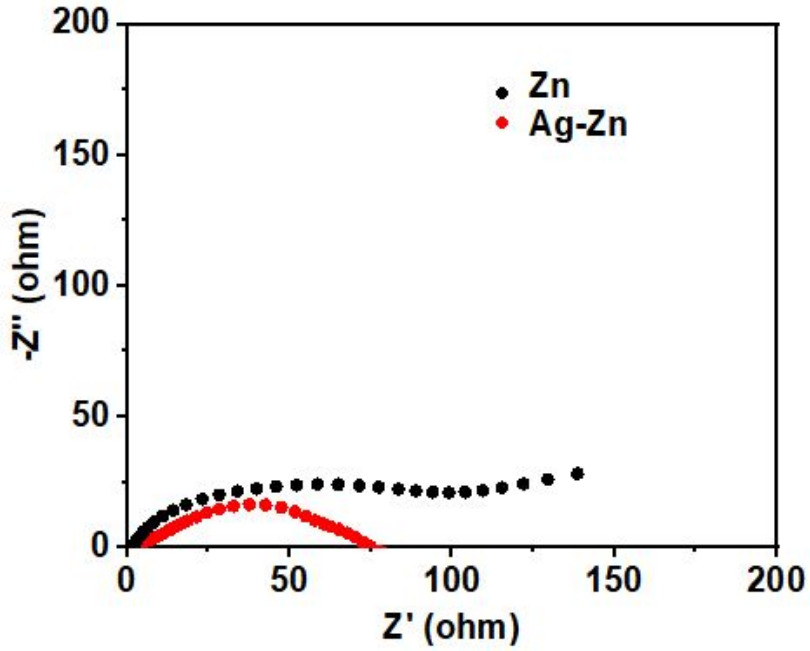

Figure S9. Nyquist plot of symmetric cells Zn and Ag-Zn cells.

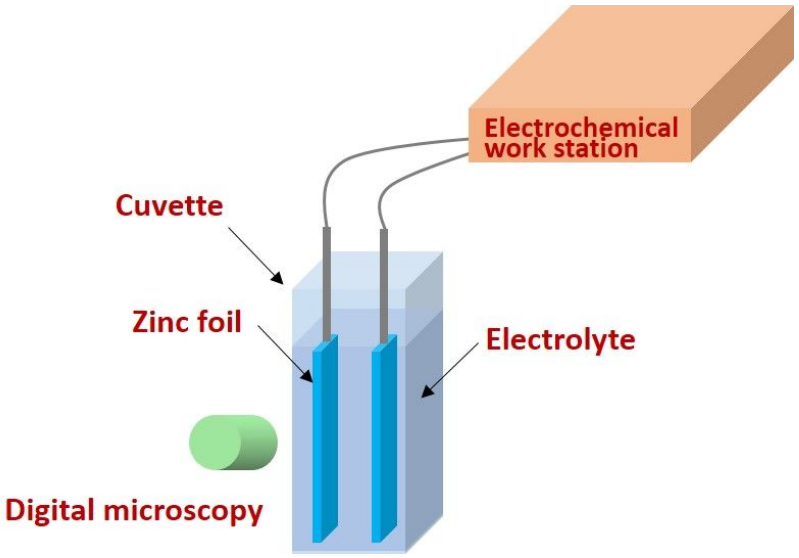

Figure S10. Schematic diagram of the set-up for *in situ* microscopy for Zn deposition.

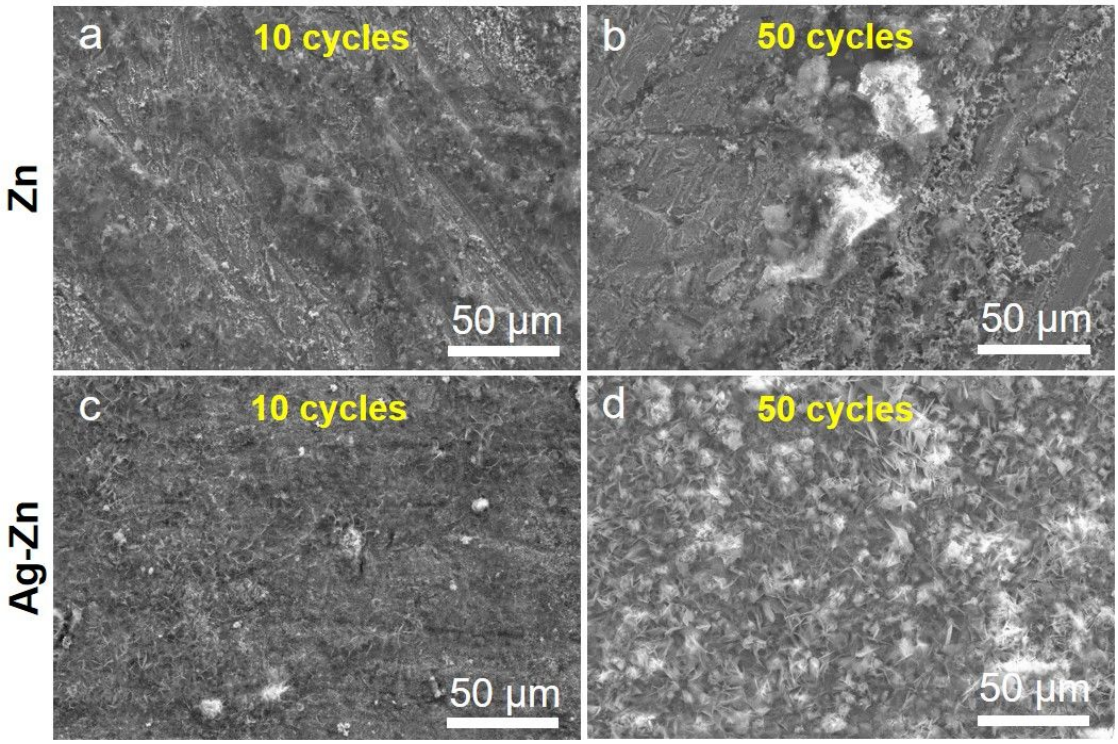

Figure S11. SEM images of Zn and Ag-Zn after 10 cycles and 50 cycles at a current density of 0.25 mA cm^{-2} with a capacity of 0.05 mA h cm^{-2}.

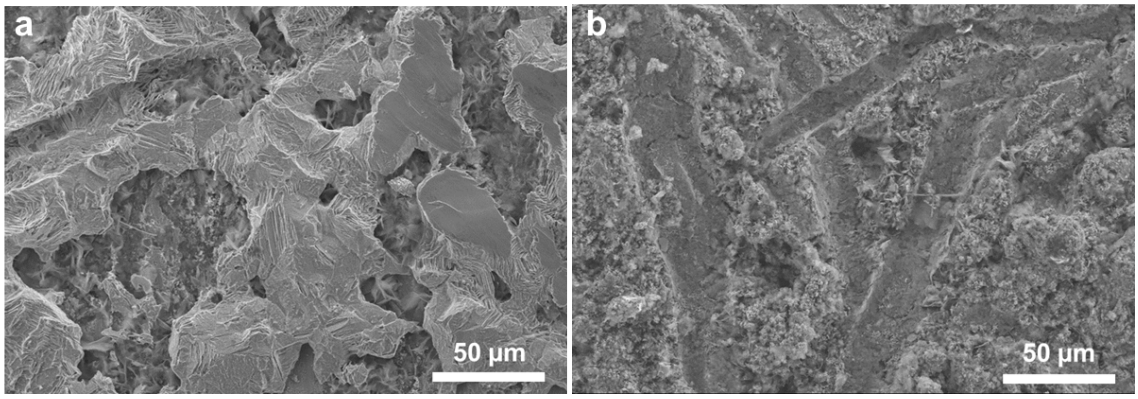

Figure S12. SEM images of a) Zn and b) Ag-Zn after 30 cycles at a current density of 5 mA cm^{-2} with a capacity of 1 mA h cm^{-2}. The grooves in b are due to the fiber of separator.

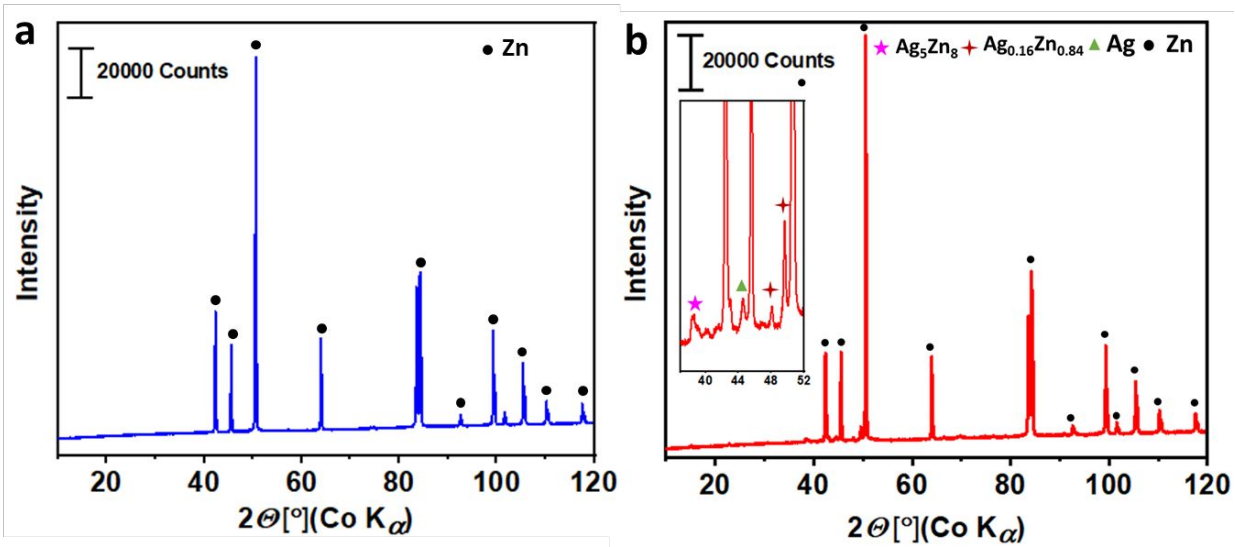

Figure S13. XRD pattern of a) Zn and b) Ag-Zn after 30 cycles at a current density of 5 mA cm^{-2} with a capacity of 1 mA h cm^{-2}.

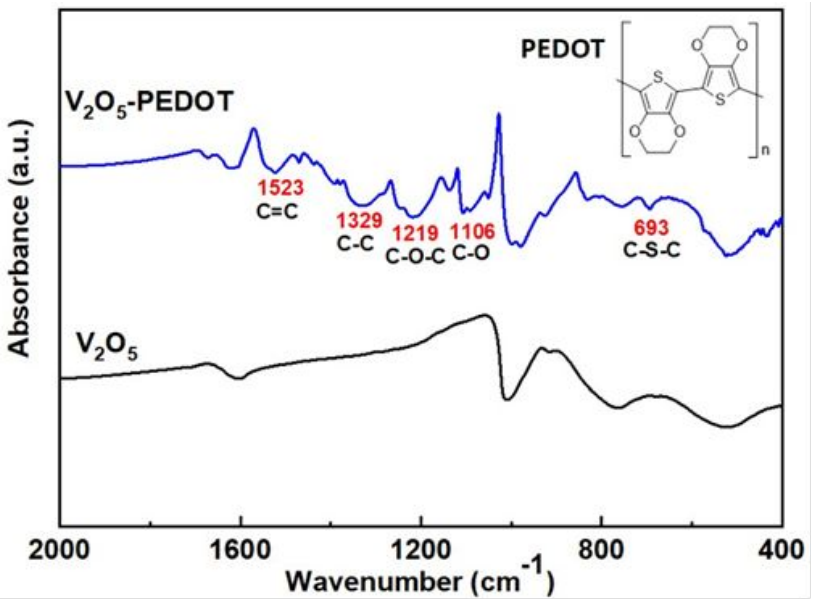

Figure S14. FTIR spectra of V_2O_5 and V_2O_5-PEDOT, inset represents the molecular structure of PEDOT.

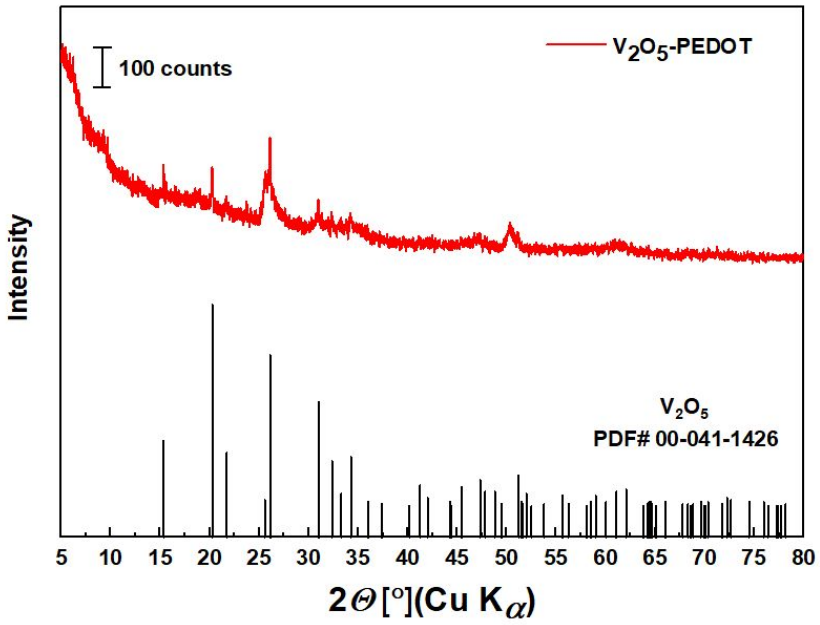

Figure S15. XRD pattern of PEDOT-V_2O_5 composite.

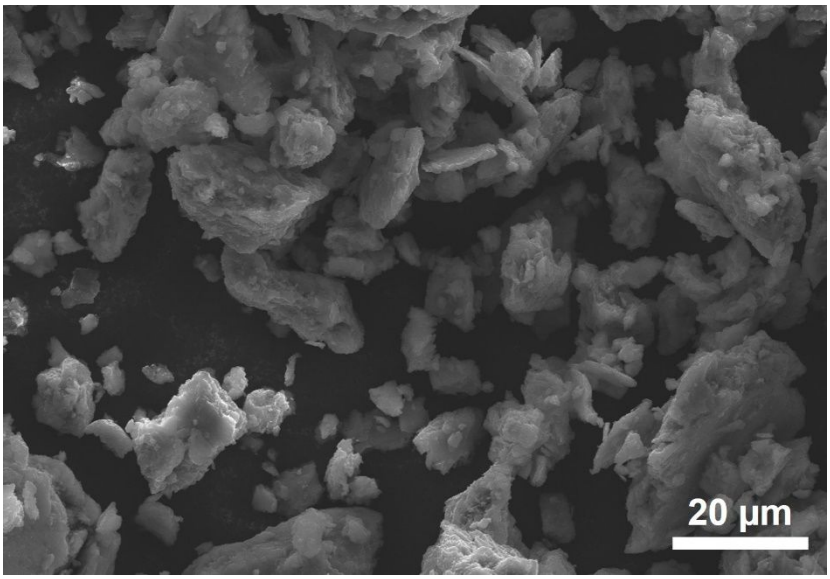

Figure S16. SEM image of PEDOT-V_2O_5 composite.

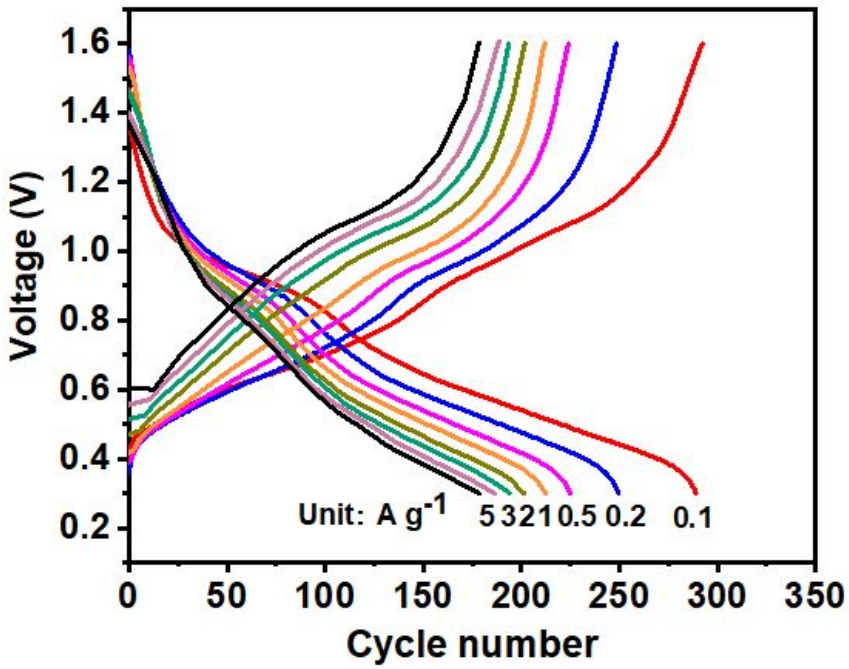

Figure S17. Charge/discharge curves of Zn//V_2O_5-PEDOT at different current densities.

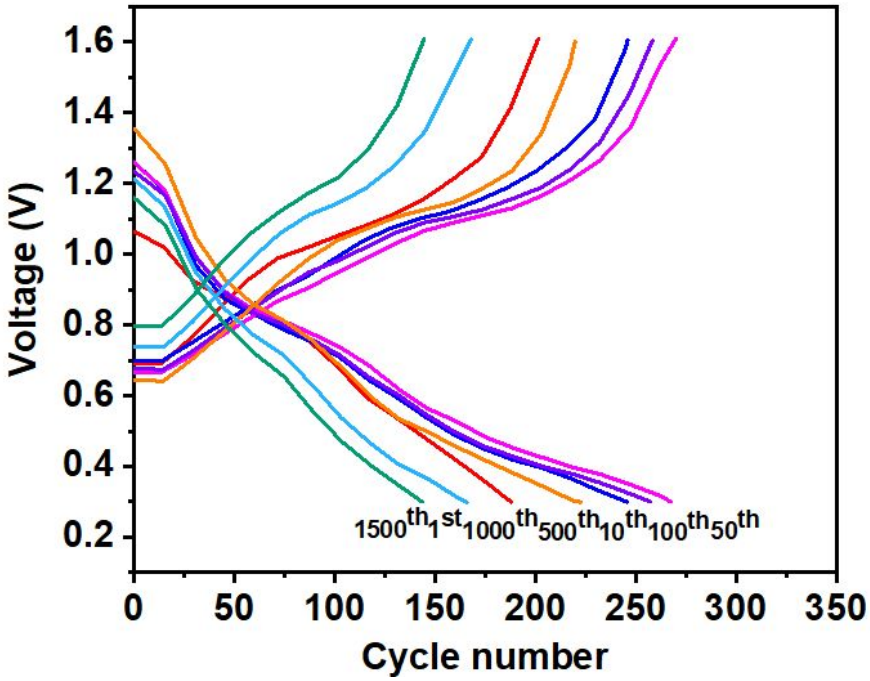

Figure S18. Charge/discharge curves of Zn//V_2O_5-PEDOT at different cycles at 5 A g^{-1}.

References

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