Electronic Supplementary Material (ESI) for ChemComm.

Defect Engineering of molybdenum disulfide nanosheets boosting super Zn^{2+} storage from polyaniline intercalation cathode Supporting Information

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Experimental section

Chemicals

Ammonium molybdate and thiourea were purchased from Shanghai Macklin Biochemical Company Limited. Aniline, and isopropanol directly buy from Shanghai Aladdin Bio-Chem Technology Company Limited. The nitric acid comes from Sinopharm Chemical Reagent Company Limited. All chemicals were used as received.

Synthesis of MoO_3 nanobelts

Typically, 3 g ammonium molybdate was dissolved in 60 mL deionized water with stirring for 20 mins and then adding 15 mL nitric acid to form a transparent solution. The solution was poured to a 100 mL Teflon autoclave and retention 180 °C for 24 h. After the solution cooling to room temperature, the product was obtained via filtration and drying.

Synthesis of peony-like MoS_2

685 mg thiourea dissolve in 60 mL deionized water with stirring for 20 mins. And the 100 mg MoO_3 was poured, followed by ultrasonication for 30 mins. Finally, the solution was transferred to a 100 mL Teflon autoclave and retention at 200 °C for 24 h. The resulting product is obtained by filtration and drying.

Synthesis of peony-like PA-MoS_2

In brief, 0.3 g MoS_2 was mixed with 30 mL isopropanol by ultrasonication. After stirring for 15 mins, 5 mL aniline was added to the solution to form an even solution with stirring for 30 mins, and then the solution was maintained at 60 °C for 90 mins. Finally, after the solution cooling to room temperature, the product was obtained via filtration and drying at 60 °C.

Materials characterization

Thermo Scientific K-Alpha was used to observe the structure characterized. Microstructure and the distribution of elements were observed via JEOL JEM-F200 and Talos F200x G2, respectively. X-ray photoelectron spectroscopy (XPS) was performed on the Thermo Scientific K-Alpha Nexsa system.

Electrochemical measurements

CR-2032 coin consisted of zinc foil, glass fiber membrane, and 3M $Zn(CF_3SO_3)_2$ served as an anode, separator, and electrolyte, respectively. Material, conductive carbon, and polyvinylidene fluoride were mixed with the radio of 7:2:1 to fabricate the uniform slurry when the 1-methyl-2-pyrrolidinone was used as a solution, which was painted in the carbon paper. And the carbon paper was moved to a blast dryer to move the 1-methyl-2-pyrrolidinone at 60 °C for 12 h. Electrochemistry performances and galvanostatic intermittent titration technique were tested on the NEWARE battery test system with the voltage window of 0.2-1.3 V (vs Zn/Zn^{2+}). The electrochemical workstation (CHI660A) was employed to test electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV) curves.

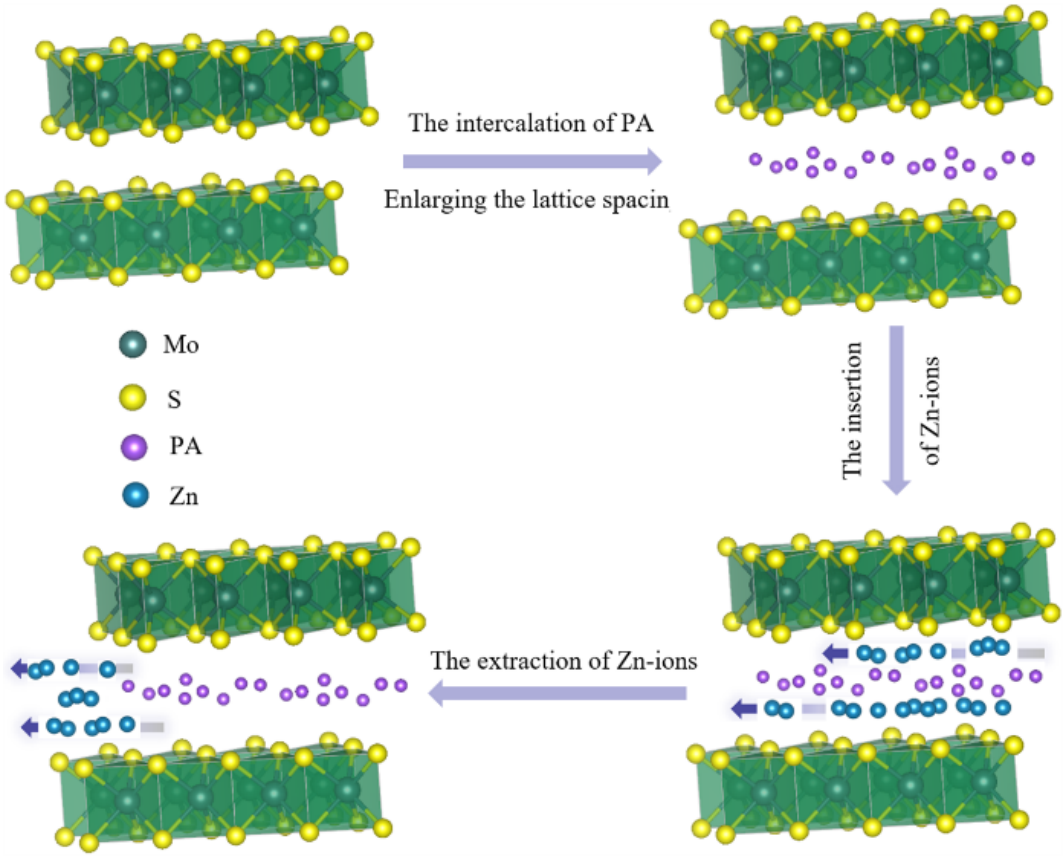

Fig. S1 Schematic illustration of the intercalation/extraction process of Zn-ions during the cycle process.

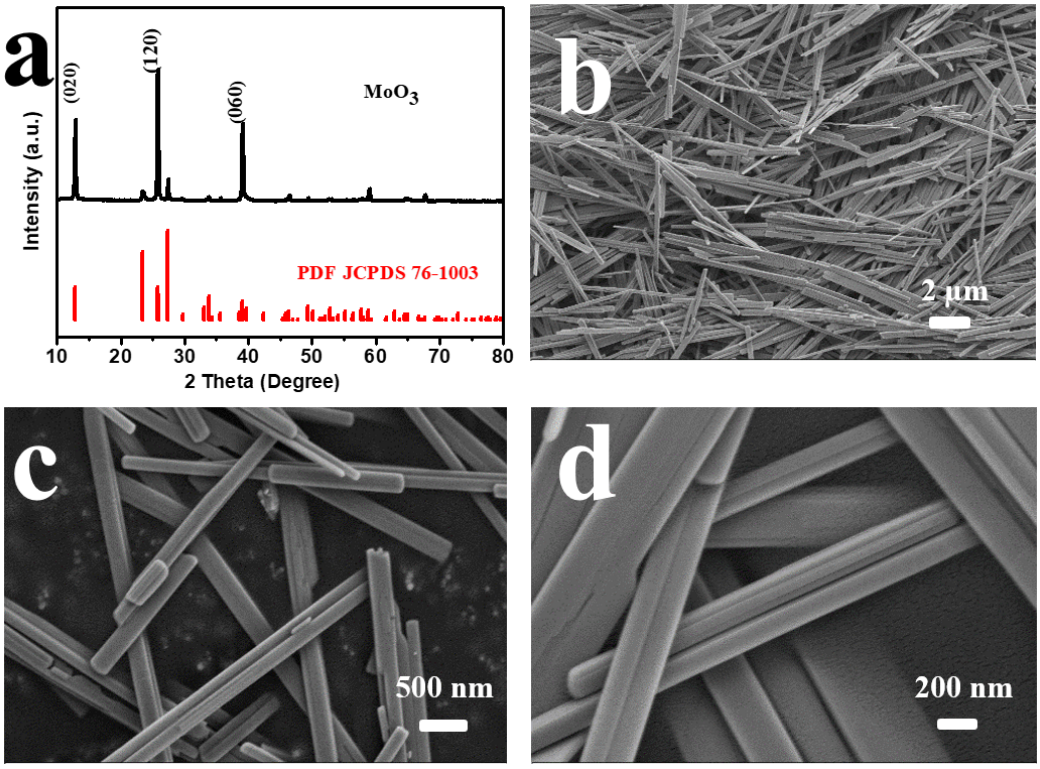

Fig. S2 (a) XRD pattern, (b-c) SEM images of MoO_3.

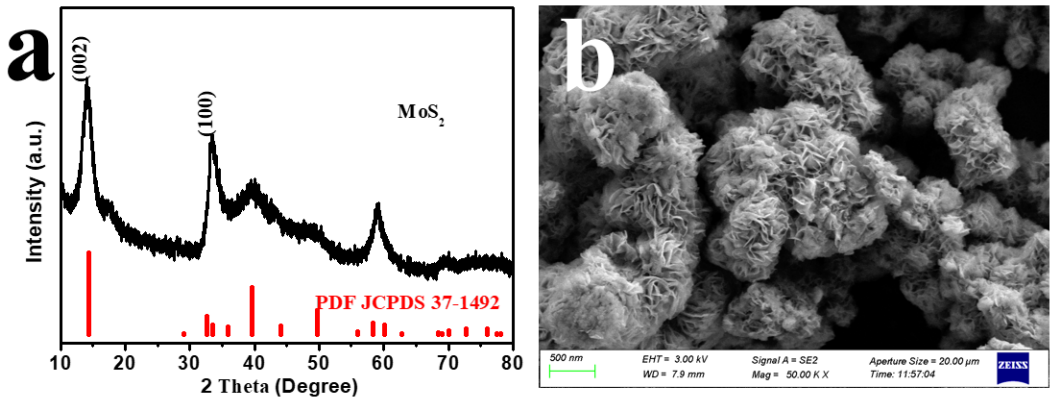

Fig. S3 (a) XRD pattern, (b) SEM images of MoO_3.

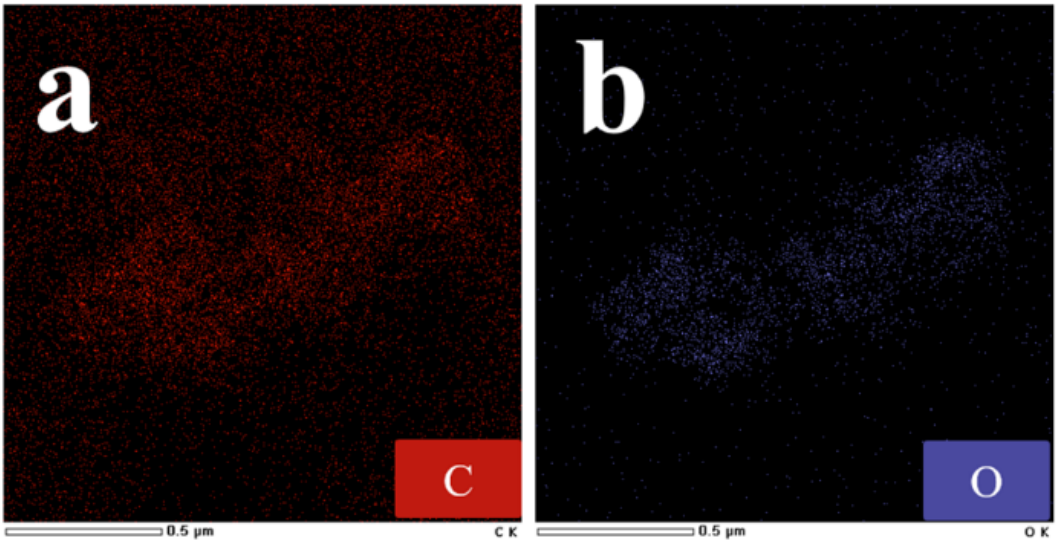

Fig. S4 Elemental mapping of PA-MoS_2.

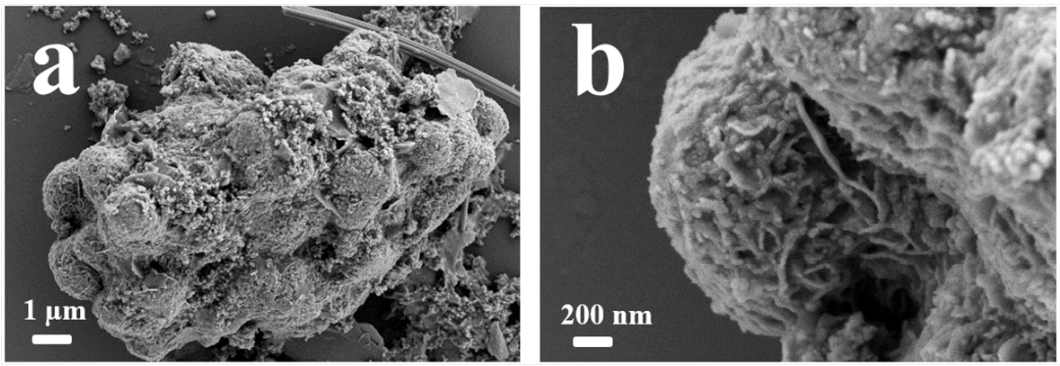

Fig. S6 SEM of PA-MoS_2 after cycling.

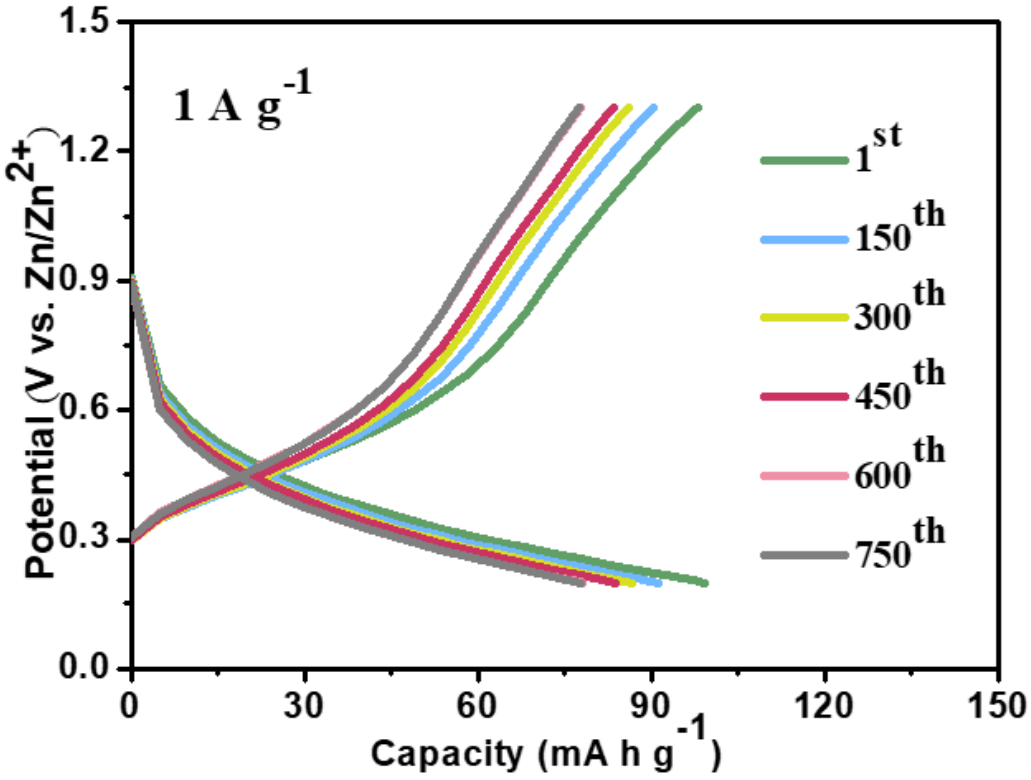

Fig. S7 Galvanostatic charge-discharge curves at 1 A g^{-1}.

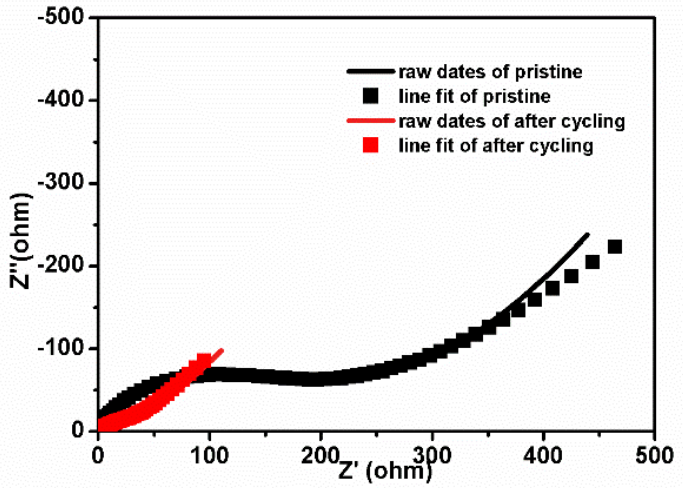

Fig. S7 Nyquist plots of PA-MoS_2.

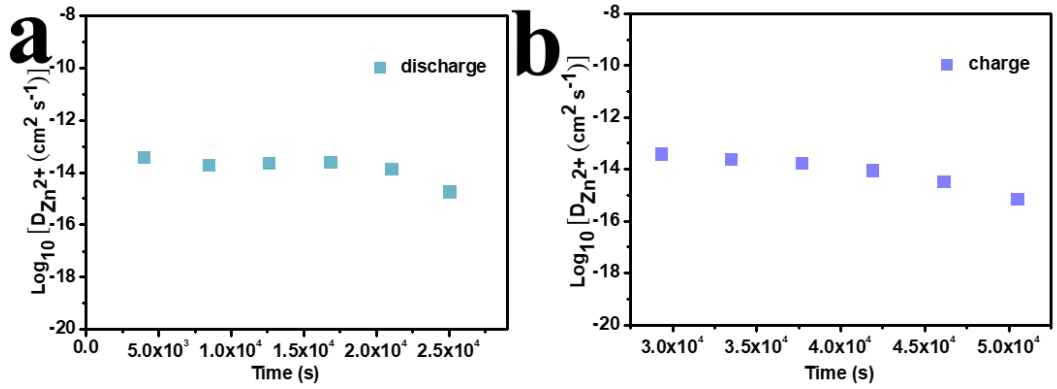

Fig. S8 (a) Zn^{2+} diffusion coefficient of the discharge process, (b) the charge process at 0.1 A g^{-1}.

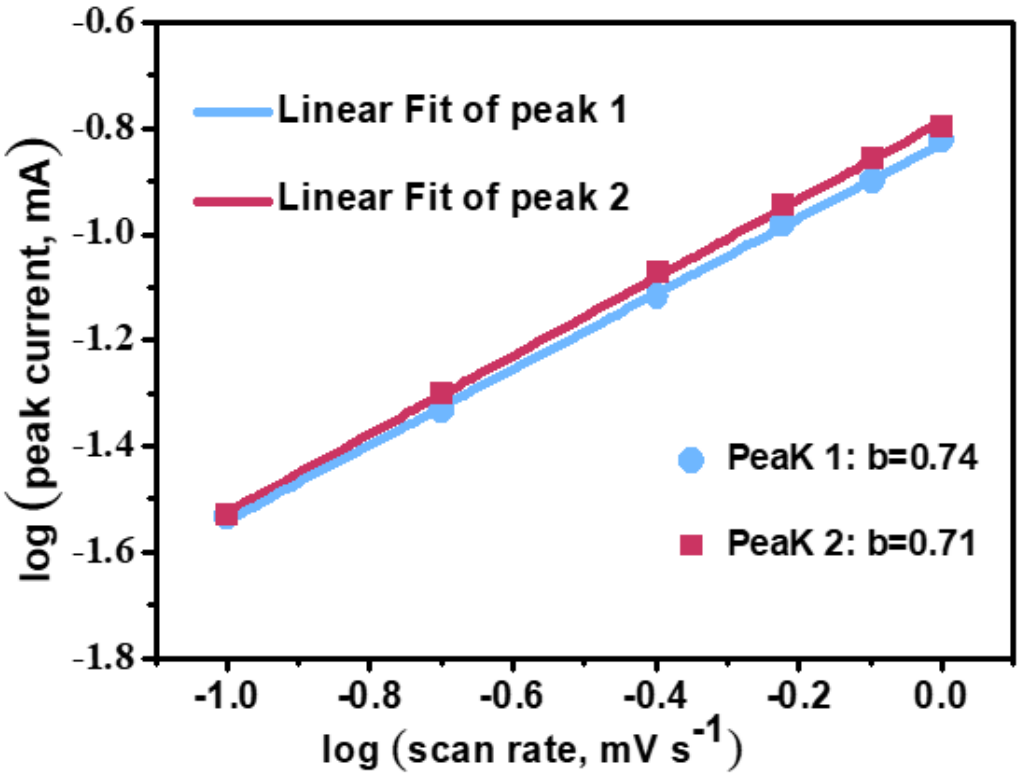

Fig. S9 (a) log(*i*) *vs* log(*mv*) plots at specific currents.

Table S1. comparison of the electrochemical performance among PA-MoS_2 and other reported Mo-based cathode materials.

Materials	Electrolyte	Voltage window (V vs Zn/Zn^{2+})	Cyclic capacity (mAh g^{-1}/th/A g^{-1})	Ref.
P-MST	3 M $Zn(CF_3SO_3)_2$	0.2-1.25	125/100/1; 88/300/2	1
MoS_2@CNTs	3 M $Zn(CF_3SO_3)_2$	0.3-1.2	92.2/500/1	2
TNC@MoS_2 NWS	2 M $ZnSO_4$	0.3-1.3	ca. 65/100/0.5	3
MoS_{2-x}250	3 M $Zn(CF_3SO_3)_2$	0.25-1.25	92.8/600/0.5	4
PA-MoS_2	**3 M $Zn(CF_3SO_3)_2$**	**0.2-1.3**	**157.7/80/0.1; 77.8/750/1**	**This work**

References

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