Supplementary Information

Mn_2O_3/Al_2O_3 cathode material derived from metal-organic framework with enhanced cycling performance for aqueous zinc-ion batteries

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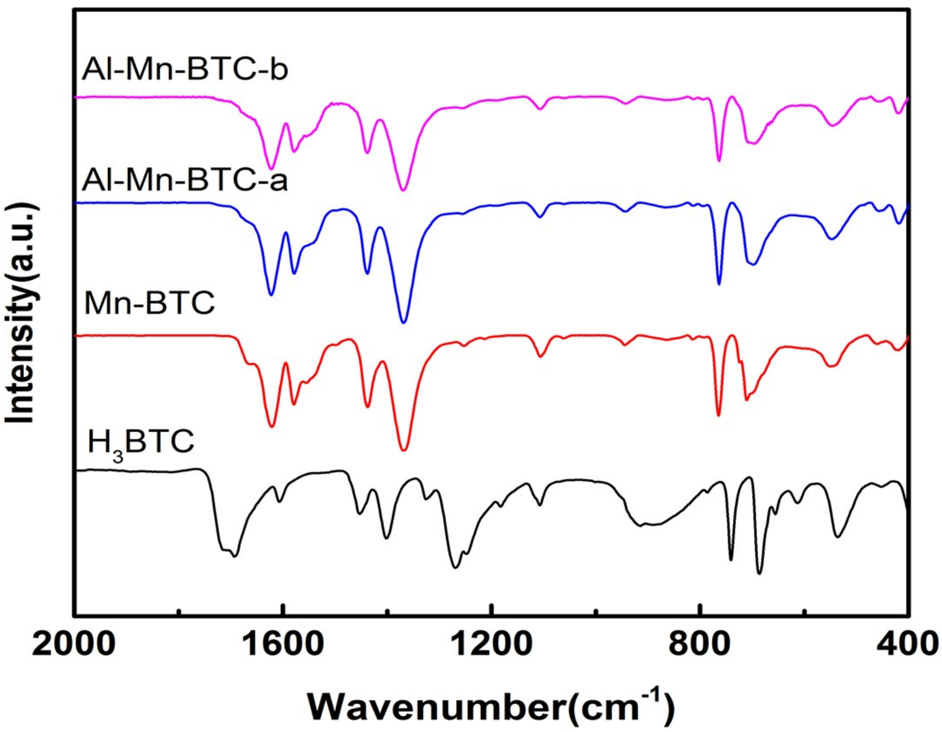

Fig.S1 FTIR spectra of Mn-BTC, Al-Mn-BTC-a, Al-Mn-BTC-b and H_3BTC.

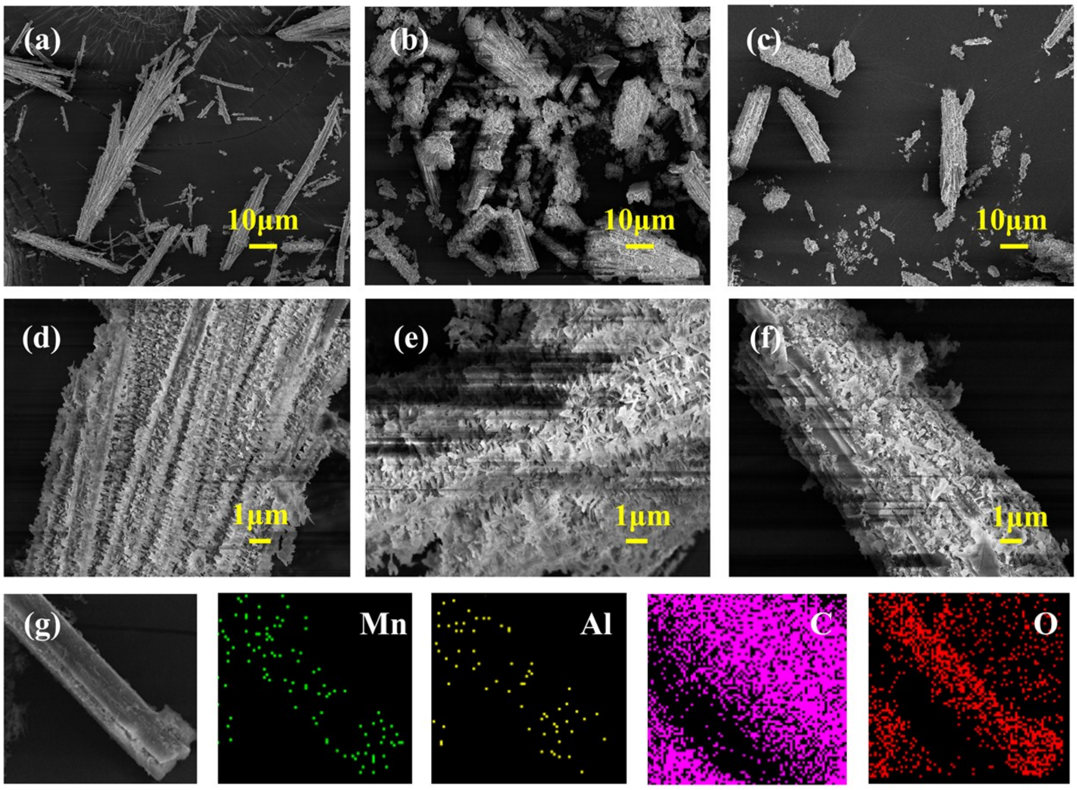

Fig.S2 The SEM images of Mn-BTC (a, d), Al-Mn-BTC-a (b, e), and Al-Mn-BTC-b (c, f), and the corresponding EDS mapping images of a single Al-Mn-BTC-a nanorod (g).

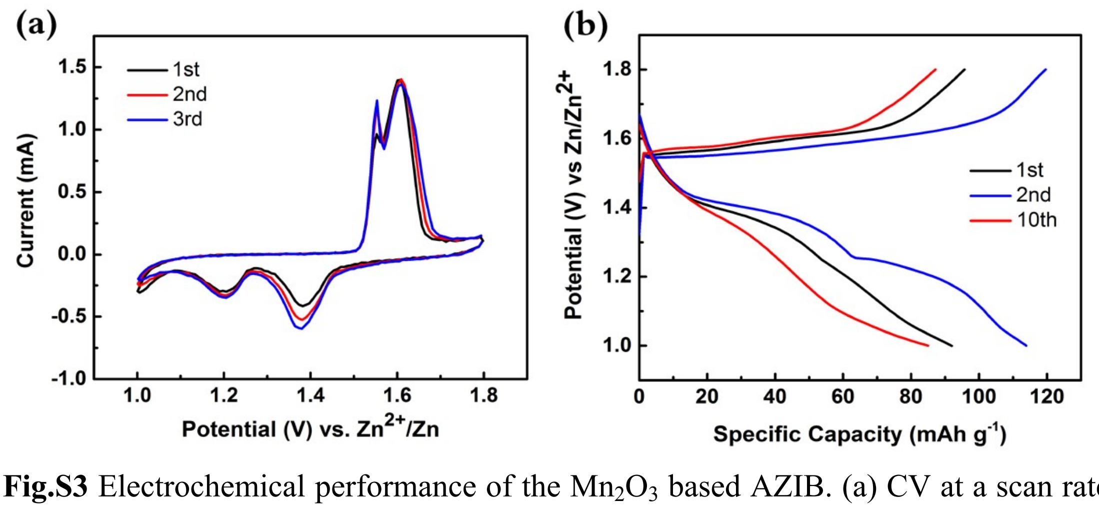

Fig.S3 Electrochemical performance of the Mn_2O_3 based AZIB. (a) CV at a scan rate of 0.5 $mV\cdot s^{-1}$ in the potential window of 1.0–1.8 V vs. Zn^{2+}/Zn.(b) Discharge–charge profile at a current density of 300 $mA\cdot g^{-1}$.

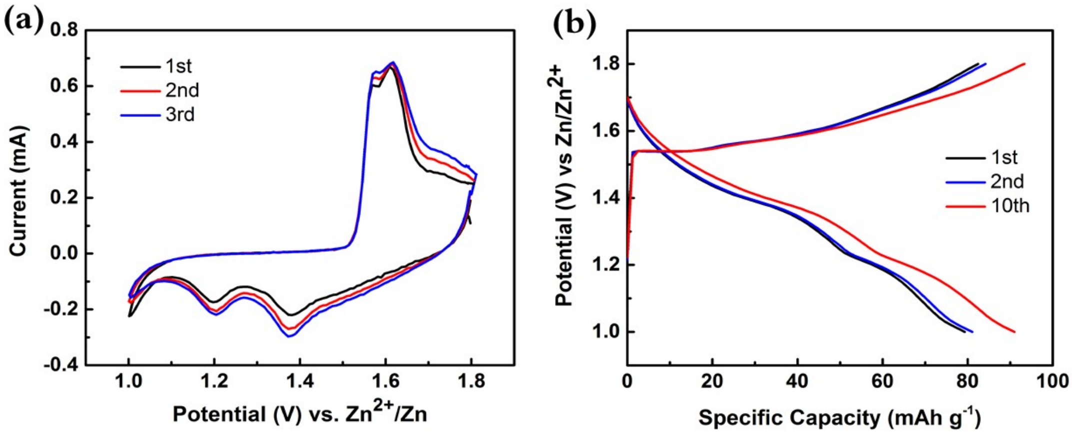

Fig.S4 Electrochemical performance of the Mn_2O_3/Al_2O_3-b based AZIB. (a) CV at a scan rate of 0.5 $mV \cdot s^{-1}$ in the potential window of 1.0–1.8 V vs. Zn^{2+}/Zn.(b) Discharge–charge profile at a current density of 300 mA g^{-1}.

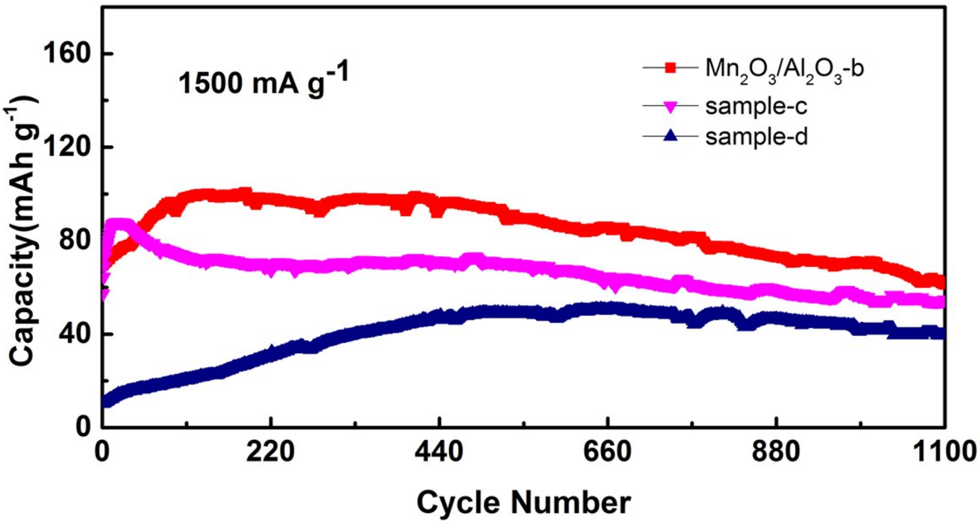

Fig.S5 Long-term cycling performance of different Al:Mn molar ratio Mn_2O_3/Al_2O_3 electrodes at a high current density of 1500 mA g^{-1}.

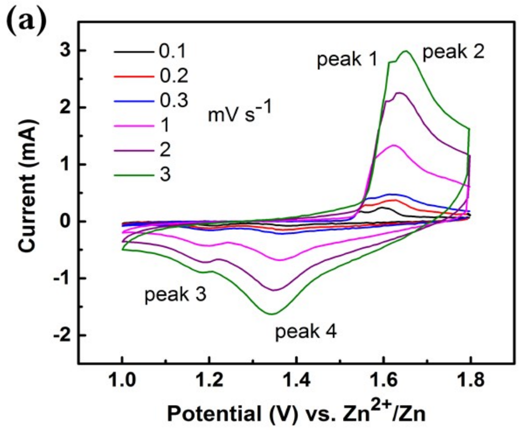

Fig.S6 (a) CV curves of Mn_2O_3/Al_2O_3-b electrode at different scan rate.

For the Mn_2O_3 and Mn_2O_3/Al_2O_3-a electrode, the peak current Ip and of the scan rate $v^{1/2}$ show the good line relationship, revealing diffusion-controlled kinetics. Then, the D_{Zn} can be estimated based on Eq S1

$$I_p=2.695\times10^5ACD^{1/2}n^{2/3}v^{1/2} \quad \text{Eq S1}$$

where I_p is the peak current, A is electronchemcial active area, C is the Zn^{2+} concentration, D is the Zn^{2+} diffusion coefficient, n is the number of electrons per reaction species, and v is the scan rate. Based on equation S1, the ion diffusion coefficient is proportional to the slope of I_p vs. $v^{1/2}$, which can compare the diffusion kinetics between Mn_2O_3 and Mn_2O_3/Al_2O_3-a electrode.

Table S1 Elemental composition of Al and Mn elements in the Mn_2O_3、Mn_2O_3/Al_2O_3-a and Mn_2O_3/Al_2O_3-b sample by ICP.

element	Mn_2O_3	Mn_2O_3/Al_2O_3-a	Mn_2O_3/Al_2O_3-b
Mn	80.80%	70.03%	67.18%
Al	-	1.23%	3.72%

Table S2 Collected ICP data of cycled electrodes first time and stopped at fully charged state in electrolytes free of Mn^{2+}.

electrolyte	Mn_2O_3	Mn_2O_3/Al_2O_3-a
Zn(ppm)	907.6	1034.0
Mn(ppm)	1.66	1.41