Electronic Supplementary Information (ESI)

3D Zinc@Carbon fibers composite framework anode for aqueous Zn-MnO_2 batteries

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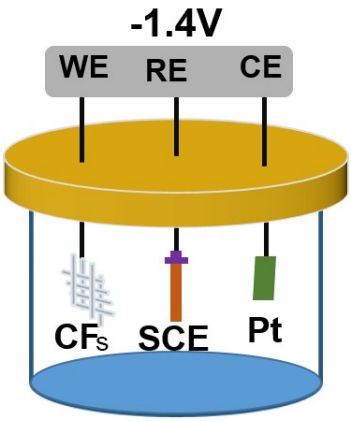

Fig. s1 Schematic illustration for preparation of Zn@CFs electrode in a three-electrode glass under -1.4V vs. SCE.

The area of hydrophilic carbon clothes was 4 cm^2 (2cm*2cm, shanghai hesen, 99%) as working electrode, a Pt foil (alfa, 99%) as counter electrode, a SCE as the reference electrode. The electrodeposition voltage was under -1.4 V (vs. SCE) in a solution containing 0.2 mol L^{-1} $ZnSO_4$ and 0.5 mol L^{-1} $Na_3C_6H_5O_7 \cdot H_2O$ for 0.5 h. Before deposition, the carbon clothes were immersed in the solution for 10 mins to maintain a better infiltration and eliminate the bubbles.

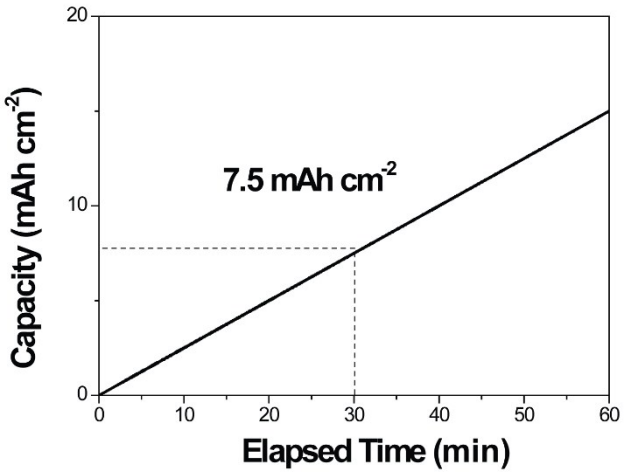

Fig. s2 Deposition capacity curve over time (min)

After electrodeposition for 30 mins under -1.4 V (vs. SCE), the capacity reach to 7.5 mA h cm^{-2} and the mass load of Zn was about 9.5 mg cm^{-2} (after 30 mins electrodeposition).

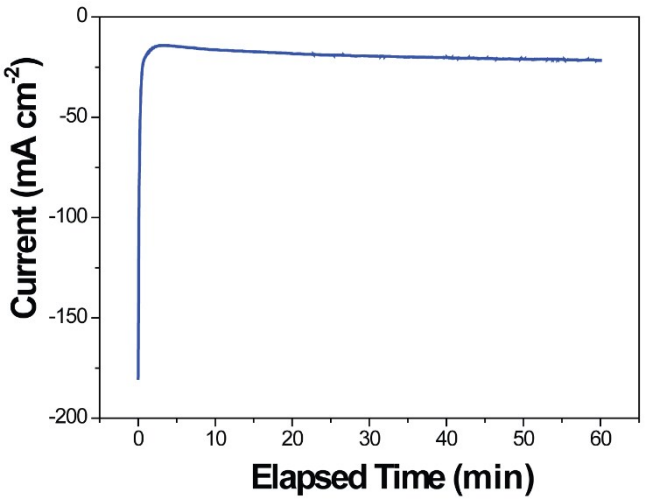

Fig. s3 Deposition current curve over time (min)

Through constant voltage (-1.4V) electrodeposition process, with the increment Zn amount, the electrical resistance of Zn@CFs anode decreased which was reflected by increment of deposition current.

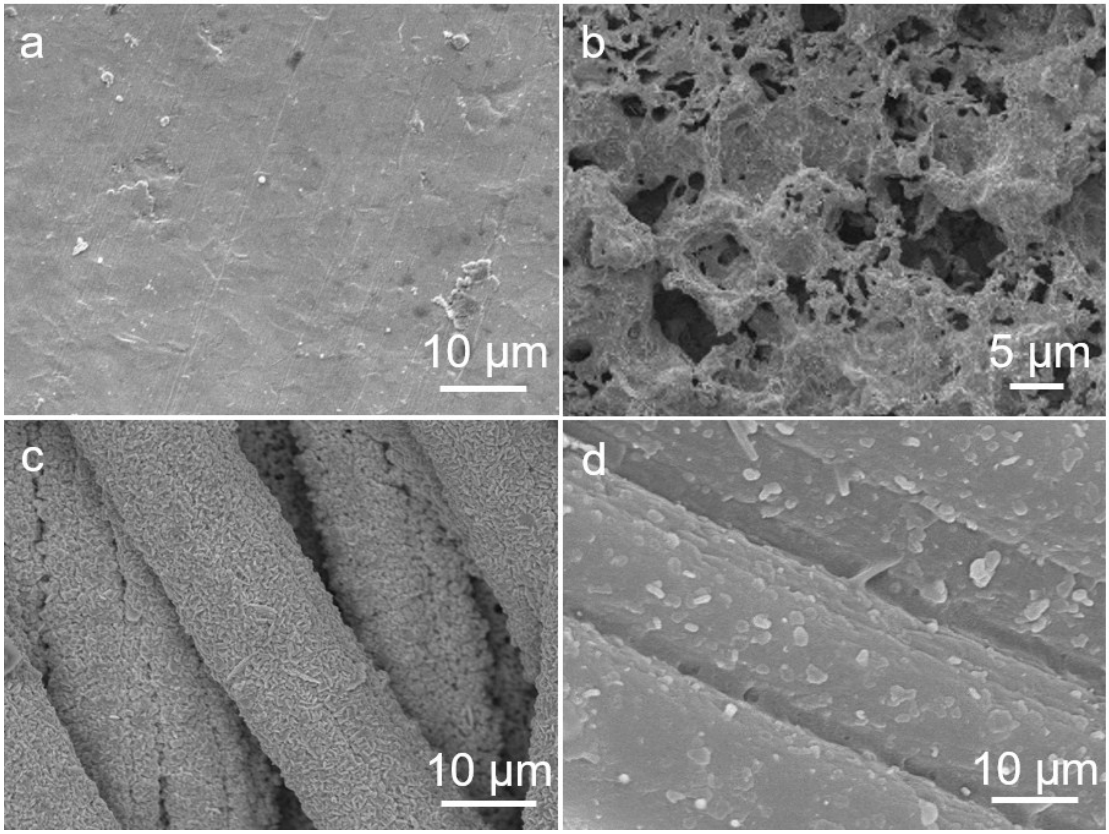

Fig. s4 the morphology changes of a commercialized Zinc plate anode before cycling test (a)and the SEM image of Zn dendrite after cycling(b). The morphology changes of Zn@CFs anode before(c) and after (d) cycling test.

Table S1 Comparison of the as-obtained Zn@CFs |α-MnO_2 aqueous battery with previous reported Zn^{2+} ion aqueous battery systems.

Life span	Cathode material	Initial discharge capacity	Capacity Retention	Electrolyte	Highest rate Current	Energy density (W h kg^{-1})	Power density (kW kg^{-1})	Reference
140	α-MnO_2	239.4 mA h g^{-1} (1 C)	86.80%	2 M $ZnSO_4$ and 0.1 M $MnSO_4$	1540 (5 C)	392.2	2.2	**This work**
150	Prussian Blue	81mA h g^{-1} (100 mA g^{-1})	85%	0.5 M Na_2SO_4 and 0.5 M $ZnSO_4$	500 mA g^{-1}	97.2	0.6	Electrochim. Acta, 2017, 244, 172–177
125	δ-MnO_2	123 mA h g^{-1} (C/25)	49%	0.5 M AN−Zn $(TFSI)_2$ electrolyte	1 C (208 mA g^{-1})	116.9	0.21	Chem. Mater., 2017, 29, 4874−4884
80	α-MnO_2	171.5 mA h g^{-1}	85.60%	1 M $ZnSO_4$	200 mA g^{-1} (about 1.2 C)	248.7	0.29	J. Electrochem. Soc., 2015, 162, A1439-A1444
60	MnO_2	220 mA h g^{-1}	40.90%	25 wt% KOH solution	C/20(15.5 mA h g^{-1})	291.5	0.02	Electrochem. Commun., 2017,81, 136-140