Electronic Supplementary Information

Facile synthesis of manganese-based complex as cathode materials for conductive-carbon-assisted aqueous rechargeable batteries

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Figure S1. The photographs of the cathode film.

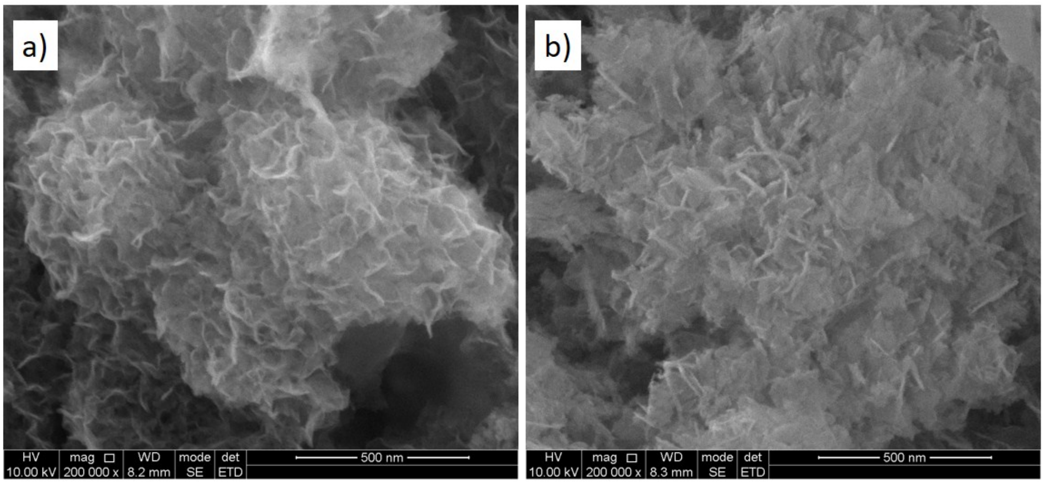

Figure S2. SEM images of cathode electrode in the charged/discharged state. a) 1.85V, charged state, b) 1V discharged state.

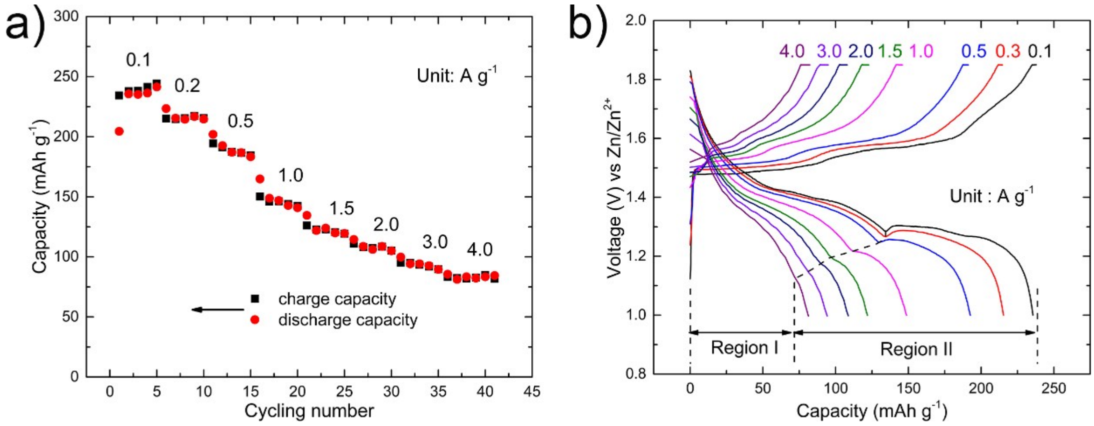

Figure S3. Electrochemical performance of manganese-based complex in 1M $ZnSO_4$. a) Cycling performance at various current densities (0.1-4.0 A g^{-1}). b) Charge and discharge voltage profiles using 1M $ZnSO_4$ as electrolyte at various current densities between 1.0-1.85 V vs. Zn/Zn^{2+}

Table S1. Specific capacity and energy density of manganese-based complex.

Current density ($A\ g^{-1}$)	0.1	0.2	0.5	1.0	1.5	2.0	4.0
Discharge capacity ($mAh\ g^{-1}$)	248	231	196	175	160	149	131
Energy density ($Wh\ kg^{-1}$)	335.0	317.3	261.5	231.0	211.8	197.5	175.0

Table S2. Summary of electrochemical performance of different cathode materials for aqueous rechargeable batteries

Samples	Electrolyte	Energy density base on the active mass of electrode materials	Cycling performance	Reference number
$LiMn_2O_4$	21M LiTFSI	~200 Wh/kg at 24 mA/g	~40 mAh/g 68% with 1000 cycles at 540 mA/g and 78% with 100 cycles at 18 mA/g	3
$LiMn_2O_4$	0.5 M Li_2SO_4	~75 Wh/kg at 500 mA/g	~120 mAh/g 100% capacity after 1200 cycles at 500 mA/g	4
$LiMn_2O_4$	0.5 M Li_2SO_4	~100 Wh/kg at 500 mA/g	37 mAh/g 93% capacity retained after 10000 cycles at 1000 mA/g	5
$NaMnO_2$	2 M CH3COONa	30Wh/kg at 60 mA/g	37 mAh/g 75% capacity retained after 500 cycles at 300	6
$Na_{0.95}MnO_2$	0.5M $Zn(CH_3COO)_2$ 0.5M CH_3COONa	~84 Wh/kg at 1C	40 mAh/g 92% capacity retained after 1000 cycles at 4C	7
Amorphous $FePO_4$	1M $ZnSO_4$	--	96mAh/g at 10 mA/g	8
$ZnMn_2O_4$	3M $Zn(CF_3SO_3)_2$	~202 Wh/kg at 50 mA/g	~90 mAh/g 94% capacity retained after 500 cycles at 500 mA/g	2
CuHCF	20mM $ZnSO_4$	~95Wh/kg at 60 mA/g	~55 mAh/g 96.3% capacity retained after 100 cycles at 60 mA/g	9
$Zn_3[Fe(CN)_6]_2$	1M $ZnSO_4$	100 Wh/kg at 60 mA/g	~65 mAh/g 76% capacity retained after 100 cycles at 60 mA/g	10

α-MnO_2	1M $ZnSO_4$	--	195 mAh/g 70% capacity retained after 30 cycles at 10 mA/g	11
α-MnO_2	1M $ZnSO_4$	~315 Wh/kg at 32 mA/g	100 mAh/g 100% capacity retained after 100 cycles at 380 mA/g	12
δ-MnO_2	1M $ZnSO_4$	--	252 mAh/g 44% capacity retained after 100 cycles at 83 mA/g	13
α-MnO_2	1M $ZnSO_4$	--	225 mAh/g 63% capacity retained after 50 cycles at 83 mA/g	14
VS_2	1M $ZnSO_4$	123 Wh/kg at 50 mA/g	190.3 mAh/g 98% capacity retained after 200 cycles at 50 mA/g	15
$Na_3MnTi(PO_4)_3$	1M Na_2SO_4	~82 Wh/kg at 58.7 mA/g	58.4 mAh/g 98% capacity retained after 100 cycles at 58.7 mA/g	16
γ -MnO_2 with TiB_2	1M ZnSO4 saturated LiOH	--	220 mAh/g 55% capacity retained after 40 cycles at 0.5 mA/cm^2	17
γ -MnO_2 with TiS_2	1M ZnSO4 saturated LiOH	--	148 mAh/g 50% capacity retained after 40 cycles at 0.5 mA/cm^2	18
Manganese-based complex.	1M $ZnSO_4$ 0.1M $MnSO_4$	335 Wh/kg at 100 mA/g 175 Wh/kg at 4000 mA/g	149 mAh/g 100% capacity retained after 500 cycles at 2000 mA/g 131 mAh/g 93.9% capacity retained after 2000 cycles at 4000 mA/g	This work

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