Supporting Information

Fe/Zn Co-doped MnO_2 Nanoflowers for High-Performance Aqueous Zinc-Ion Batteries†

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† Electronic supplementary information (ESI) available.

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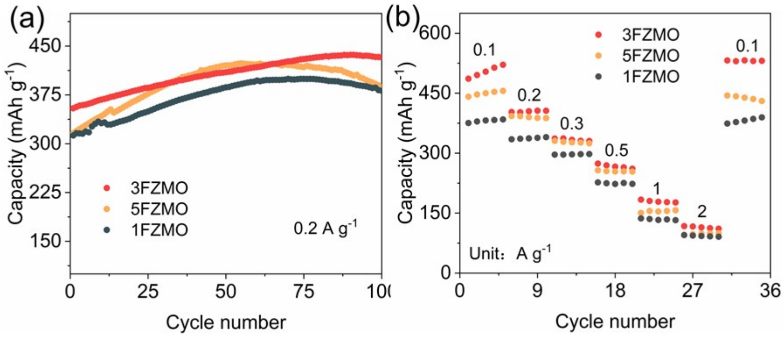

Figure.S1　Comparison of rate performance (a) and cycling performance (b) of the FZMO.

During the preparation of the samples, 0.25 mmol, 0.15 mmol, and 0.05 mmol of iron(III) nitrate nonahydrate and zinc nitrate hexahydrate were added respectively, resulting in 5FZMO, 3FZMO, and 1FZMO.

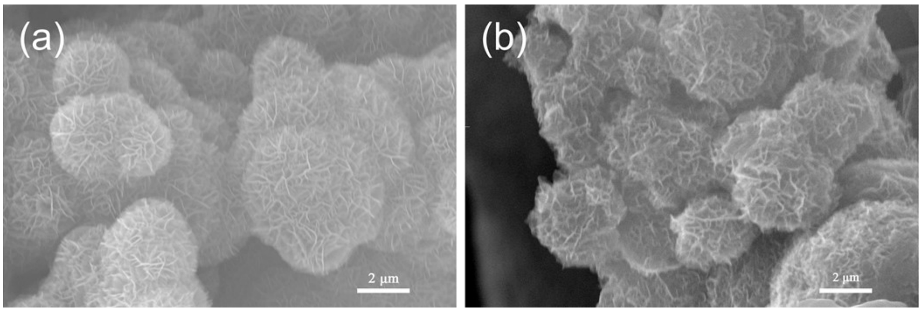

Figure.S2　(a) SEM images of FMO. (b) SEM images of ZMO.

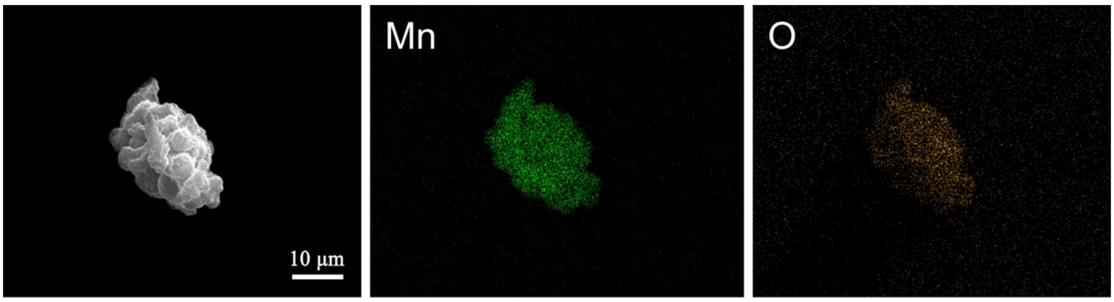

Figure.S3　EDS elemental mapping of the MO sample.

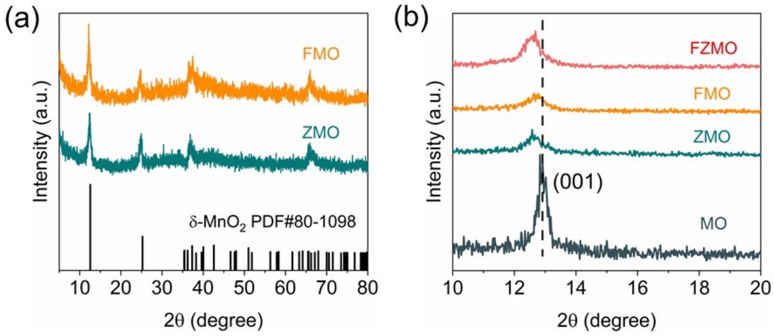

Figure.S4 (a) XRD patterns of FMO and ZMO. (b) The (001) crystal plane diffraction peak in the XRD patterns of FZMO, FMO, ZMO and MO.

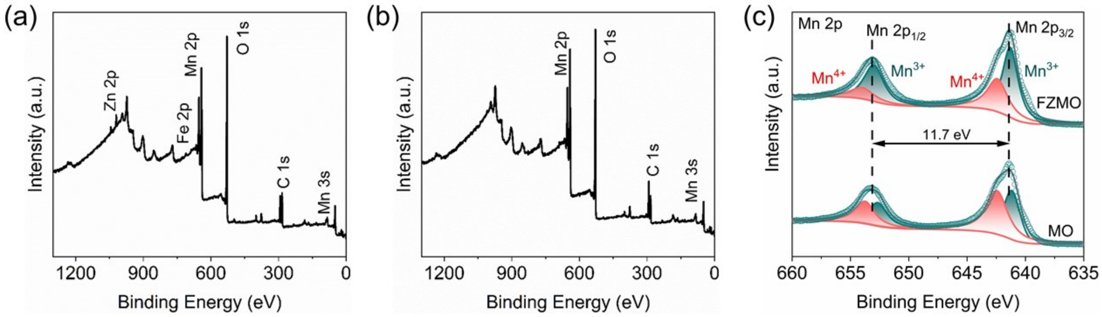

Figure.S5 (a and b) XPS survey spectra of FZMO and MO (c) XPS spectra of Mn 2p.

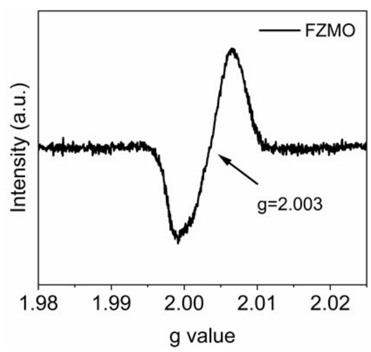

Figure.S6 EPR spectroscopy of FZMO.

Table.S1 ICP analysis of the as-prepared FZMO sample.

Sample	Mn(wt%)	K(wt%)	Fe(wt%)	Zn(wt%)	Mn:Fe molar ratio	Mn:Zn molar ratio
FZMO	49.78	7.01	1.87	1.66	1:0.0369	1:0.0280

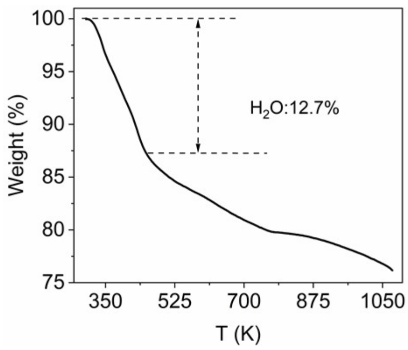

Figure.S7 TGA curve of the as-prepared FZMO sample from 303 to 1073 K.

Analysis of the results from TGA and ICP tests indicates that the modified sample is $K_{0.198}Zn_{0.028}Fe_{0.0369}MnO_{1.861}\cdot 0.778H_2O$.

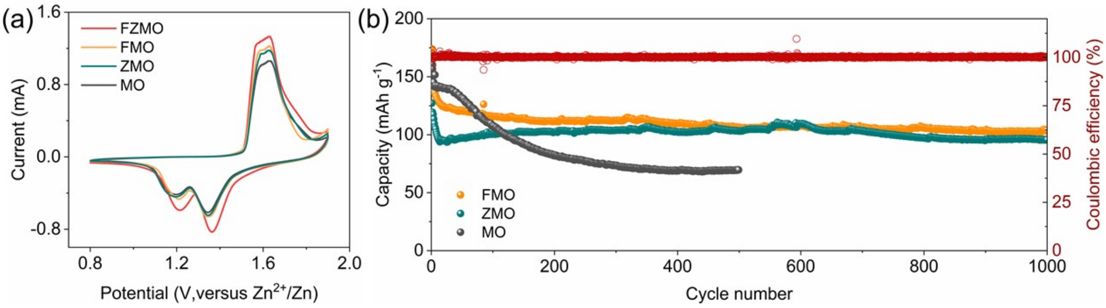

Figure.S8 (a) CV curves of FZMO, FMO, ZMO and MO, (b) Cycling performance of FMO and ZMO at 1.0 A g^{-1}.

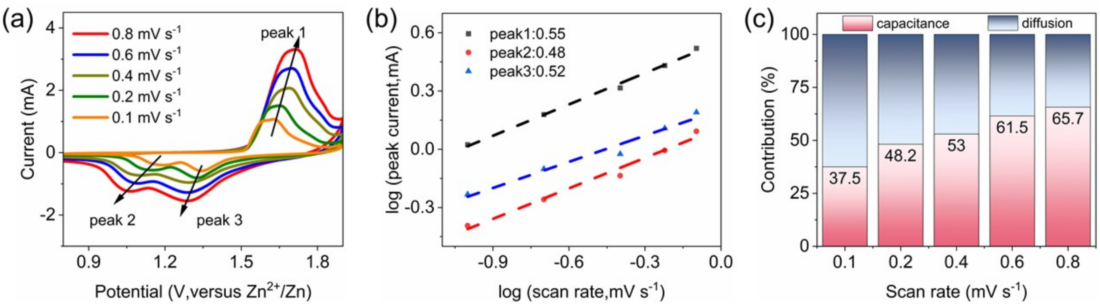

Figure.S9 (a) CV curves at different scan rates, (b) Log (i) vs. log (v) plot of three peaks in CV curves, (c) Capacitive and diffusion contribution at different scan rates of MO electrode.

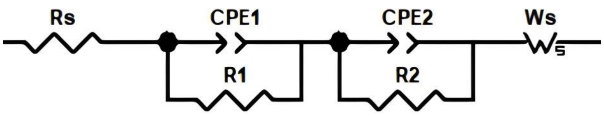

Figure.S10 Equivalent circuit for zinc ion batteries.

Table S2 At 0.2 A g^{-1}, the intercalation capacity contributions of H^+ and Zn^{2+} for the four materials.

Sample	H^+ capacitance contribution (mAh g^{-1})	Zn^{2+} capacitance contribution (mAh g^{-1})	H^+ contribution rate	Zn^{2+} contribution rate
FZMO	243.9	163.3	59.9%	40.1%
FMO	206.8	84.6	71.0%	29.0%
ZMO	180	89.5	66.8%	33.2%
MO	110	44.4	71.2%	28.8%

Table S3 Comparison of the capacity and rate performance between the FZMO and recently reported Mn-based materials.[1–8]

Cathode materials	Specific capacity at different current density (mAh g^{-1})						Ref.
BMO-6	0.1 A g^{-1}	0.2 A g^{-1}	0.4 A g^{-1}	0.6 A g^{-1}	0.8 A g^{-1}	1 A g^{-1}	1
	363	332	286	251	217	197	
Ca/N-MnO_2	0.3 A g^{-1}	0.5 A g^{-1}	1 A g^{-1}				2
	280.3	216.7	134.2				
CaMnO	0.5 A g^{-1}	1 A g^{-1}	1.5 A g^{-1}	2 A g^{-1}			3
	250.4	193.1	132.9	103.5			
Fe/α-MnO_2@ppy	0.1 A g^{-1}	0.2 A g^{-1}	0.4 A g^{-1}	0.6 A g^{-1}	0.8 A g^{-1}	1 A g^{-1}	4
	265	210	164	131	96	73	
Layered MnO_2	0.05 A g^{-1}	0.1 A g^{-1}	0.25 A g^{-1}	0.5 A g^{-1}	0.75 A g^{-1}	1 A g^{-1}	5
	289	217	146	100	76	61	
NS-MnO_2	0.2 A g^{-1}	0.4 A g^{-1}	0.6 A g^{-1}	0.8 A g^{-1}	1 A g^{-1}	2 A g^{-1}	6
	284	224	187	154	124	74	
δ-MnO_2@2-ML	0.1 A g^{-1}	0.2 A g^{-1}	0.3 A g^{-1}	0.5 A g^{-1}	0.8 A g^{-1}	1 A g^{-1}	7
	309.5	260	236.7	193.4	162.9	137.6	
Mo-MnO_2	0.1 A g^{-1}	0.2 A g^{-1}	0.5 A g^{-1}	1 A g^{-1}	2 A g^{-1}		8
	288.7	247.2	185.4	139.4	103.5		
FZMO	0.1 A g^{-1}	0.2 A g^{-1}	0.3 A g^{-1}	0.5 A g^{-1}	1 A g^{-1}	2 A g^{-1}	This work
	512	406	337	266	178	114	

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