Supporting information

Molten salt strategy and plasma technology induced MnO_2 with oxygen vacancy for high performance Zn-ions battery

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Calculation

According to the reported literature[1, 2], the current (i) and scan rate (v) in CV curves have relationships with equation:

$$i = av^b \quad (1)$$

$$lg(i) = blg(v) + lg(a) \quad (2)$$

where i is peak current, a correspond to constant, v is the scan rate and b is equaled to the slope of the lg(v)-lg(i) plots. If b approximately equals to 0.5, suggests the diffusion process is dominant, while a capacitive behavior will dominate when b is about 1[3].

The contribution ratios of the two processes at scan rates from 0.1 to 0.5 mV s^{-1} can be calculated by equations (3):

$$i(v) = k_1 v + k_2 v^{1/2} \quad (3)$$

where $k_1 v$ and $k_2 v^{1/2}$ corresponds to the current contributions originating from the surface capacitive effects and the diffusion-controlled insertion processes, respectively. By determining the values of k_1 and k_2, we can further analysis contribution ratios between diffusion-controlled process and capacitive effects at different scan rates. The Eq. (3) can be changed as follows:

$$i(v)/v^{1/2} = k_1 v^{1/2} + k_2 \quad (4)$$

The values of k_1 and k_2 can be obtained from the slope and y intercept of the linear fit of the plot of $i(v)/v^{1/2}$ versus $v^{1/2}$, respectively. The capacitive and diffusion-controlled currents assistance to the total charge was separately calculated by inserting the values of k_1 and k_2 into the Eq. (4).

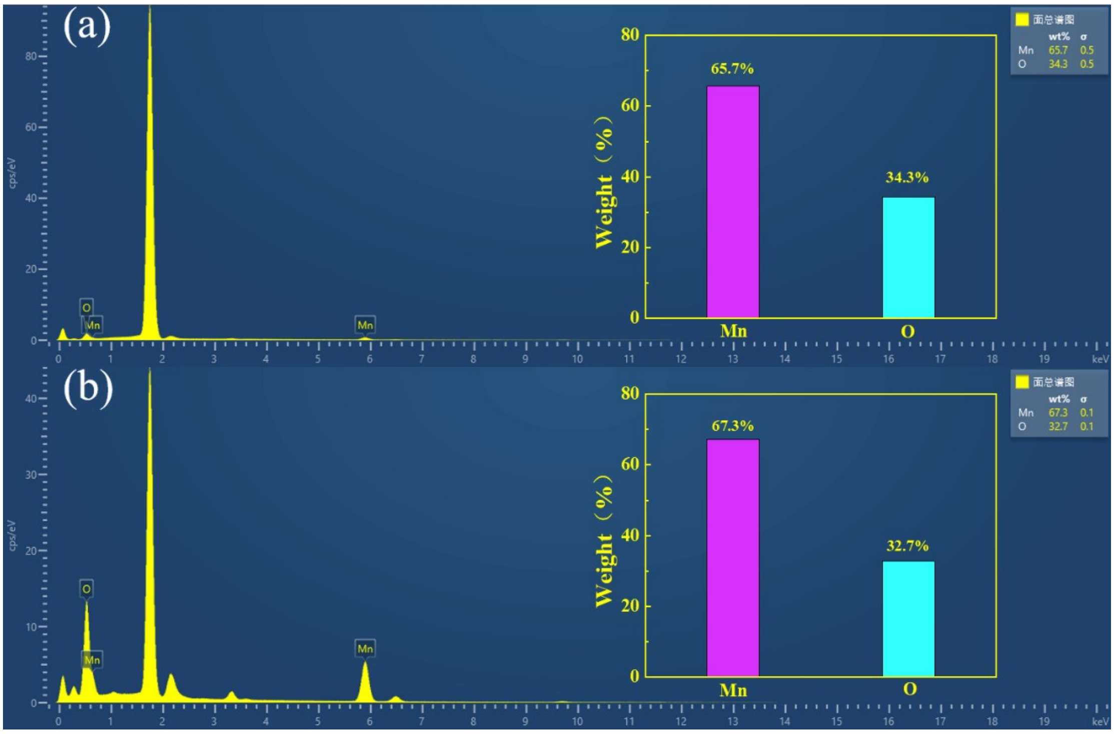

Figure S1. Elemental composition analysis of (a) MnO_2 and (b) MnO_2-3.

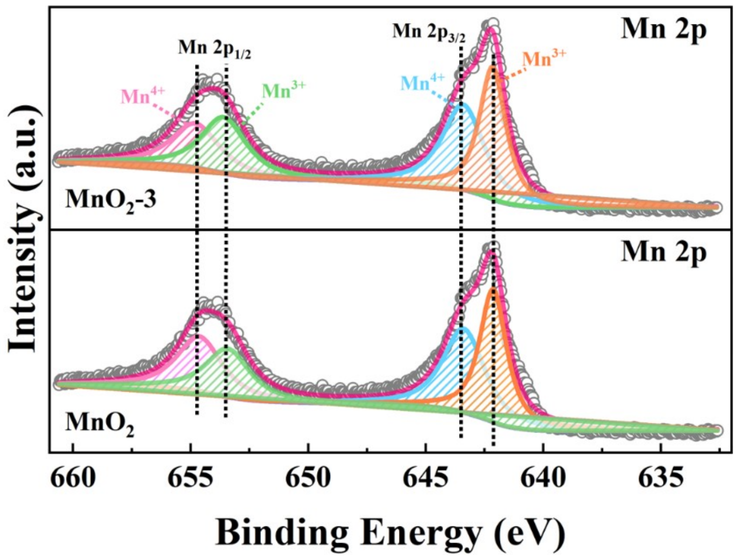

Figure S2. Mn 2p XPS spectra comparison of MnO_2 and MnO_2-3.

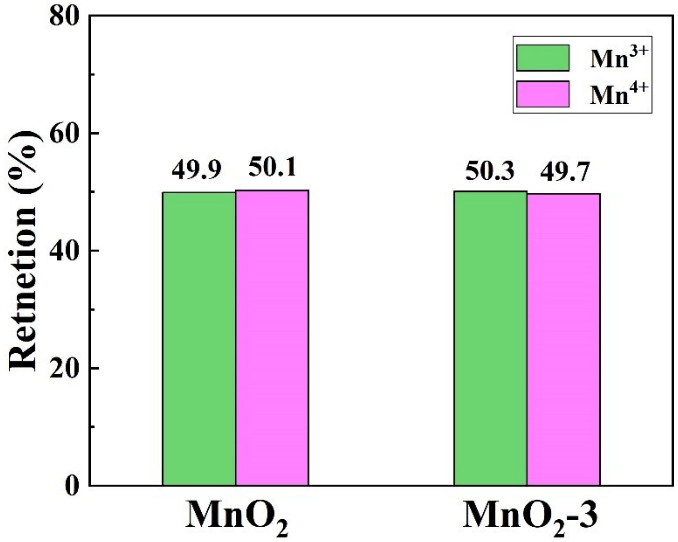

Figure S3. quantitively statistics of the percentage of Mn^{3+} and Mn^{4+} in the samples.

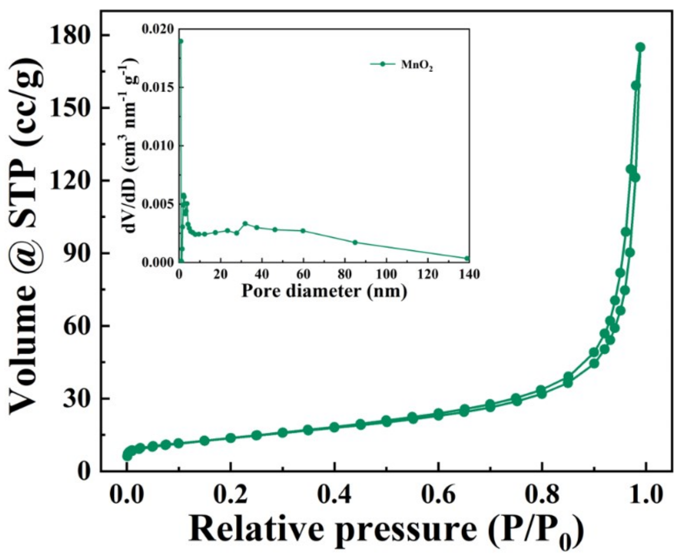

Figure S4. Nitrogen adsorption-desorption isotherm and pore distribution of MnO_2.

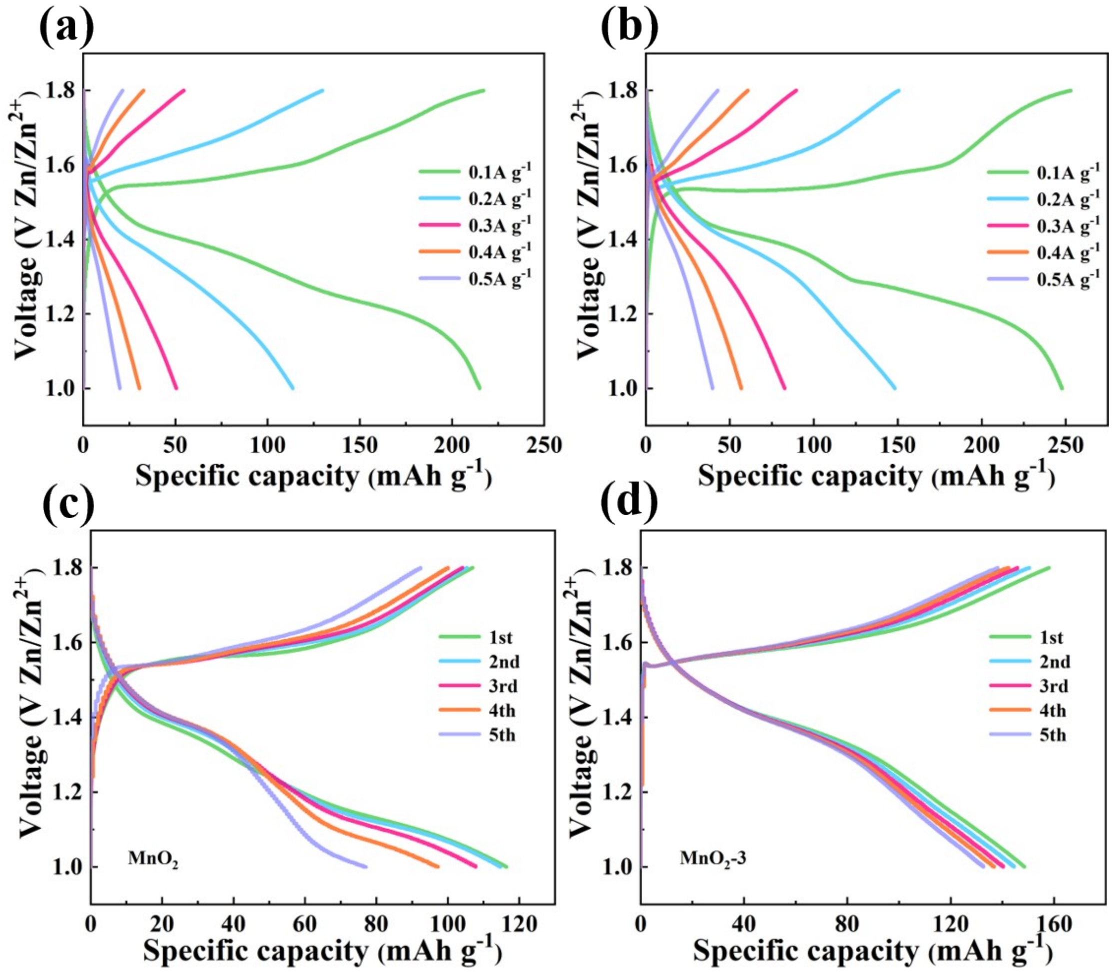

Figure S5. GCD curves at current densities from 0.1 to 0.5 A g^{-1} of (a) MnO_2 and (b) MnO_2-3. GCD profiles in the initial 5 cycles of (c) MnO_2 and (d) MnO_2-3.

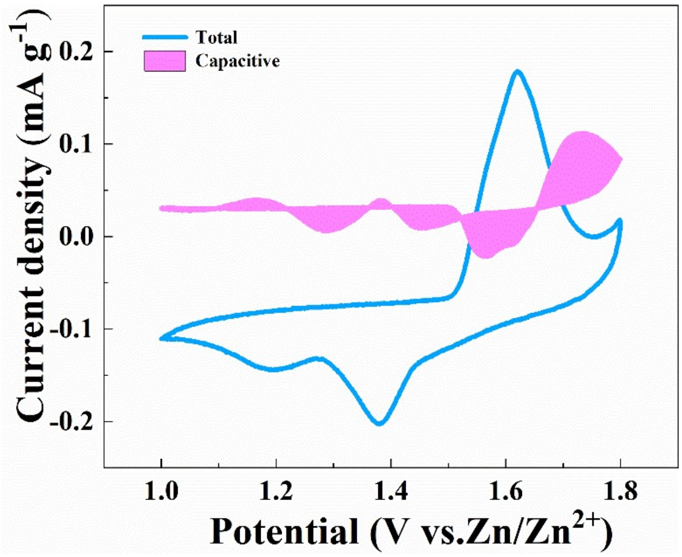

Figure S6. Capacitive and diffusion-controlled contribution analysis of the CV curves of MnO_2-3.

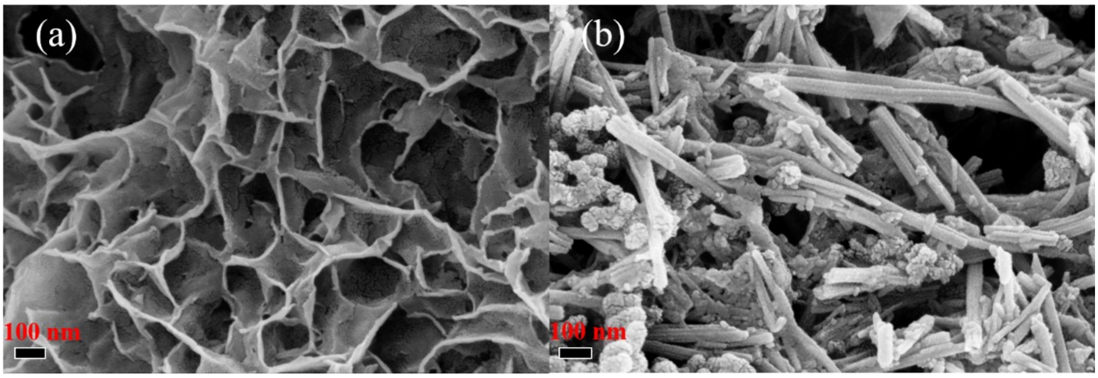

Figure S7. SEM images of (a) MnO_2 and (b) MnO_2-3 after 10 cycles.

Table S1. Comparison of electrochemical performance of other materials

Materials	Specific capacity ($mA\ h\ g^{-1}$)	Cycle number	Capacity retention	Reference
δ-MnO_2	170 (0.1A g^{-1})	100 (0.1 A g^{-1})	83%	[4]
α-MnO_2@PPy	137 (0.1A g^{-1})	100 (0.1 A g^{-1})	58%	[5]
α-MnO_2	180 (42 mA g^{-1})	30 (42 mA g^{-1})	76%	[6]
δ-MnO_2	252 (82 mA g^{-1})	100 (83 mA g^{-1})	44%	[7]
δ-MnO_2	108 (12.3 mA g^{-1})	125 (12.3 mA g^{-1})	63%	[8]
UCT-1-250	222 (0.1A g^{-1})	200 (0.1A g^{-1})	57%	[9]
γ- MnO_2	250 (0.5 mA cm^{-2})	40 (0.5 mA cm^{-2})	63%	[10]
This work	**252 (0.1A g^{-1})**	**100 (0.2A g^{-1})**	**81%**	

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