Supporting Information

The Directional Structure Transition of MnO_2 during Drying Process

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Preparation of Na^+/δ-MnO_2

0.043 mol $MnSO_4$ was mixed in 100 mL of DI water via sonication for 15 min, after that, 100 mL of 0.05 mol $NaMnO_4$ was slowly added to the above solution within 5 min under vigorous magnetic stirring, followed by stirring at 80 ℃ for 100 minutes. After cooling down to room temperature, the precipitates were collected by centrifugation and washed several times with DI water.

After washing, equal amount of wet materials were put into three identical containers, each container was sealed with a cap with a small hole, and the drying rate of the materials in the container was adjusted by changing the size of the hole.

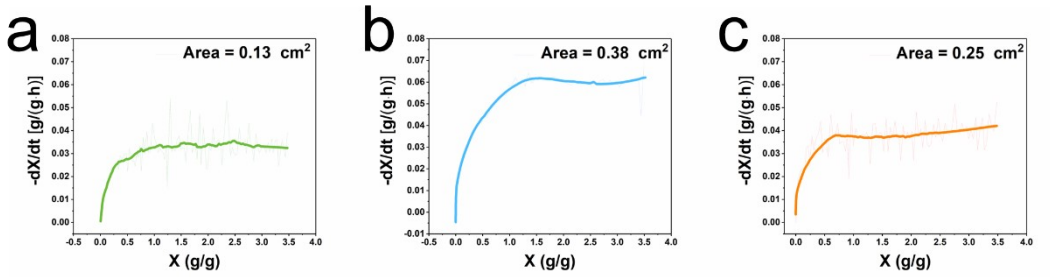

Fig. S1 The drying rate curves (a) in the case of Area = 0.13 cm^2, (b) in the case of Area = 0.38 cm^2, (c) in the case of Area = 0.25 cm^2.

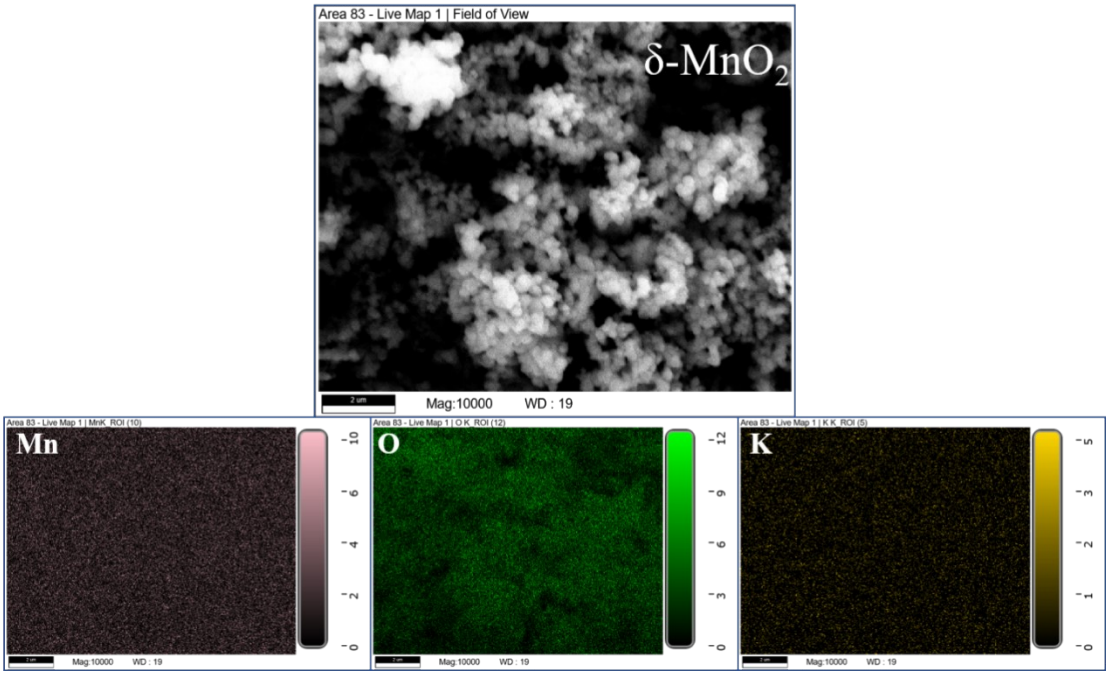

Fig. S2 EDS mapping of δ-MnO_2.

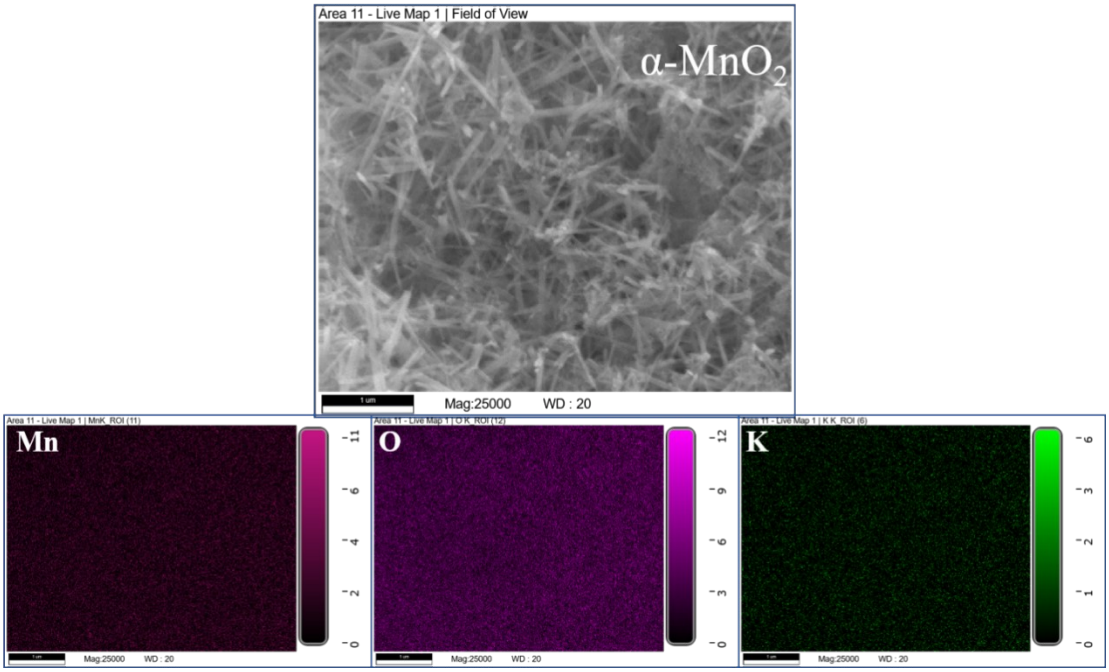

Fig. S3 EDS mapping of α-MnO_2.

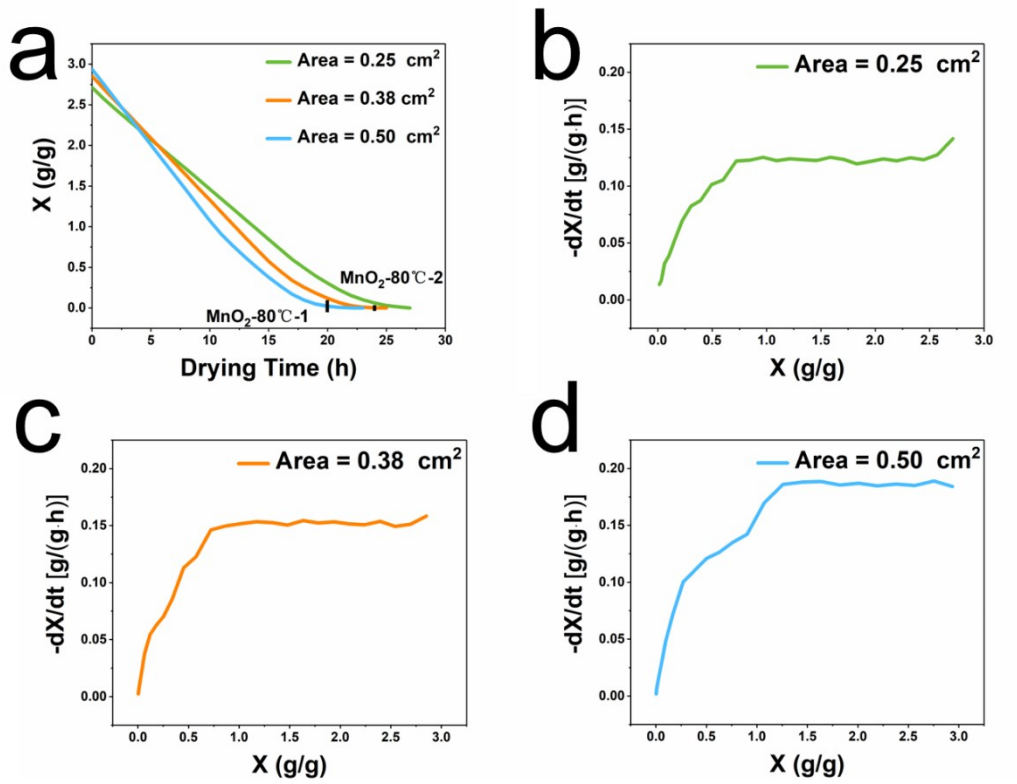

Fig. S4 The drying curves (a) in the case of Area = 0.25 cm^2, Area = 0.38 cm^2 and Area = 0.50 cm^2. The drying rate curves (b) in the case of Area = 0.25 cm^2, (c) in the case of Area = 0.38 cm^2, (d) in the case of Area = 0.50 cm^2.

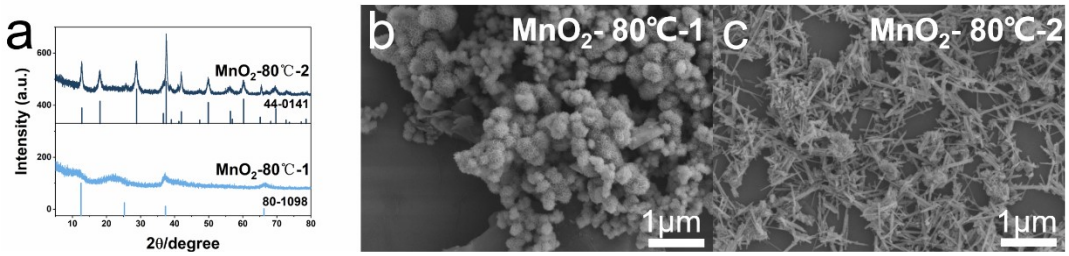

Fig. S5 XRD patterns (a) and SEM images (b and c) of MnO_2-80°C-1, MnO_2-80°C-2.

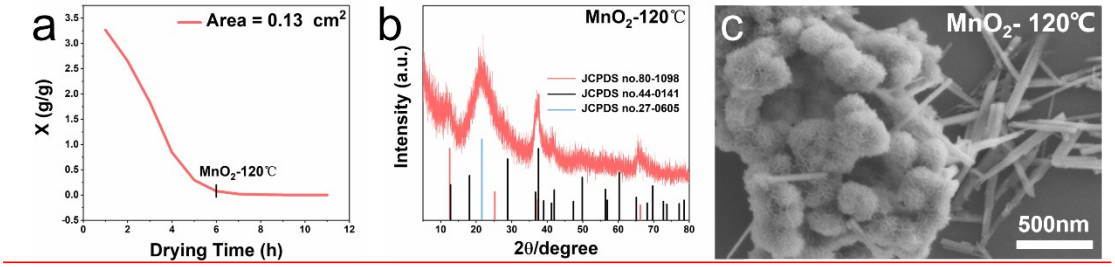

Fig. S6 The drying rate curves (a) in the case of Area = 0.13 cm^2, XRD patterns (b) and SEM images (c) of MnO_2-120°C.

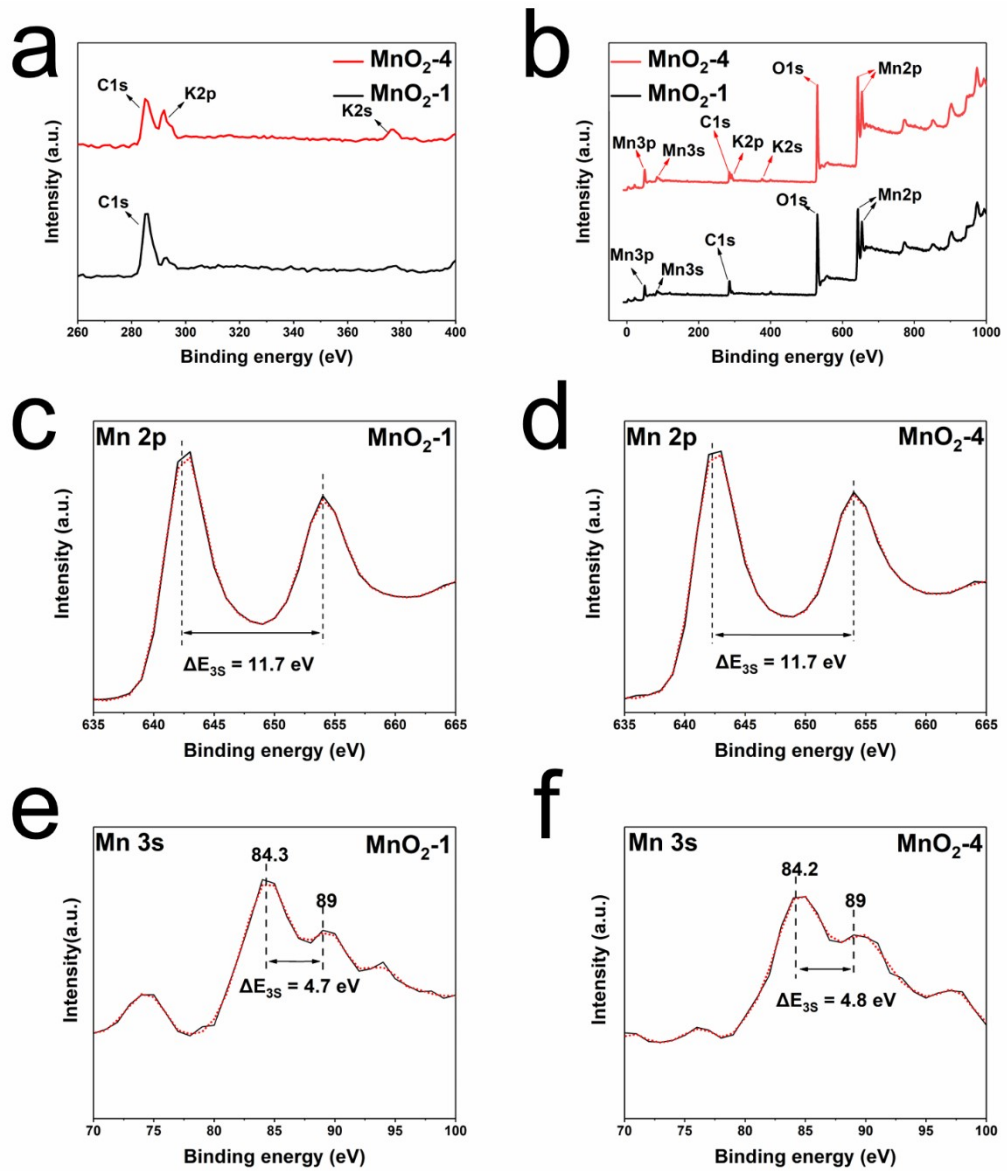

Fig. S7 (a) XPS spectra of C 1s, K 2p and K 2s for MnO_2-1 (δ-MnO_2) and MnO_2-4 (α-MnO_2). XPS survey spectra of MnO_2-1 (δ-MnO_2) and MnO_2-4 (α-MnO_2) (b). Mn 2p XPS spectra of the MnO_2-1 (c) and MnO_2-4 (d). Mn 3s XPS spectra of the MnO_2-1 (e) and MnO_2-4 (f).

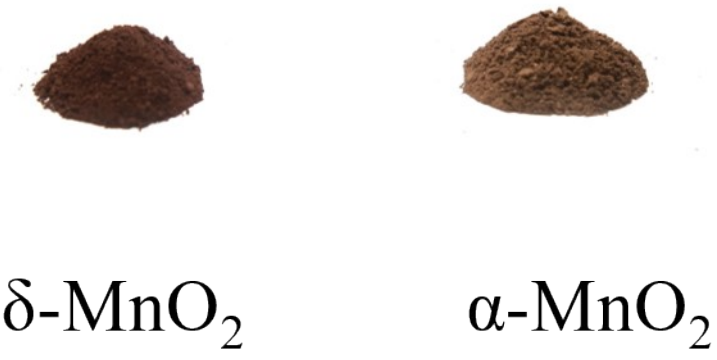

Fig. S8 Picture of synthesized MnO_2-1 (δ-MnO_2) (left) and MnO_2-4 (α-MnO_2) (right).

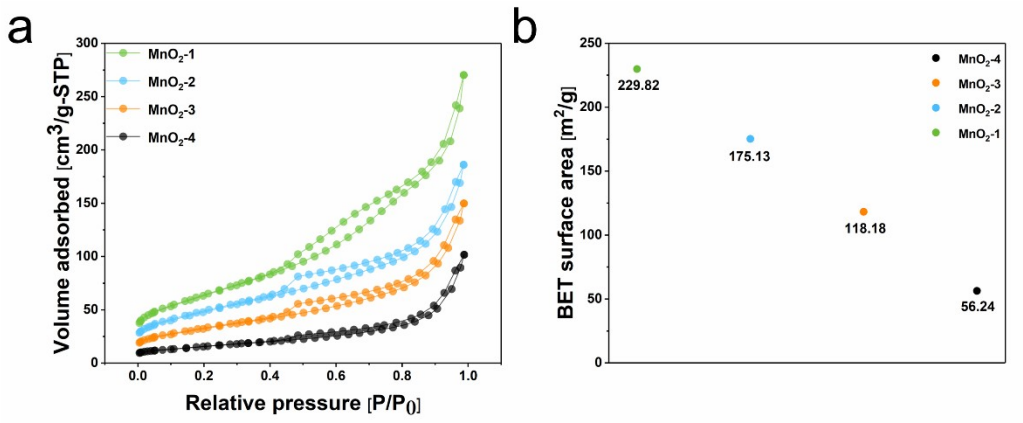

Fig. S9 Brunauer-Emmett-Teller (BET) analysis of MnO_2-1, MnO_2-2, MnO_2-3, and MnO_2-4.

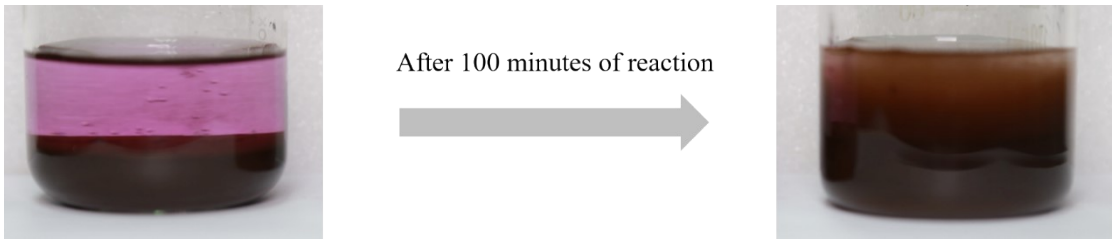

Fig. S10 Photo of solution after 100 minutes of thermal reaction.

Table S1 Comparison of specific capacitance between MnO_2 based materials

Electrode	Current density ($A\ g^{-1}$)	Specific capacitance ($F\ g^{-1}$)	Electrolyte	Ref.
δ-MnO_2+α-MnO_2	1.8	178	LiCl	1
Co_9S_8@ MnO_2	1	711.5	NaSO4	2
δ-MnO_2@α-MnO_2	0.25	206	Na_2SO_4	3
MnO_x@rGO	1	405	KOH	4
Fe: MnO_2	2	173	Na_2SO_4	5
$K_{0.17}$ MnO_2	1	206	K_2SO_4	6
α-MnO_2	0.5	535	KOH	7
MnO_2	3	304	Na_2SO_4	8
MnO_2-TEA	1	417.5	Na_2SO_4	9
δ-MnO_2	1	565	KOH	This work

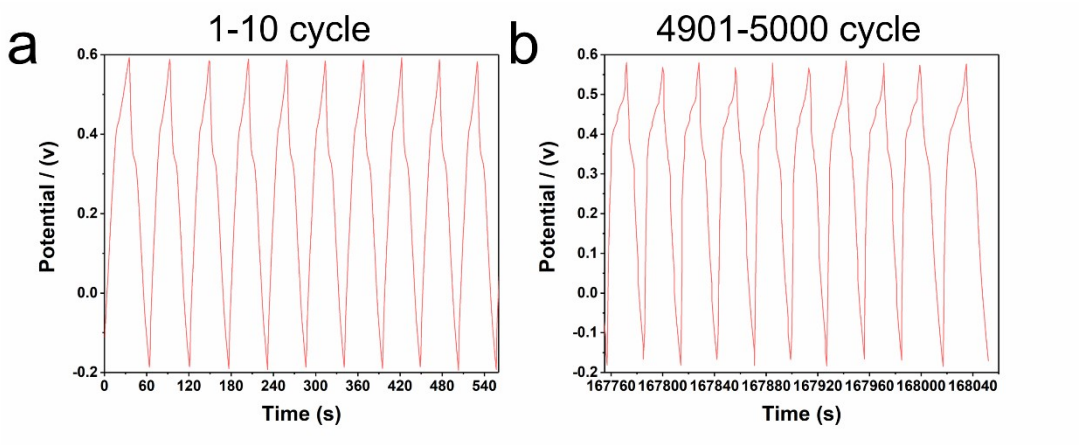

Fig. S11 The cycling tests of K^+/δ-MnO_2 electrode at the 10 A g^{-1}.

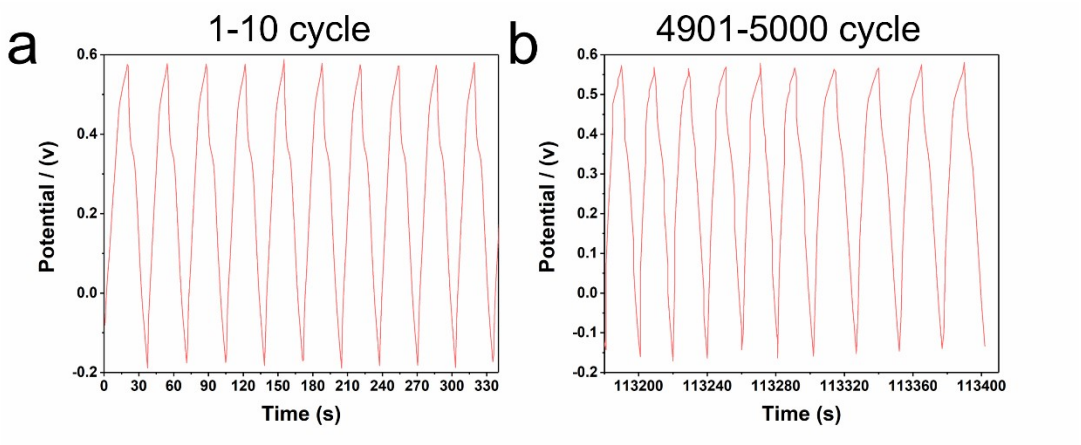

Fig. S12 The cycling tests of α-MnO_2 electrode at the 10 A g^{-1}.

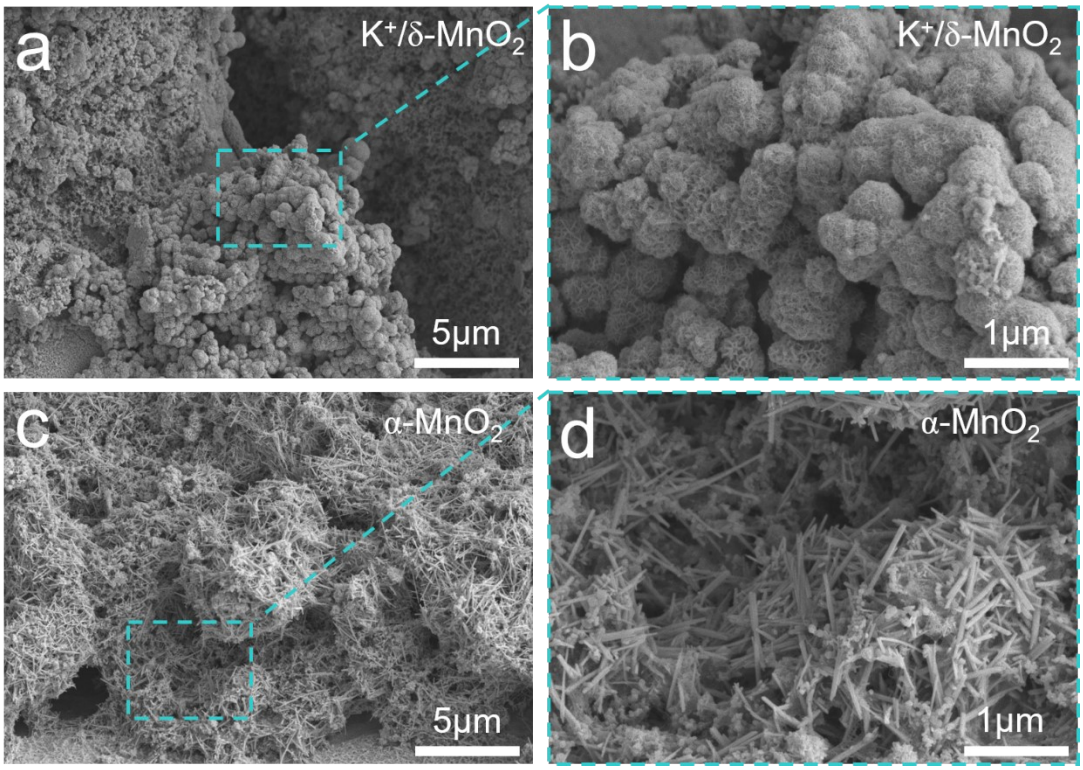

Fig. S13 SEM images of the (a, b) K^+/δ-MnO_2 electrode and (c, d) α-MnO_2 electrode after 5000 cycles at 10 A g^{-1}.

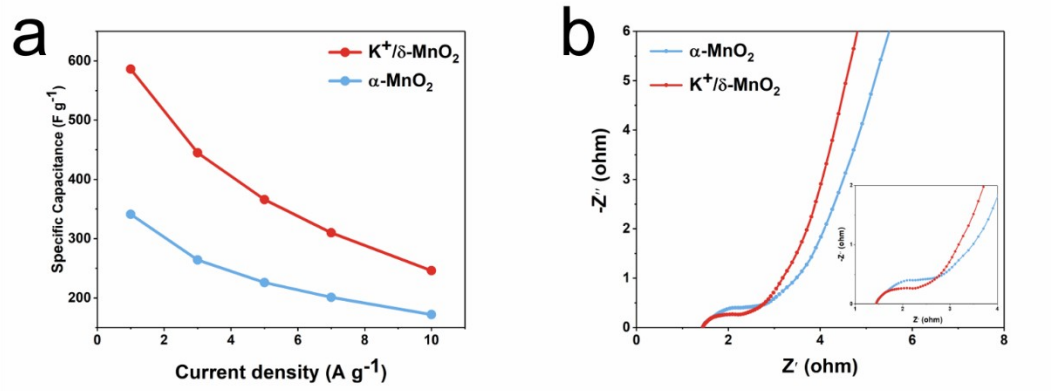

Fig. S14 (a) specific capacitance of K^+/δ-MnO_2 and α-MnO_2 at a series of current densities; (b) EIS curves of K^+/δ-MnO_2 and α-MnO_2.

References

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