Supplementary Information

Facile synthesis and the exploration of zinc storage mechanism of β-MnO_2 nanorod with exposed (101) planes as a novel cathode material for high performance eco-friendly zinc-ion battery

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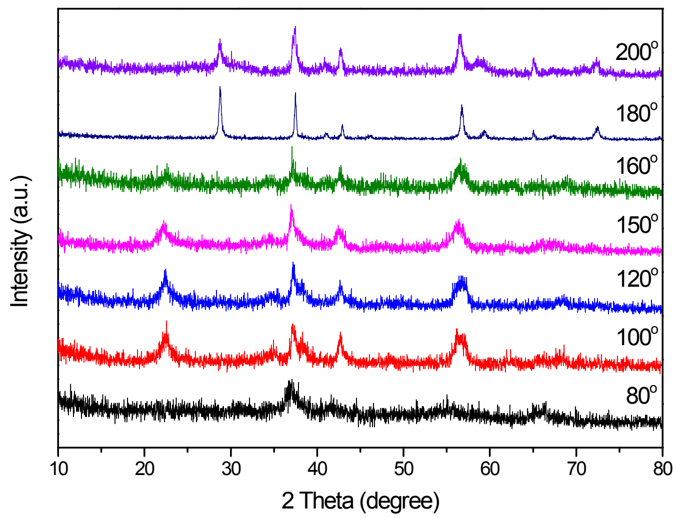

Fig. S1 XRD patterns of the ß-MnO_2 synthesized at different hydrothermal reaction temperatures.

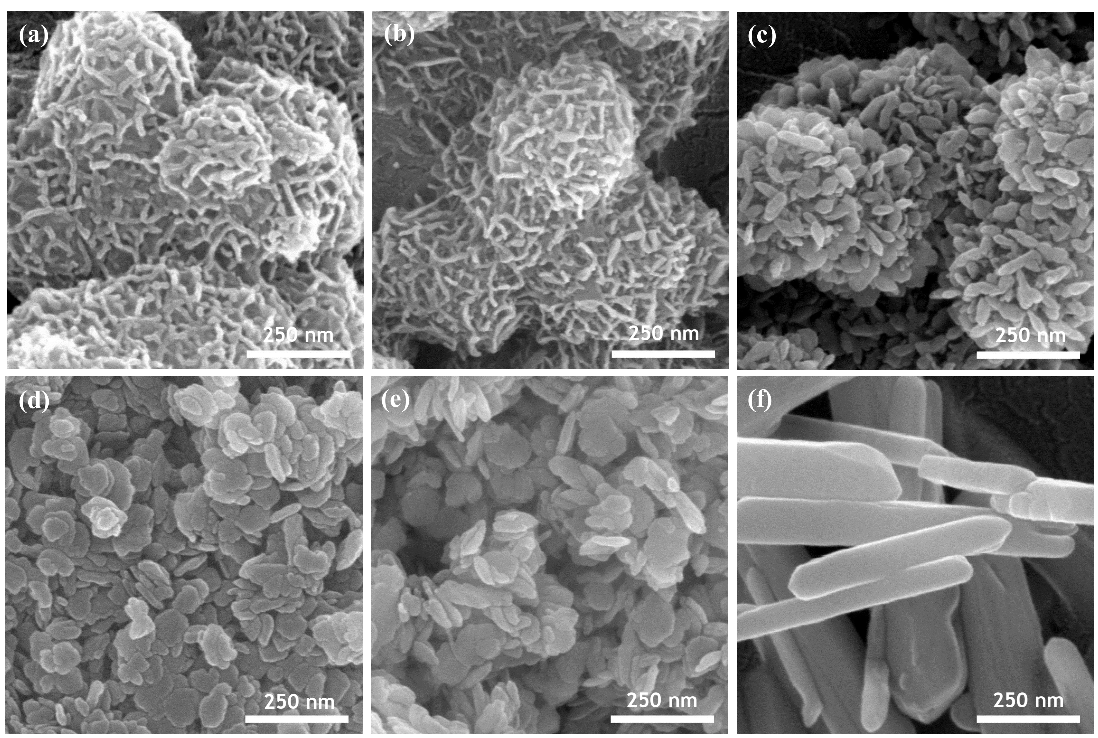

Fig. S2 FE-SEM images of the sample prepared at various reaction temperatures: (a) 80, (b) 100, (c) 120, (d) 150, (e) 160, and (f) 180 ˚C.

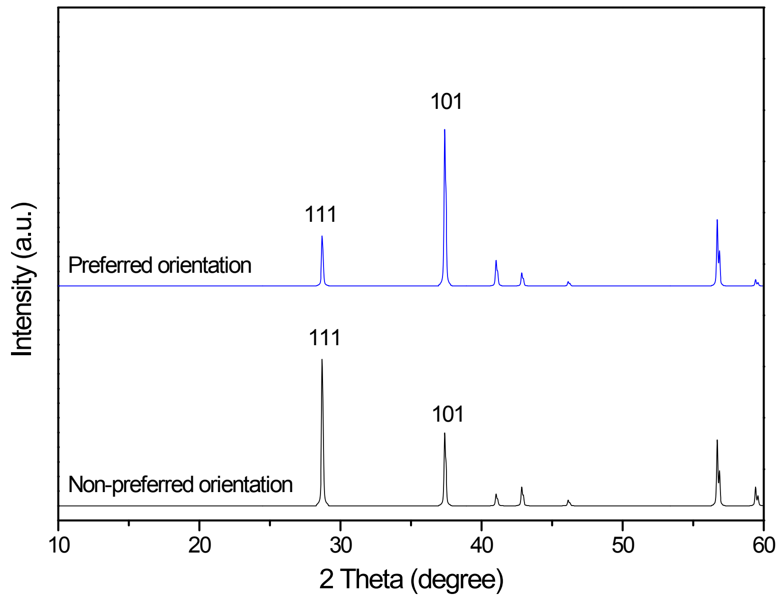

Fig. S3 Simulated XRD patterns of the ß-MnO_2 structure obtained from X'Pert HighScore Plus software.

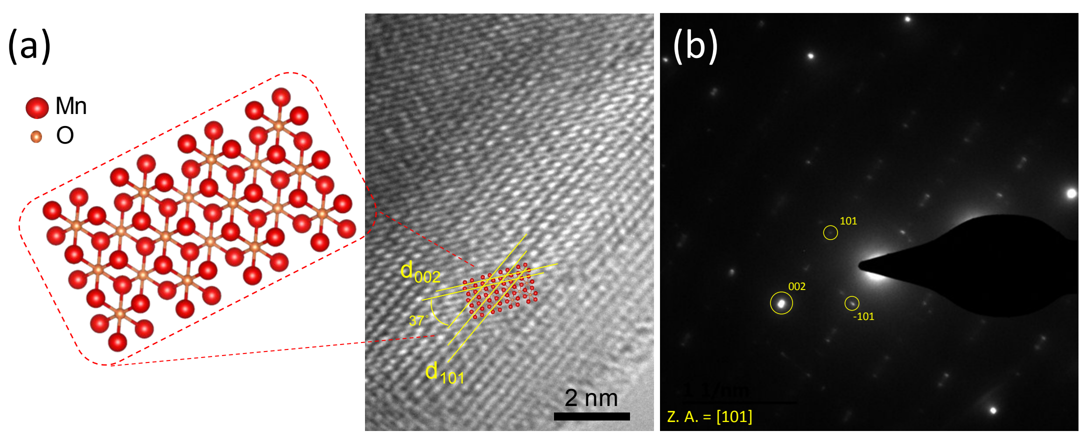

Fig. S4 HR-TEM image and corresponding SAED pattern of the β-MnO_2 nanorod.

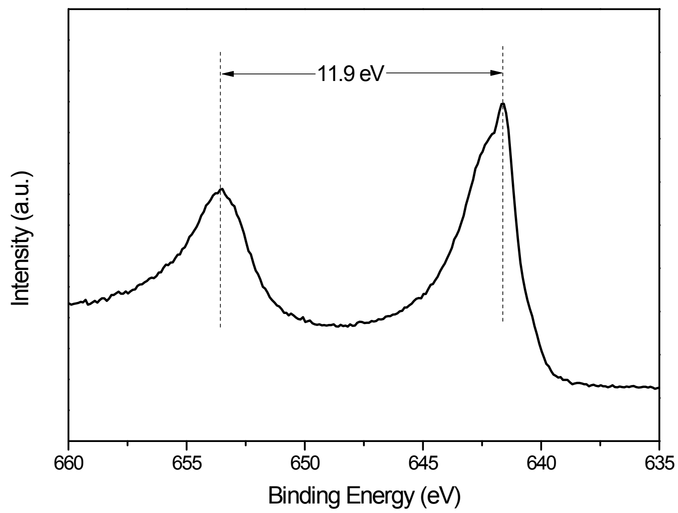

Fig. S5 XPS Mn2p spectrum of the ß-MnO_2 nanorod powder.

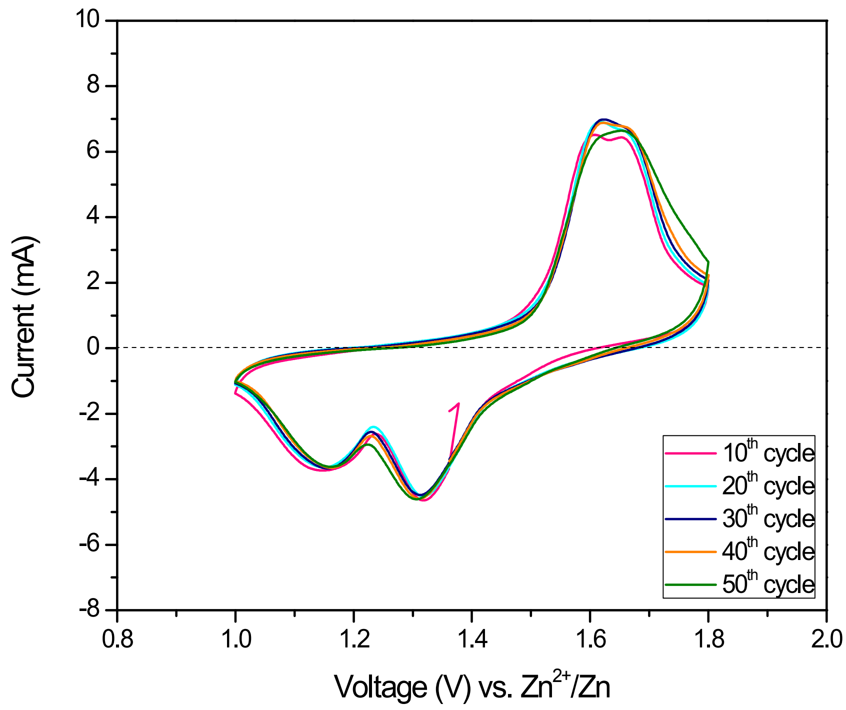

Fig. S6 CV curves of β-MnO_2 nanorod electrode in the ZIB test cell at a scan rate of 0.5 mV s^{-1}.

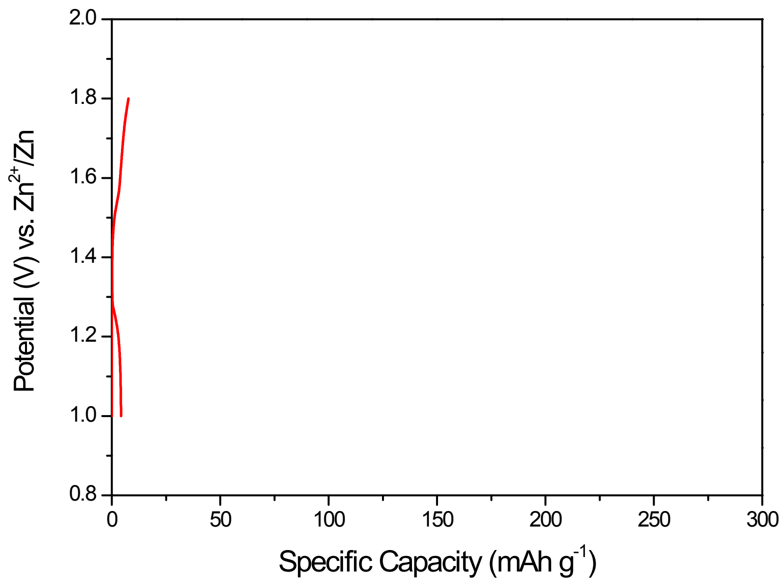

Fig. S7 Electrochemical performance of ß-MnO_2 bulk electrode in Zn test cell.

Table S1. ICP-AES results of the electrolyte recovered from the Zn test cells after the first discharge and second discharge cycles.

Electrolyte Condition	Mn concentration (ppm)
First discharge	329
Second discharge	321

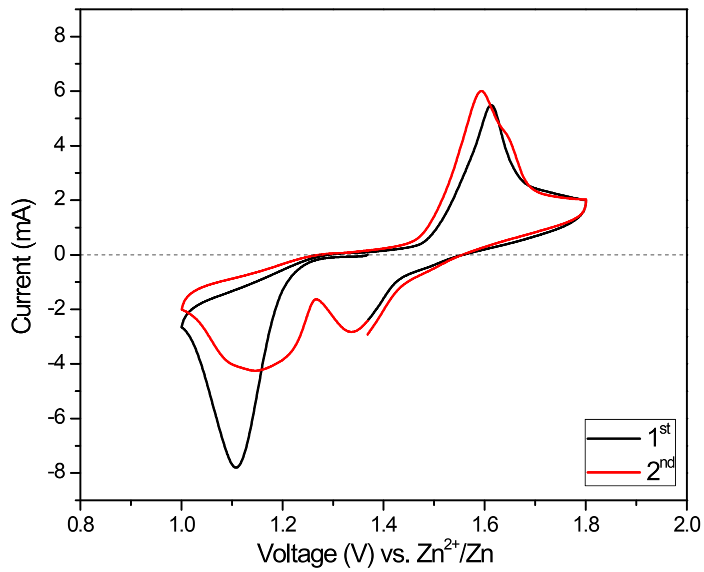

Fig. S8 CV curves of the ß-MnO_2 nanorod electrode in 1 M $ZnSO_4$ electrolyte with the addition of 0.1 M $MnSO_4$.

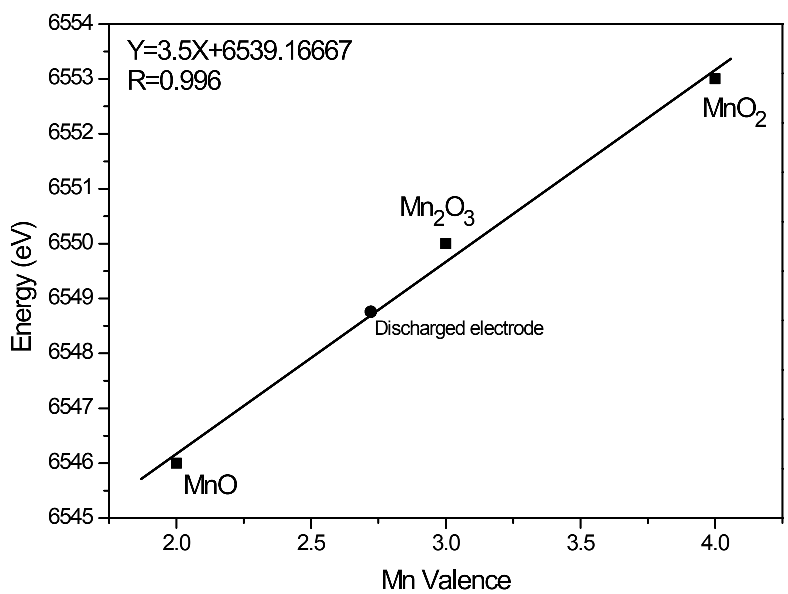

Fig. S9 Linear relationship between Mn oxidation state and photon energy recorded from XANES spectra.

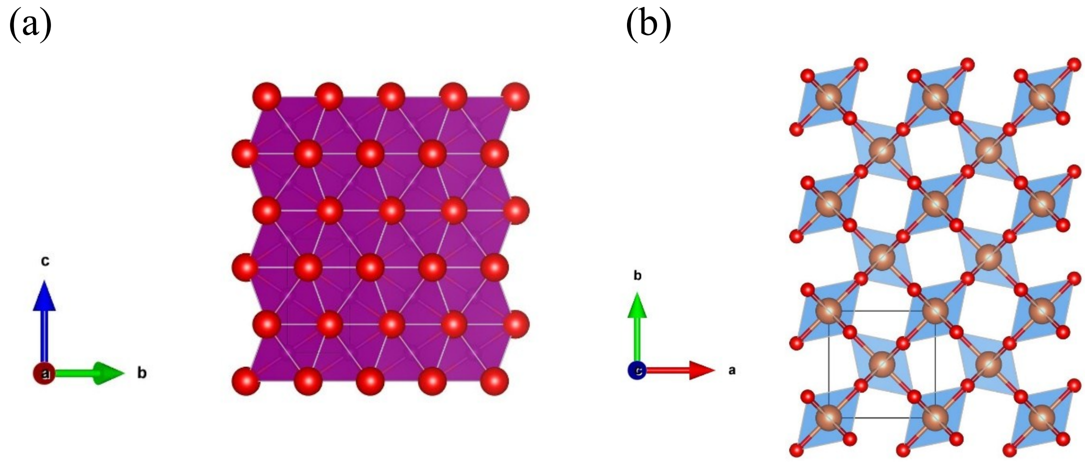

Fig. S10 Comparison of (a) ε-MnO_2 and (b) β-MnO_2 crystallographic structures.

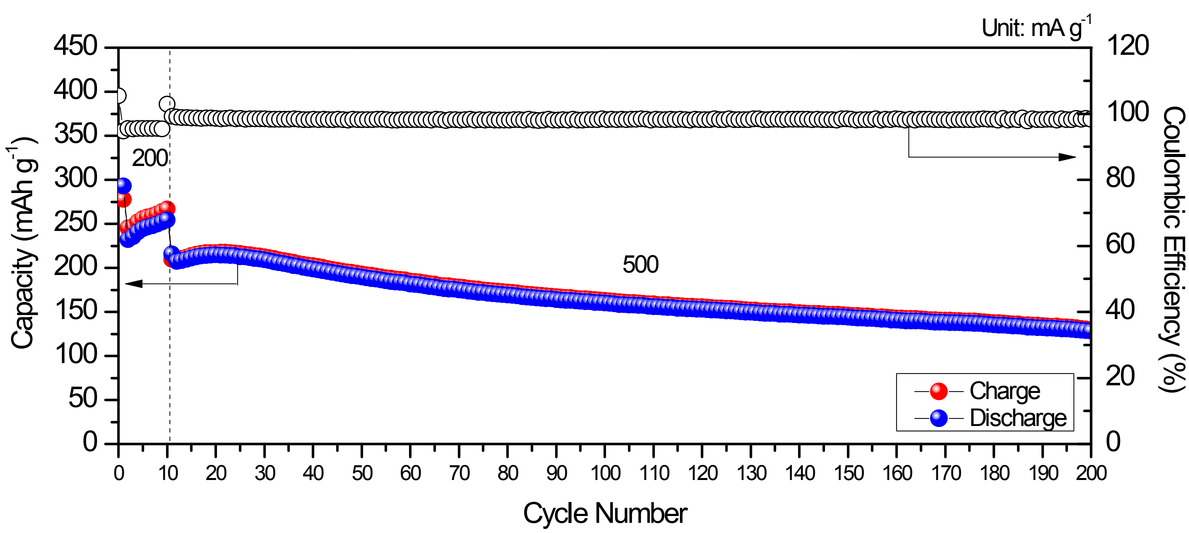

Fig. S11 Cycleability plots of β-MnO_2 nanorod cathode at current densities of 200 and 500 mAh g^{-1}.

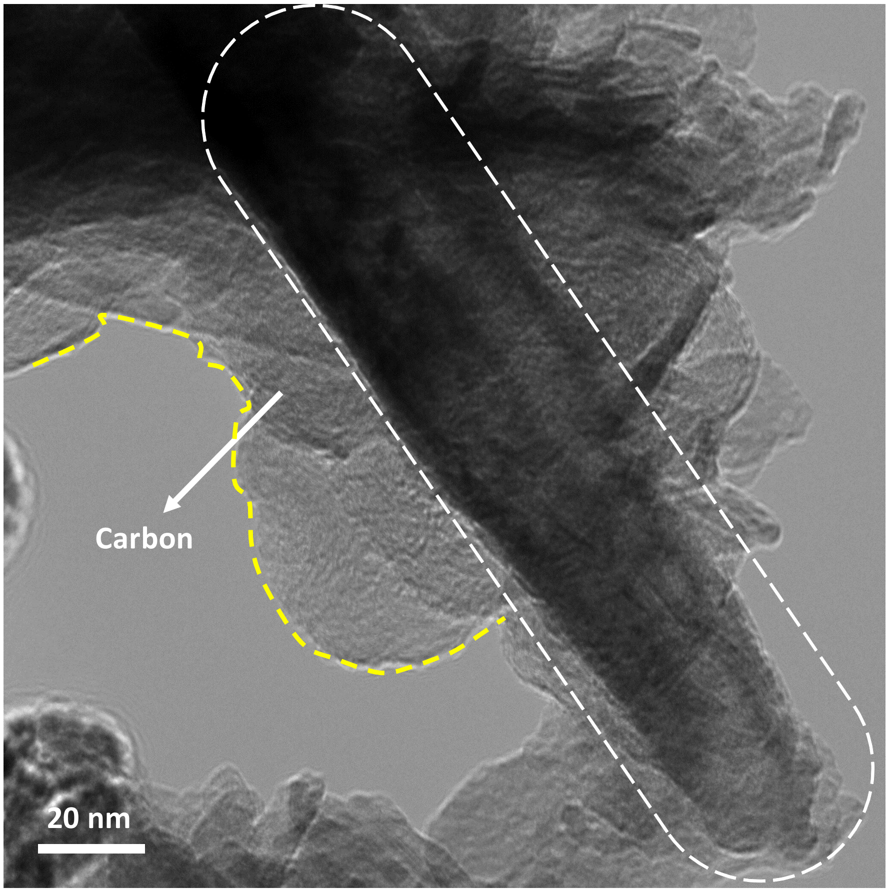

Fig. S12 FE-TEM image of β-MnO_2 nanorod cathode after 200 cycles.