Supporting information

MnO_2@CeO_2 Composite Cathode for Aqueous Zinc-ion Batteries: Enhanced Electrical Conductivity and Stability through Mn-O-Ce Bonds

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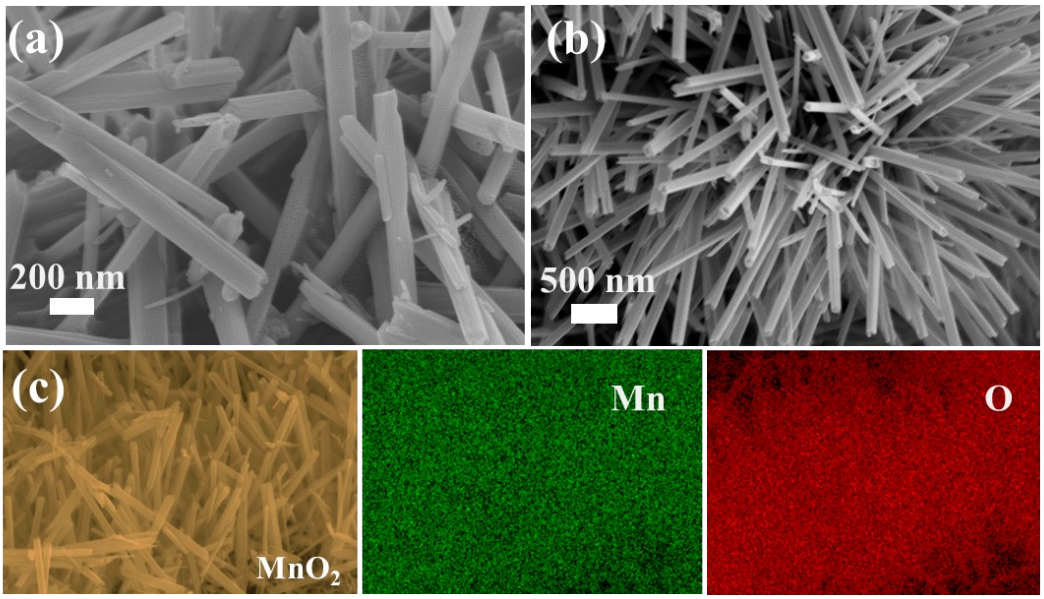

Fig. S1 Morphology characterization: SEM images of (a, b) MnO_2 nanowires at different multiples. (c) X-ray energy spectrum analysis and corresponding element mapping images of MnO_2。

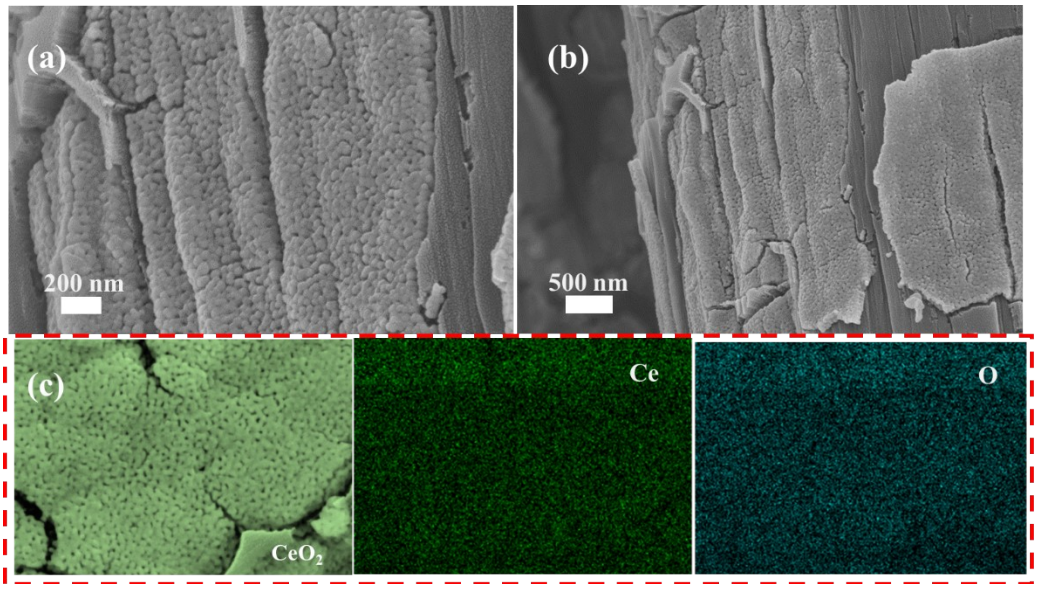

Fig. S2 Morphology characterization: SEM images of (a, b) CeO_2 nanoparticles at different multiples. (c) X-ray energy spectrum analysis and corresponding element mapping images of CeO_2。

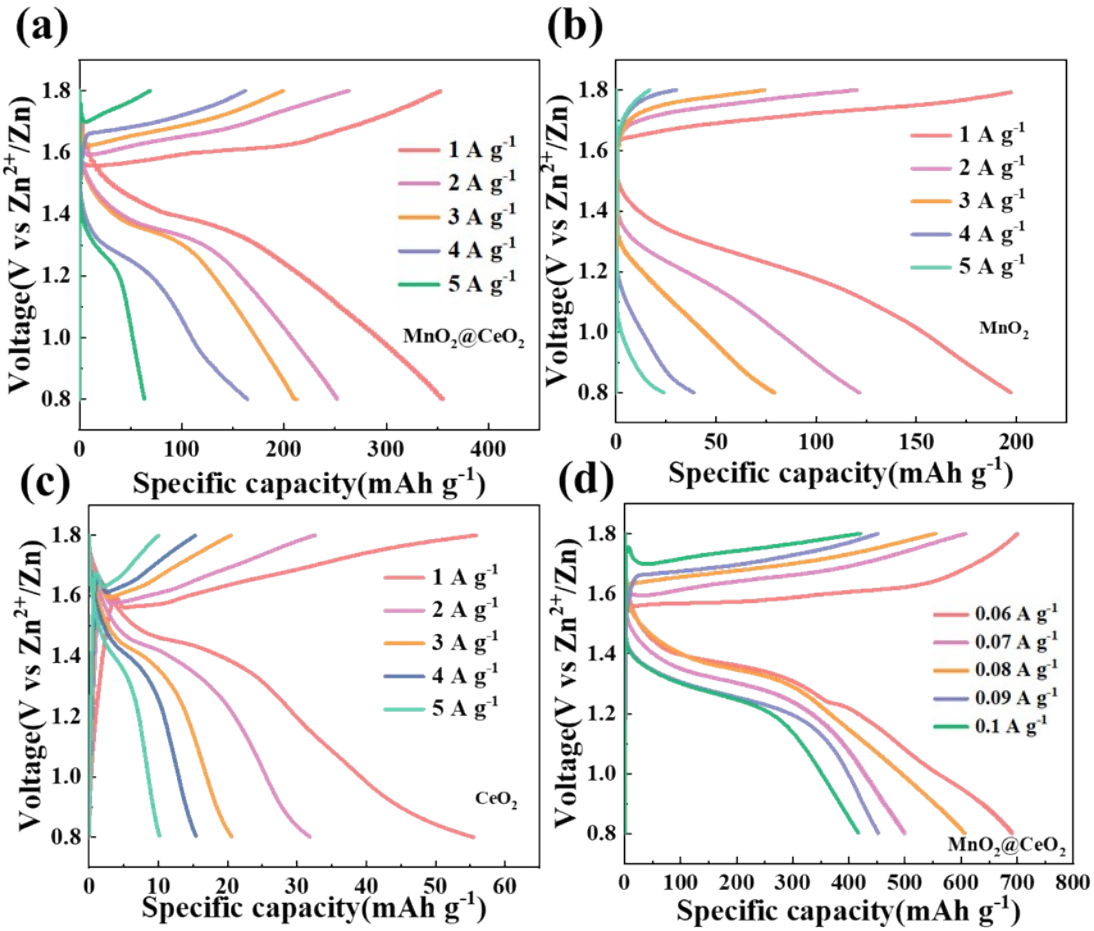

Fig. S3 Electrochemical performance: (a, d) GCD curves of MnO_2@CeO_2; (b) MnO_2 and (c) CeO_2 at different current densities.

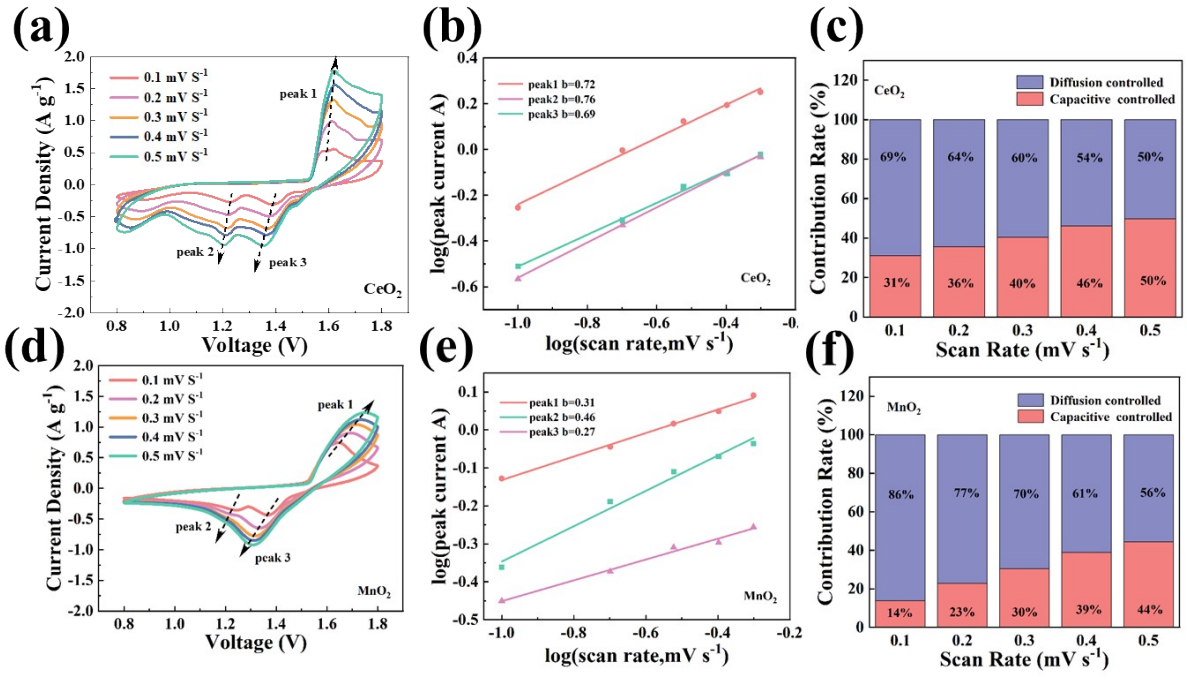

Fig. S4 Reaction kinetics analysis of MnO_2 and CeO_2: CV curves at different scanning rates (a) CeO_2; (d) MnO_2; Graph of linear logarithm relationship between the scanning rate and the peak current response value (b) CeO_2; (e) MnO_2; The contribution ratios of capacitance control and diffusion control at different scanning rates (c) CeO_2; (f) MnO_2.

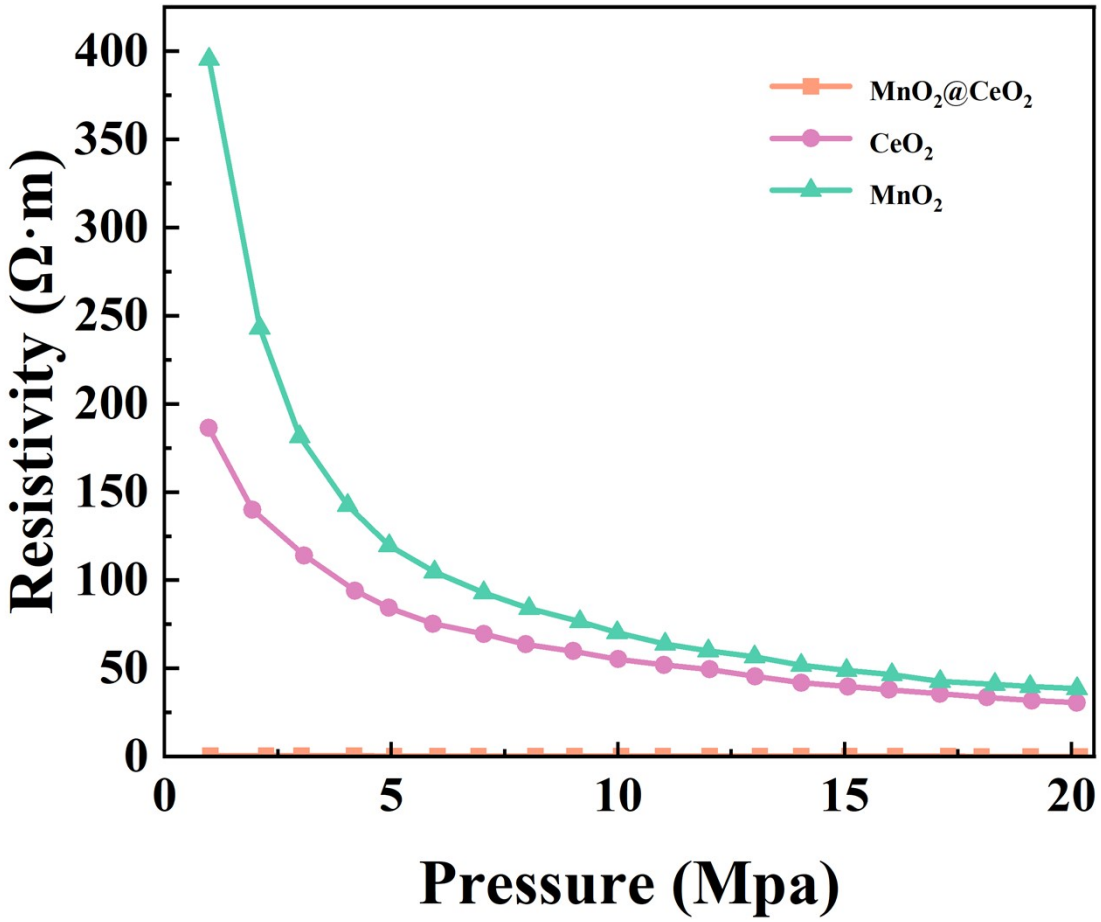

Fig. S5 Four-probe conductivity test of MnO_2, CeO_2 and MnO_2@CeO_2.

Table 1 Comparison with other manganese-based materials

Materials	Rate performance	Reference
MnO_2@CeO_2	355 mAh g^{-1} at 1 A g^{-1}, and with 89% capacity retention after 1000 cycles at high current density of 1A g^{-1}	This work
MnO_2@NC	325 mAh g^{-1} at 100 mA g^{-1}, and 95% retention after 2500 cycles	[1]
MnO_2@N	183.4 mAh g^{-1} at 0.5 A g^{-1}, and with 83% capacity retention after 1000 cycles	[2]

S-MnO_2	324 mAh g^{-1} at 0.2 A g^{-1} and with 63.3% capacity retention after 1000 cycles.	3
NM20	252 mAh g^{-1} at 0.1 A g^{-1}, and with 85.6% capacity retention after 2500 cycles at 1A g^{-1}	4
δ-MnO_2 NDs	125 mAh g^{-1} at 2 A g^{-1}, and with 86.2% capacity retention after 1000 cycles at high current density of 2A g^{-1}	5
α-MnO_2	194 mAh g^{-1} at 0.2 A g^{-1}, and with 71% capacity retention after 100 cycles at 0.3 A g^{-1}	6

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