Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Hierarchical manganese valence gradient MnO_2 via phosphorus doping for cathode materials with improved stability

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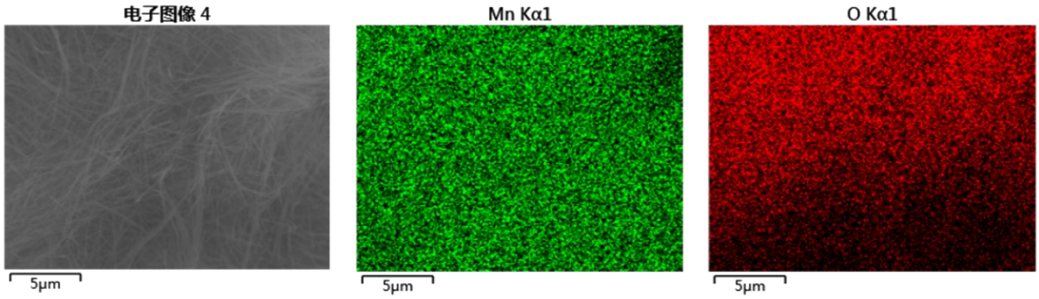

Fig. S1 EDS elemental maps for MnO_2

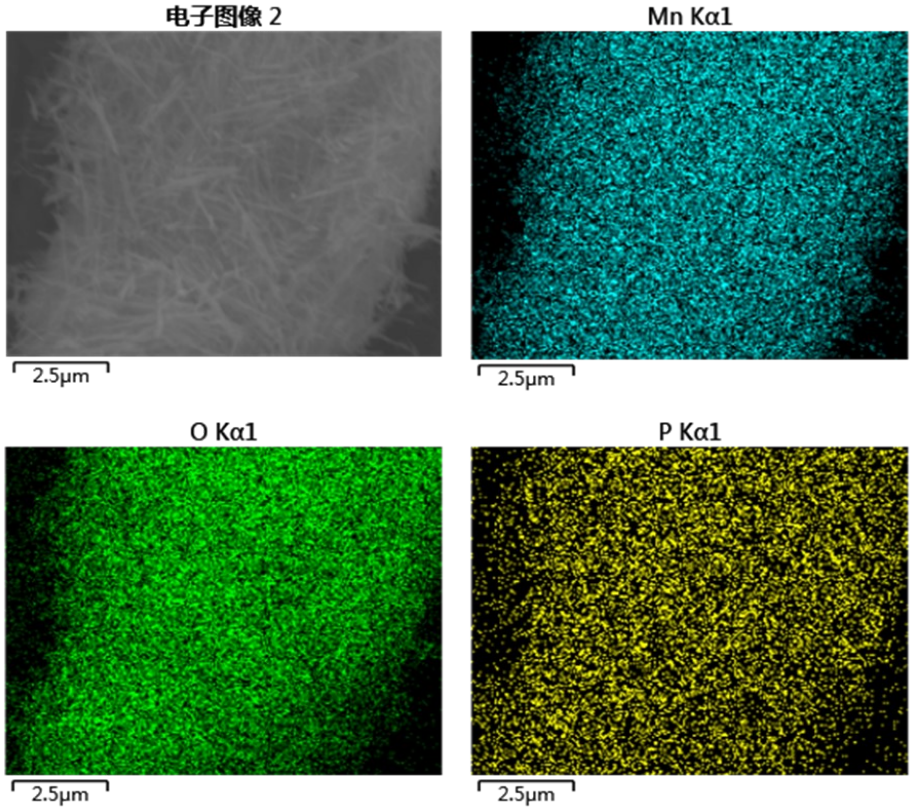

Fig. S2 EDS elemental maps for P-MnO_x

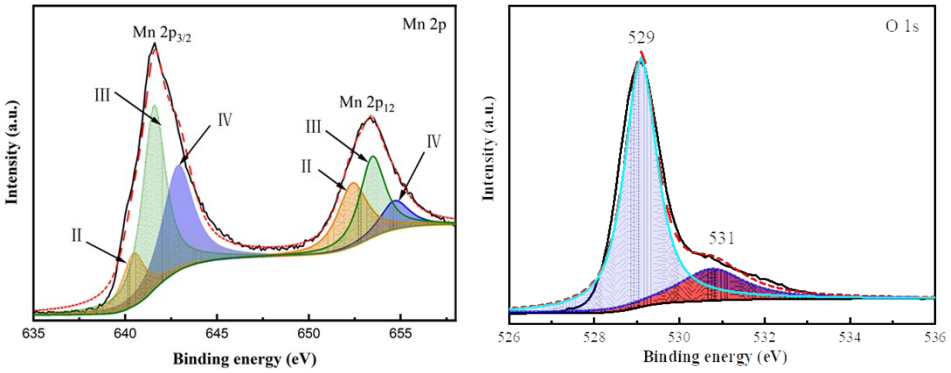

Fig. S3 high-resolution Mn 2p (a) and O 1s (b) X-ray photoelectron spectroscopy of MnO_2

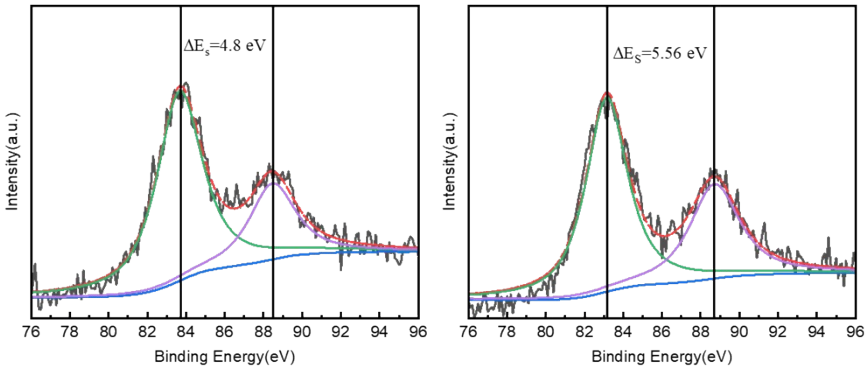

Fig. S4 high-resolution Mn 3s X-ray photoelectron spectroscopy of MnO_2 and P-MnO_x

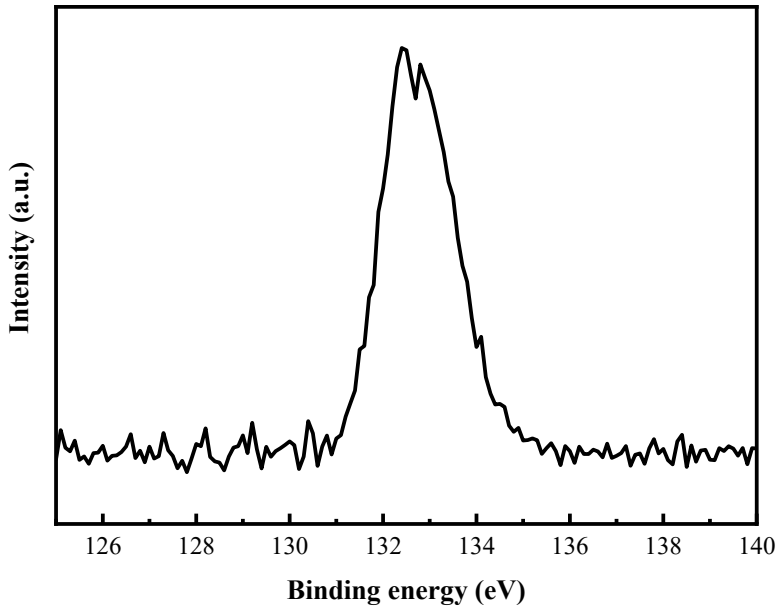

Fig. S5 high-resolution P 2p X-ray photoelectron spectroscopy of P-MnO_x

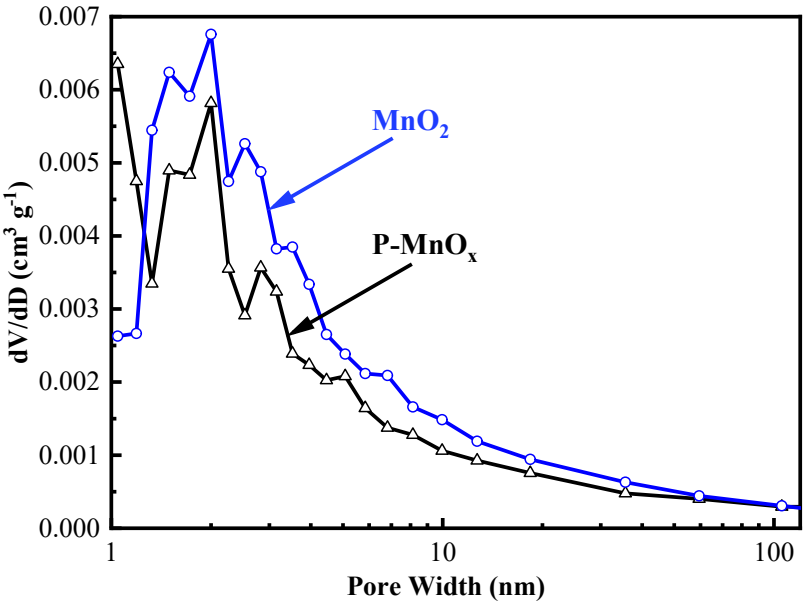

Fig. S6 pore distributions of MnO_2 and P-MnO_x

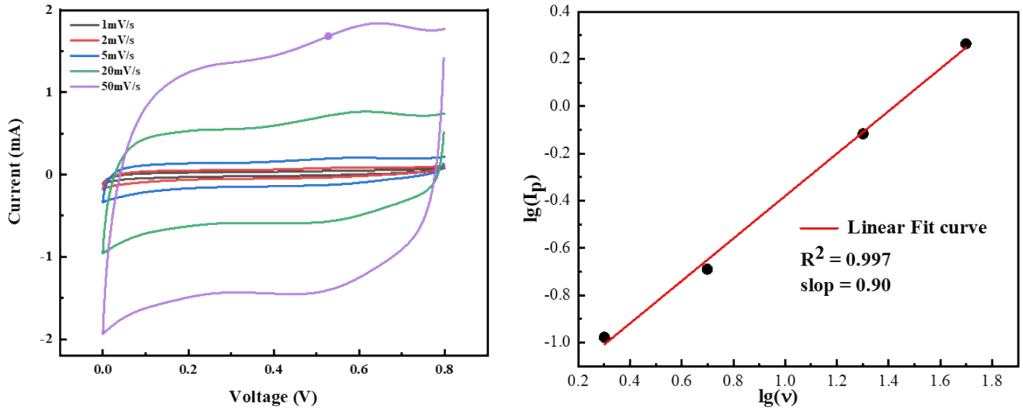

Fig. S7 (a) CV profiles of MnO_2 at various scan rates and (b) lgI vs lgν patterns for MnO_2

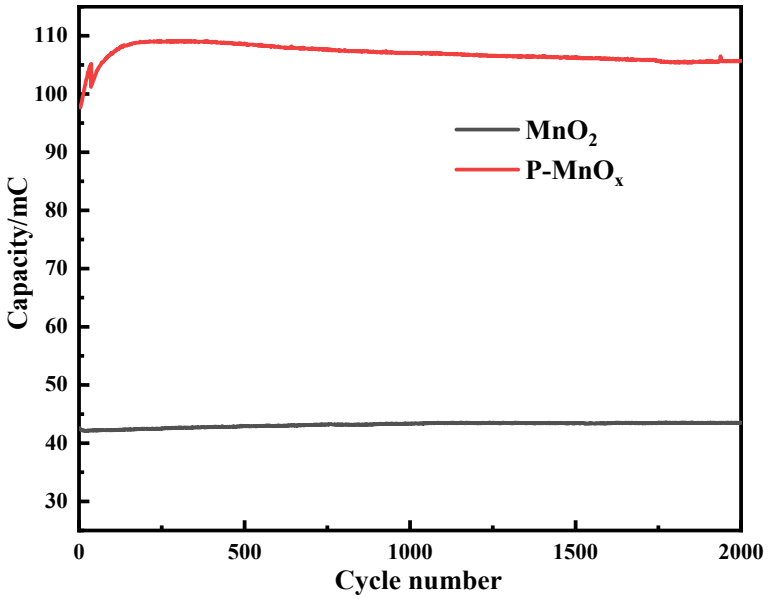

Fig. S8 Cycle lifetime of MnO_2 and P-MnO_x

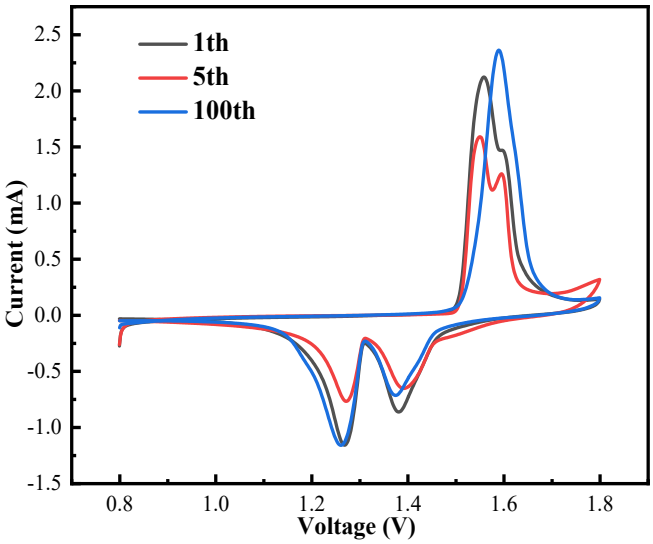

Fig. S9 the CV curve of MnO_2 at 0.1 mV/s

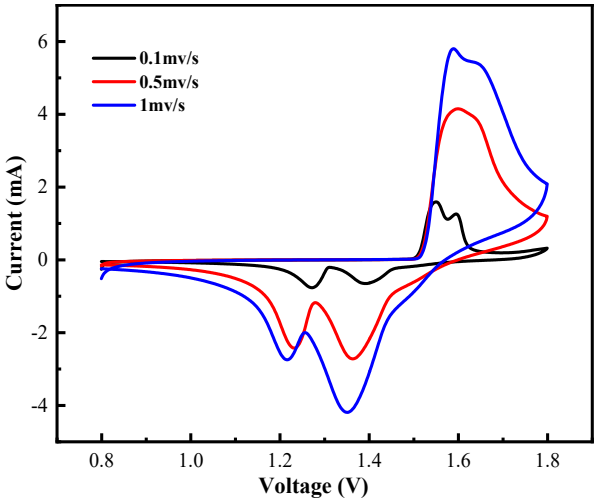

Fig. S10 the CV curve of MnO_2 at different scan rates

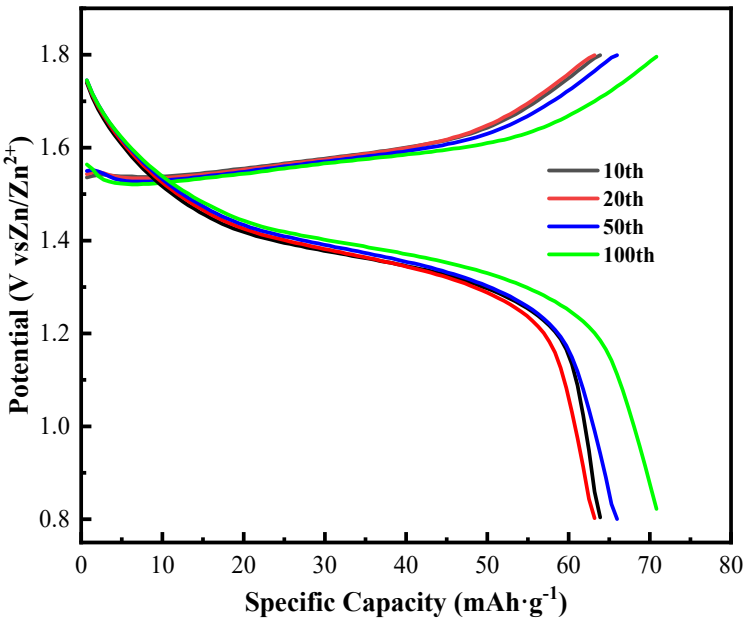

Fig. S11 the GCD curves of MnO_2 at different cycle number

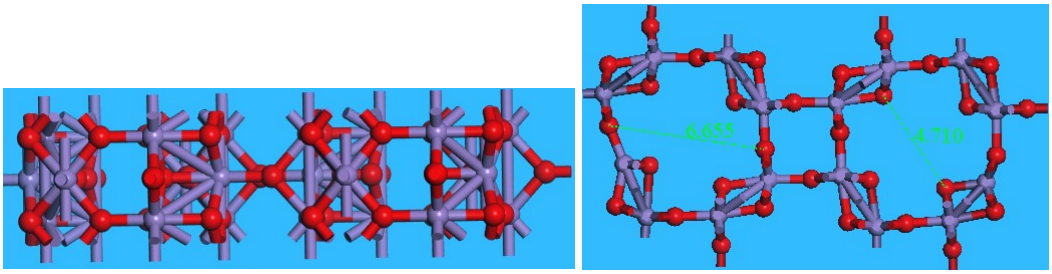

Fig. S12 the constructed structure of MnO_2 (left: lateral view, right: top view)

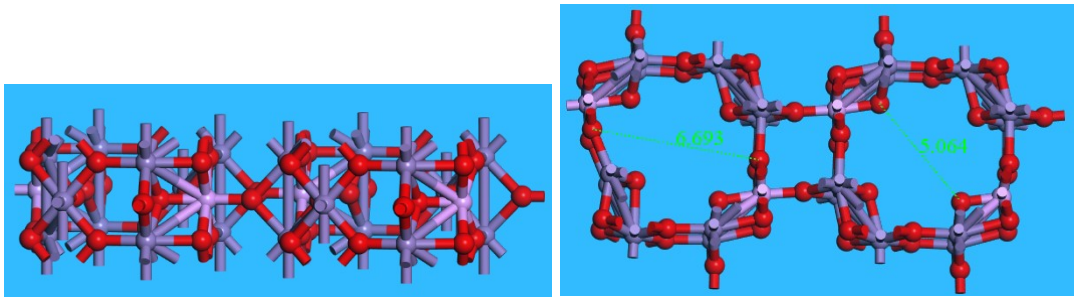

Fig. S13 the constructed structure of P-MnO_x (left: lateral view, right: top view)

Table S1 The capacity performance of some reported cathode materials

Cathode	Capacity (mAh g^{-1})	Reference
VO_2	276 mAh g^{-1} (0.2 A g^{-1})	[1]
α-Mn_2O_3 cathode	148 mAh g^{-1} (0.1 A g^{-1})	[2]
$Na_{1.1}V_3O_{7.9}$ nanoribbons/graphene	84.8 mAh g^{-1} (1 A g^{-1})	[3]
Ni-PTA-Mn	139 mAh g^{-1} (0.1 A g^{-1})	[4]
β-MnO_2	110 mAh g^{-1} (0.2 A g^{-1})	[5]
★ This work	155 mAh/g (0.1 A g^{-1})	

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