Electronic Supplementary Material (ESI) for Dalton Transactions.

Supporting Information

A ternary oxygen-vacancy abundant $ZnMn_2O_4$/$MnCO_3$/nitrogen-doped reduced graphene oxide hybrid towards superior-performance lithium storage

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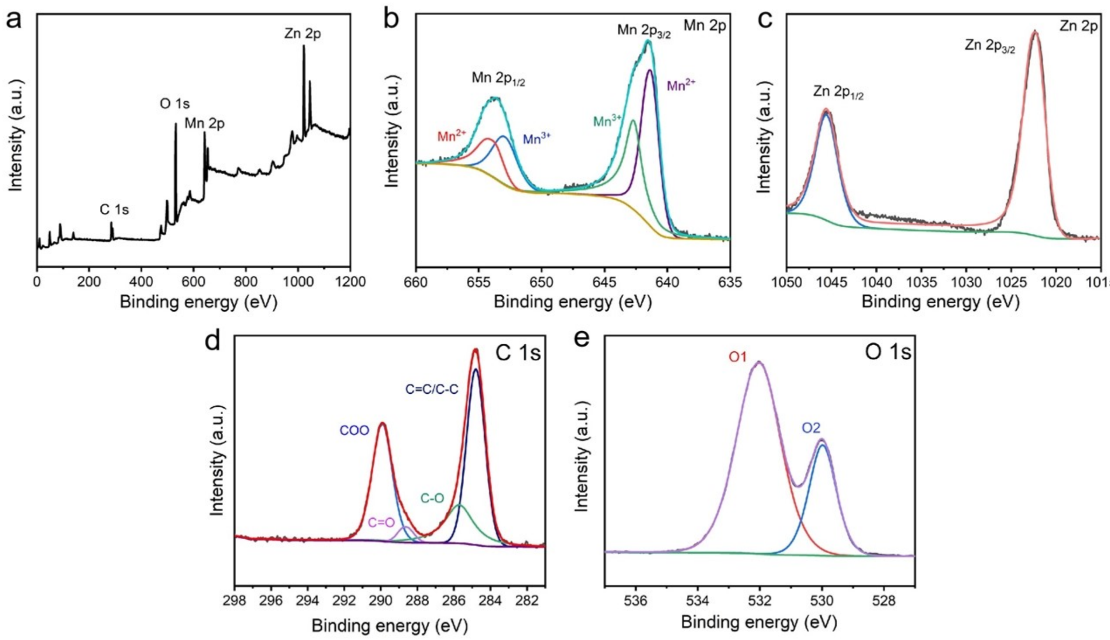

Figure S1. (a) Survey XPS spectra and high-resolution elemental (b) Mn 2p, (c) Zn 2p, (d) C 1s, and (e) O 1s spectra of the $ZnMn_2O_4/MnCO_3$.

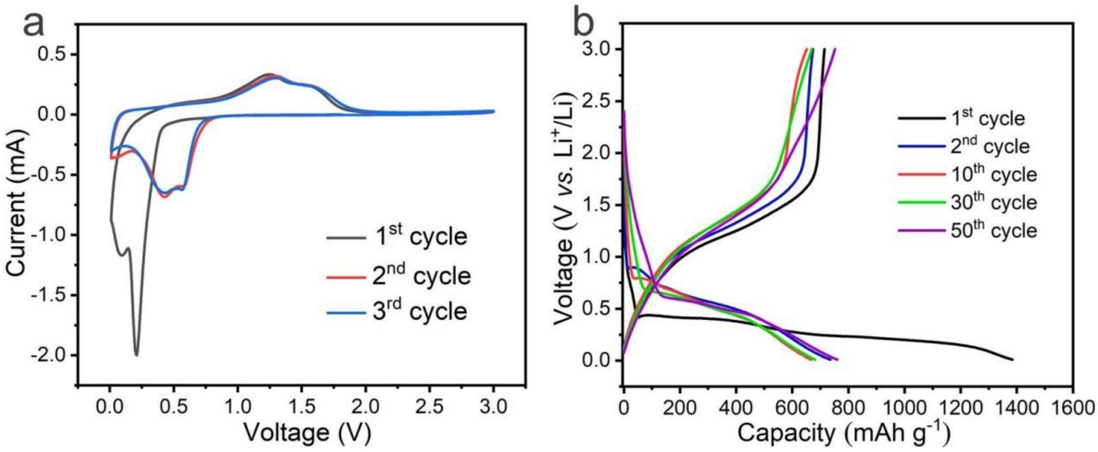

Figure S2. (a) CV cycling curves in the initial 3 cycles at 0.2mV s^{-1} and (b) charge/discharge curves of $ZnMn_2O_4/MnCO_3$.

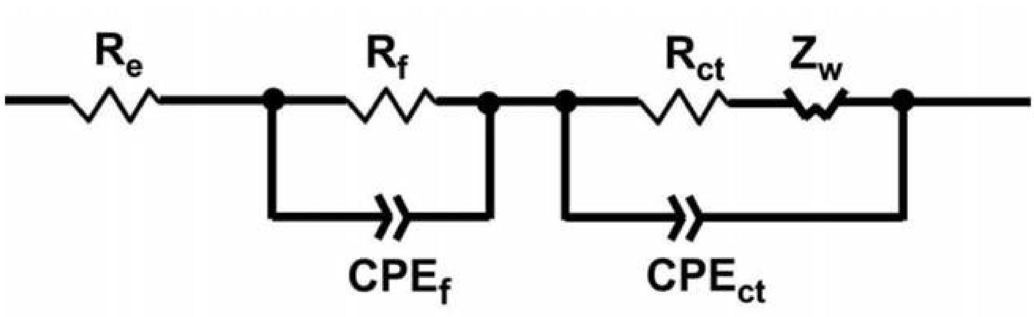

Figure S3. Equivalent circuit model for Nyquist plots in Figure 4d.

The equivalent circuit model (FigureS2 includes ohmic resistance of the electrolyte and cell components (R_e), SEI layer resistance (R_f), charge-transfer resistance (R_{ct}), Warburg diffusion impedance (Z_w), dielectric relaxation capacitance (CPE_f) and double layer capacitance (CPE_{ct}).

Table S1. Discharge specific capacity of this work as well as other $ZnMn_2O_4$-based, $MnCO_3$-based and some transition metal oxide materials as LIBs anodes under different current density.

Materials	Current density (mA g^{-1})	Capacity (mAh g^{-1})	Reference
$ZnMn_2O_4/MnCO_3$/NG	100	853	This work
	200	784	
	500	665	
	1000	569	
	2000	459	
	4000	331	
	8000	194	
$MnCO_3$-RGO	200	687.4	35
	400	611.7	
	800	531.4	
	1200	422.8	
	1600	338.7	
	2000	278.3	
$ZnMn_2O_4(ZMO_4)$	100	376.7	46
	200	222.6	
	500	156.7	
	1000	110	
ZnO/rGO-0.3	100	519	47
	200	399	
	500	318	
	1000	272	
	2000	247	
$MnO@ZnMn_2O_4$/N-C	50	635	48
	100	655	
	200	654	
	500	602	
	1000	547	
	2000	464	
	5000	287	
$ZnMn_2O_4$(S8)	100	439.1	49
	200	301.4	
	500	201.3	
	1000	107.7	
PF-ZMO	100	922	50
	200	655.8	
	300	591.1	
	500	533.9	
	1000	458.7	
	2000	373.1	

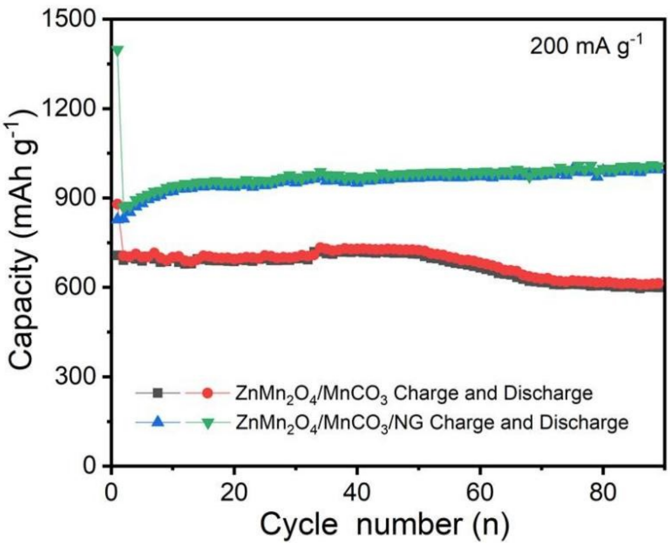

Figure S4. Cycling performances of $ZnMn_2O_4/MnCO_3$ and $ZnMn_2O_4/MnCO_3$/NG electrodes at 200 mA g^{-1}.