Electronic Supplementary Material (ESI) for RSC Advances.

Al-doped α-MnO_2 coated by lignin for high-performance rechargeable aqueous zinc-ion battery

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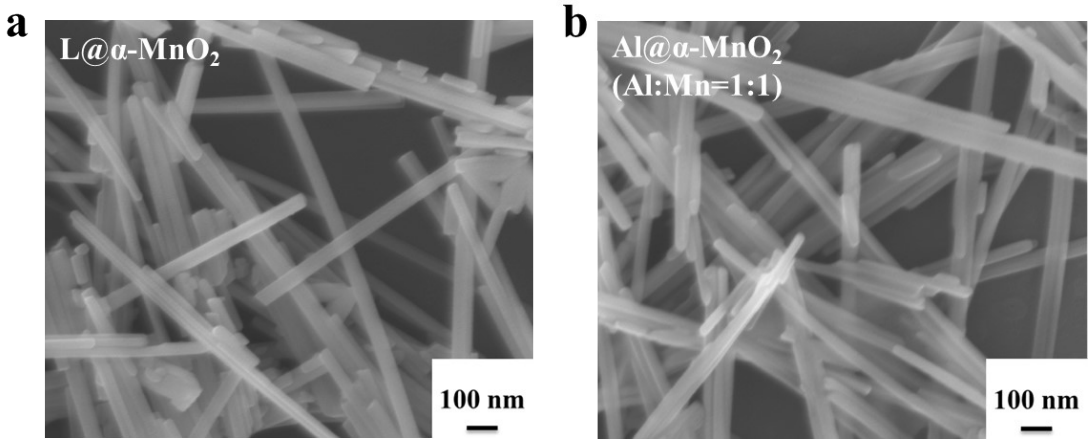

Figure S1 SEM of (a) α-MnO_2 coated by lignin and (b) MnO_2 doped by Al, Al:Mn=1:1.

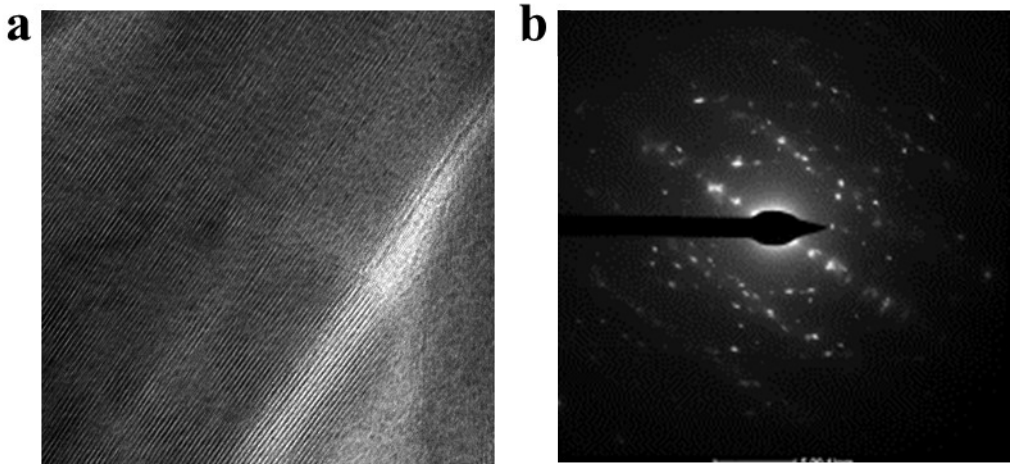

Figure S2 (a) HRTEM image and (b) SAED of L+Al@α-MnO_2

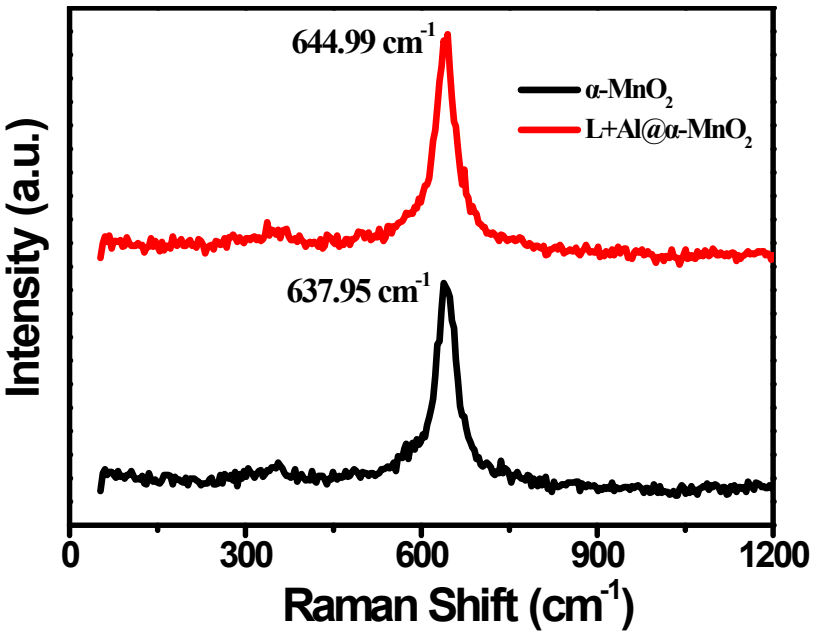

Figure S3 Raman spectra of α-MnO_2 and L+Al@α-MnO_2.

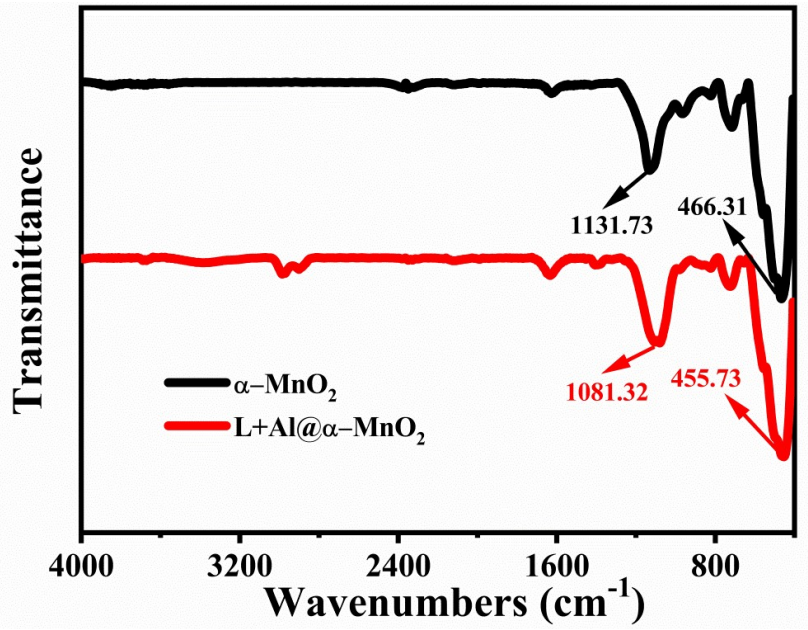

Figure S4 FT-IR spectrum of α-MnO_2 and L+Al@α-MnO_2.

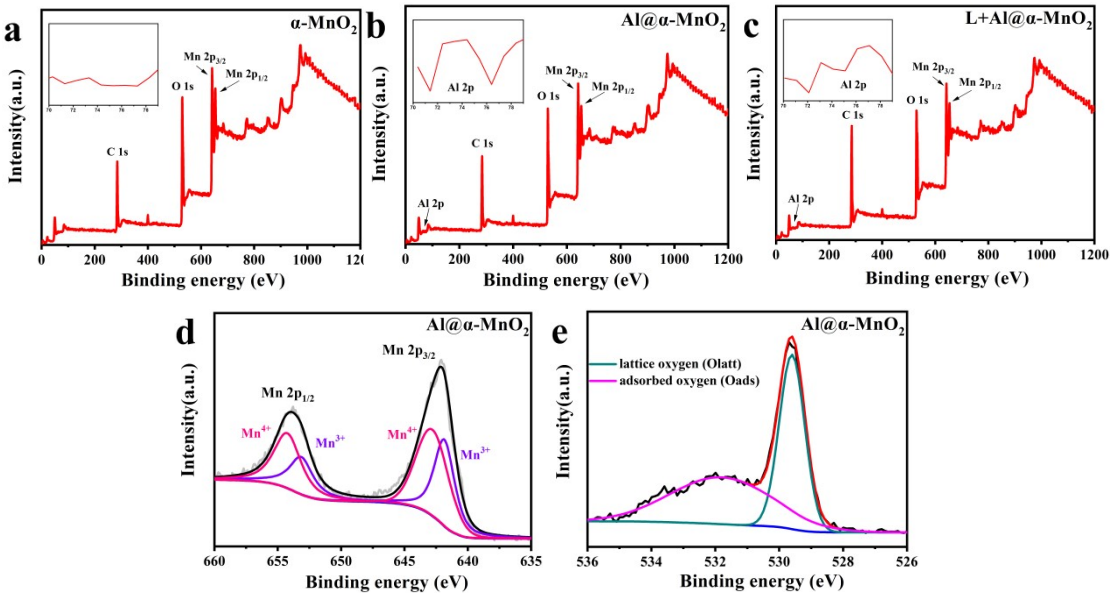

Figure S5 (a) XPS spectrum of α-MnO_2. (b) Al@α-MnO_2 and (c) L+Al@α-MnO_2. (d) Mn 2p spectrum of Al@α-MnO_2 and (e) O 1s spectrum of Al@α-MnO_2.

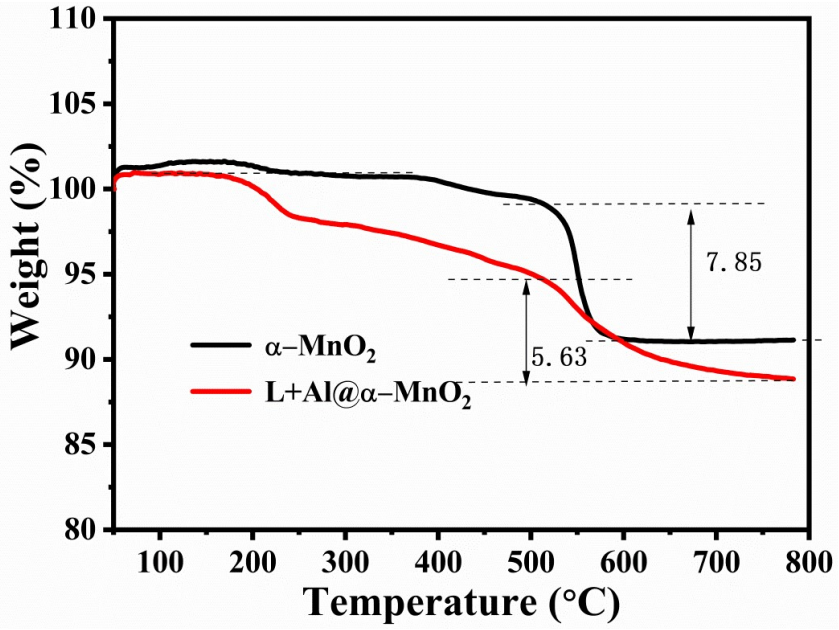

Figure S6 TG analysis of α-MnO_2 and L+Al@α-MnO_2.

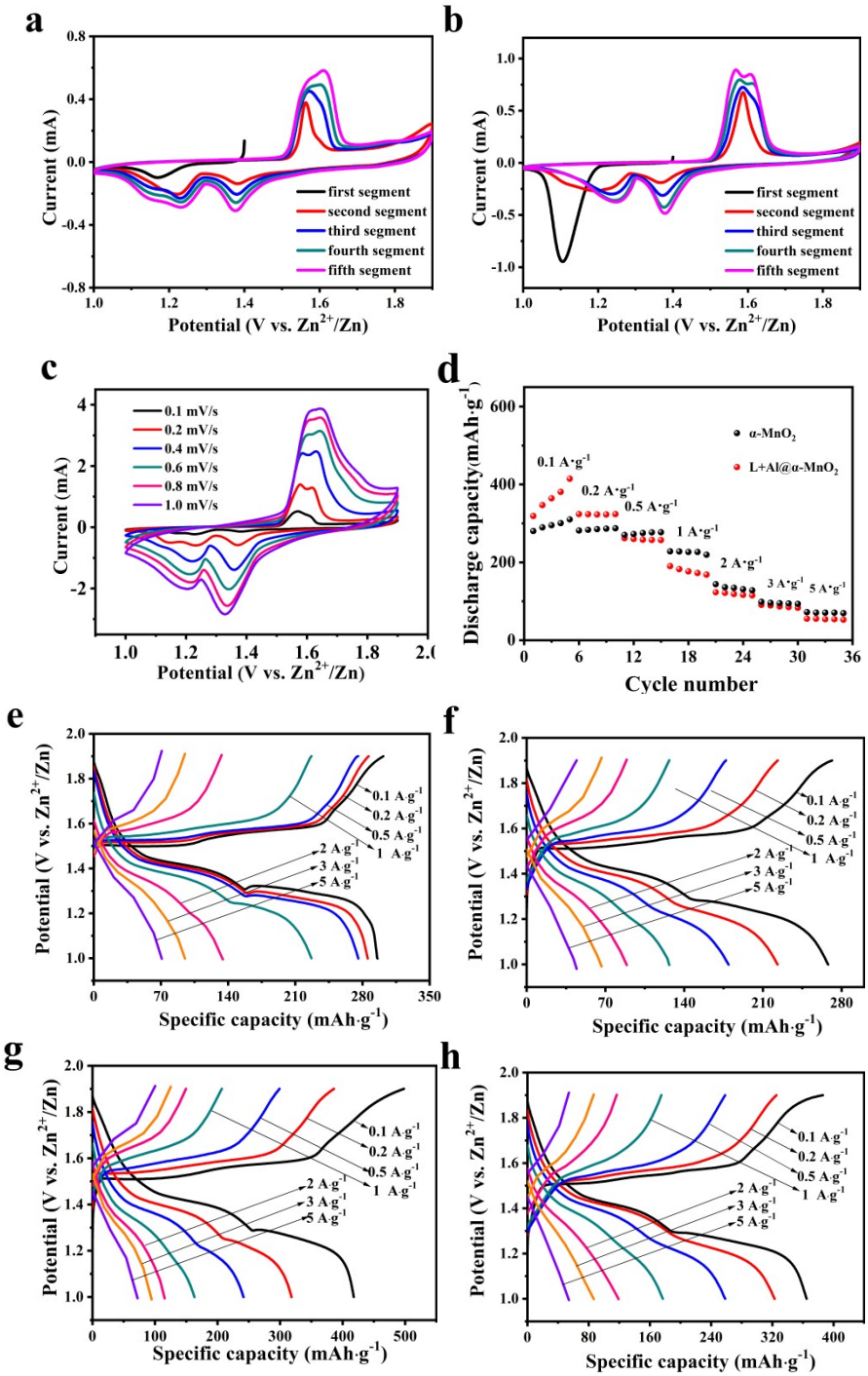

Figure S7 (a), (b) Cyclic voltammetry curves of Al@α-MnO_2 and L@α-MnO_2 at 0.1 $mV \cdot s^{-1}$. (c) CV curves of α-MnO_2 at different sweep rates. (d) Rate performance of batteries using α-MnO_2 and L+Al@α-MnO_2 as the cathode material, respectively. (e), (f), (g) and (h) Charge-discharge profiles of batteries using α-MnO_2, Al@α-MnO_2, L@α-MnO_2 and L+Al@α-MnO_2 at the current densities varying from 0.1 to 5 $A \cdot g^{-1}$, respectively.

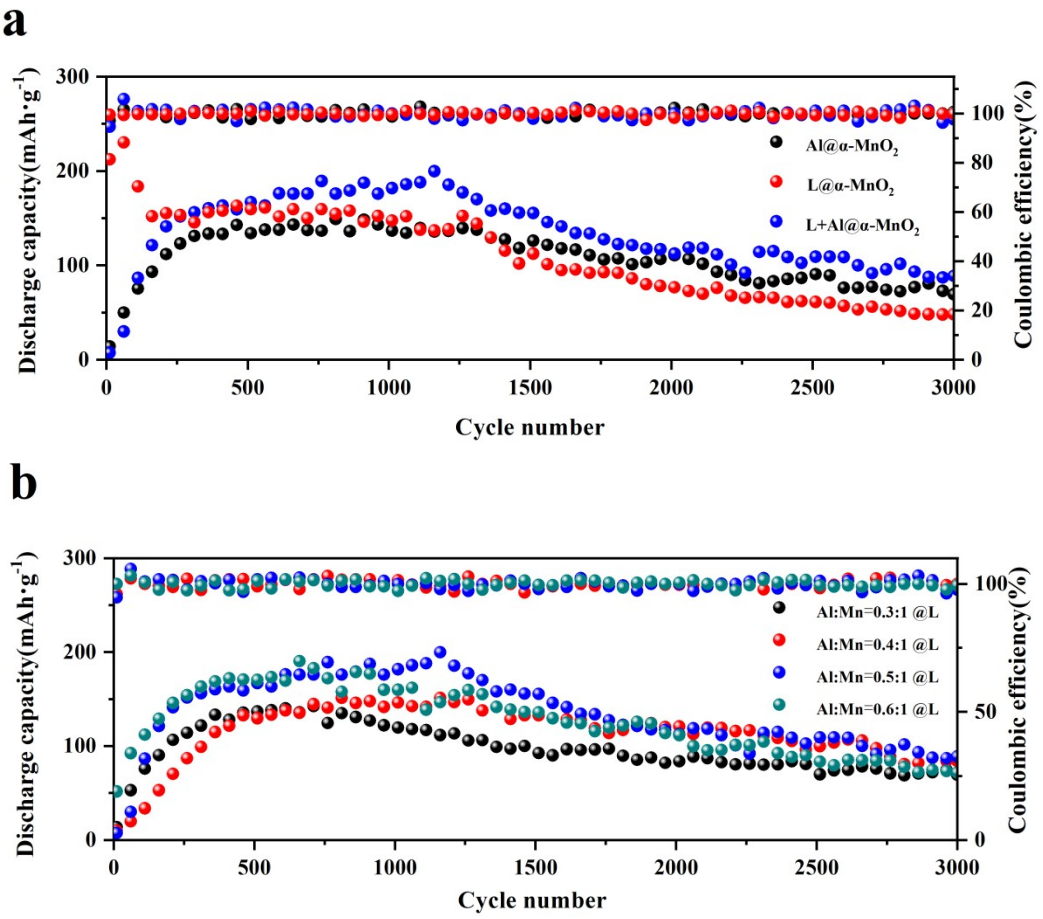

Figure S8 (a) Cycle performance of Al@α-MnO_2, L @α-MnO_2 and L+Al@α-MnO_2 at 1.5A·g^{-1}. (b) Cycle performance of L+Al@α-MnO_2 with different different initial molar ratios of Al and Mn at 1.5A·g^{-1}.