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Spherical flower $MnCo_2O_4$ with hollow structure as cathode for efficient Li-CO_2 battery

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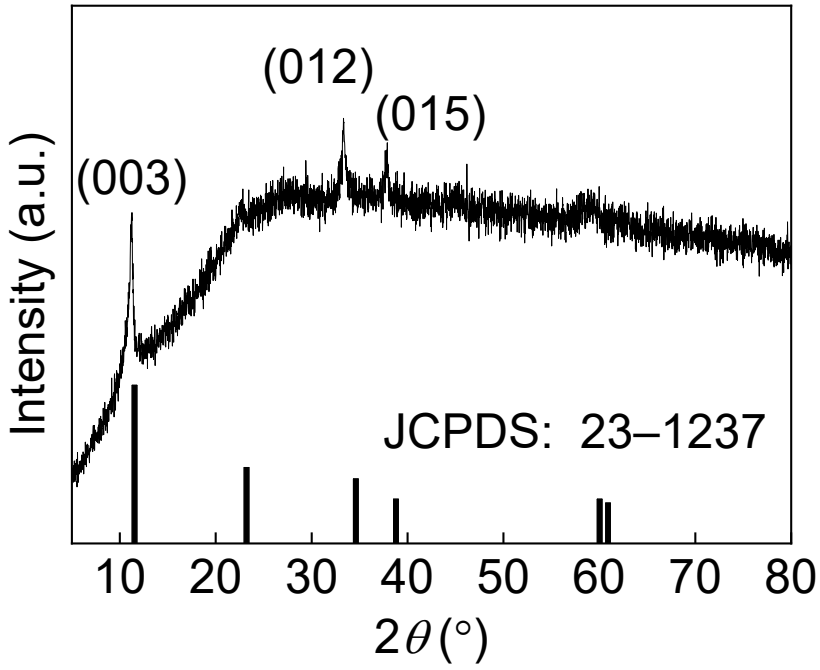

Figure S1. XRD pattern of MnCo-hydroxides.

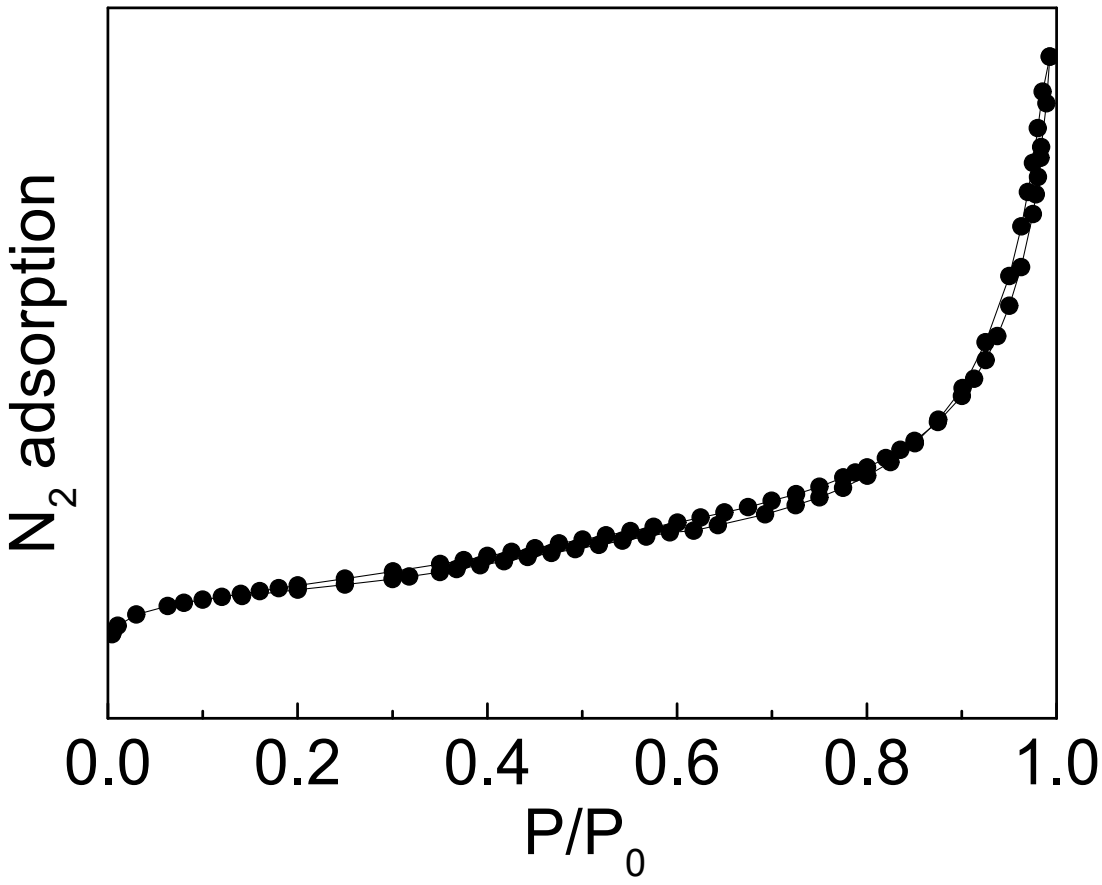

Figure S2. The nitrogen adsorption-desorption isotherms.

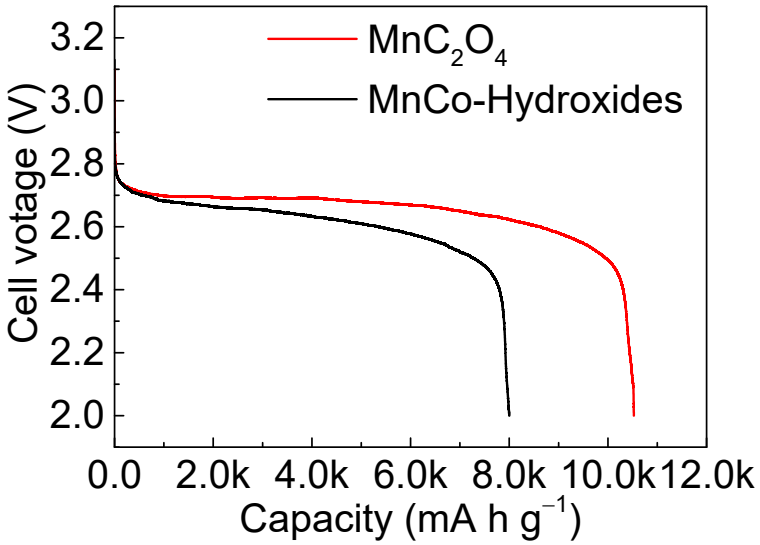

Figure S3. Full discharge curves of (a) $MnCo_2O_4$, and (b) MnCo-hydroxides as cathodes.

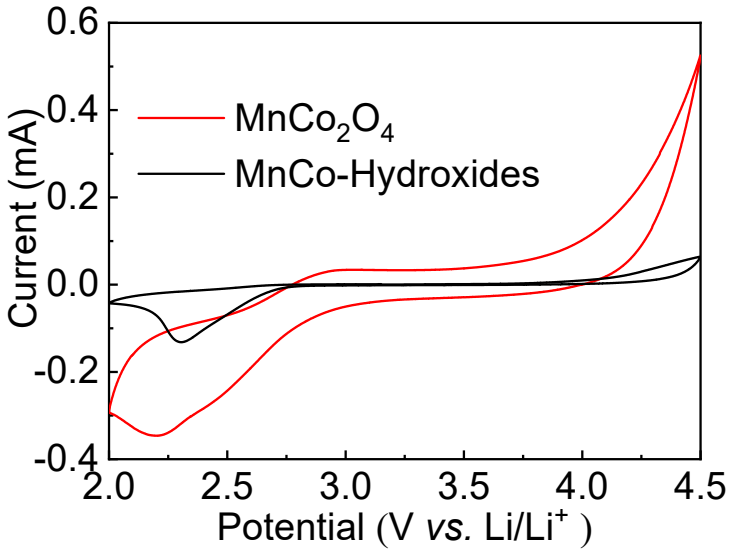

Figure S4. The cyclic voltammetry curves of the first cycles in the potential range of 2.0 – 4.5 V.

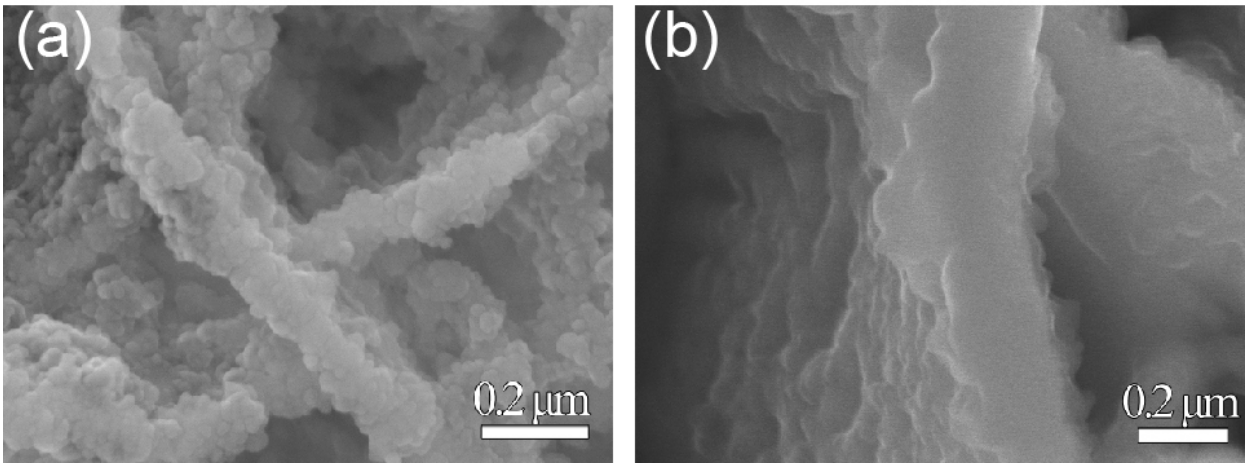

Figure S5. SEM images of $MnCo_2O_4$ electrode at different stages (a) discharged, and (b) recharged.

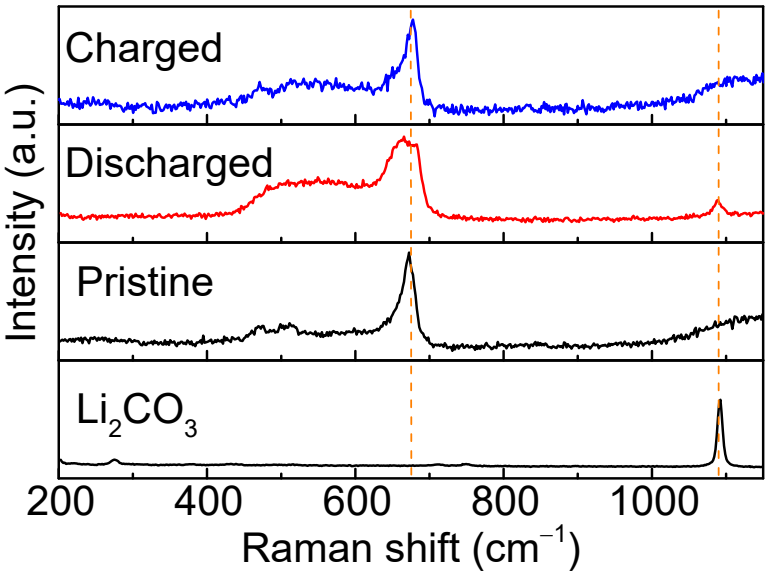

Figure S6. Raman spectra of $MnCo_2O_4$ electrode at different stages during the first cycle.

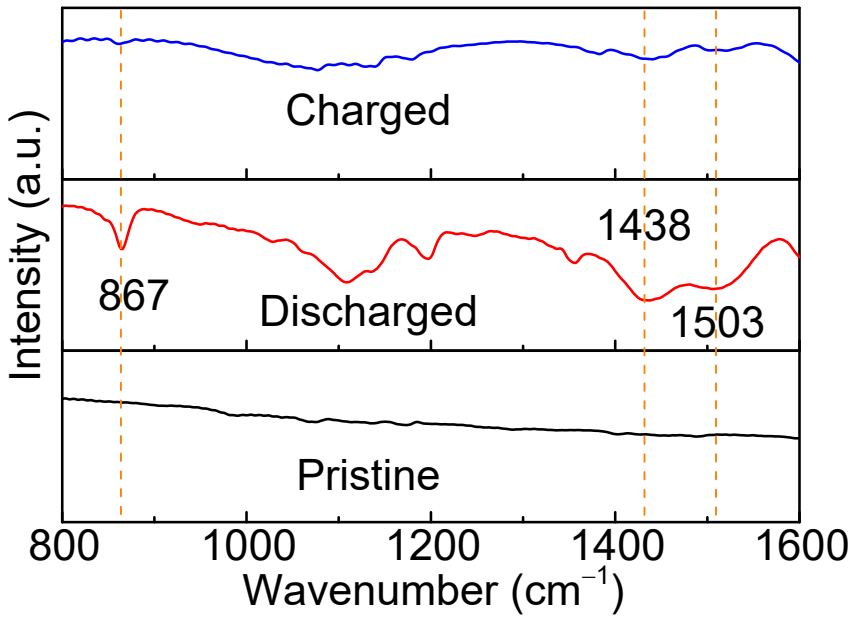

Figure S7. FTIR spectra of $MnCo_2O_4$ electrode at different stages during the first cycle.

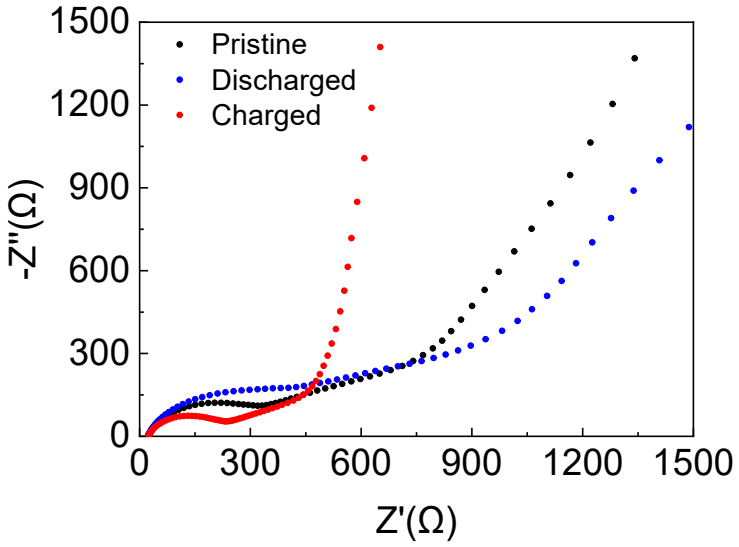

Figure S8. Impedance spectra of the Li-CO_2 battery with a $MnCo_2O_4$ cathode at pristine, first discharge, and first charge states.

The Nyquist plots at different states almost demonstrate a depressed semicircle in the high-middle frequency region and an oblique straight line in the low frequency range. After a discharge process, the electrode shows an elevated resistance due to the formation of non-conductive Li2CO3 on the surface of the electrode. Then the cell displays low contact and charge-transfer impedance according to the EIS result, due to the decomposition of Li2CO3 in the charge process.