Electronic Supplementary Information

General Formation of Mn-based Transition Metal Oxide Twin-Microspheres with Enhanced Lithium Storage Properties

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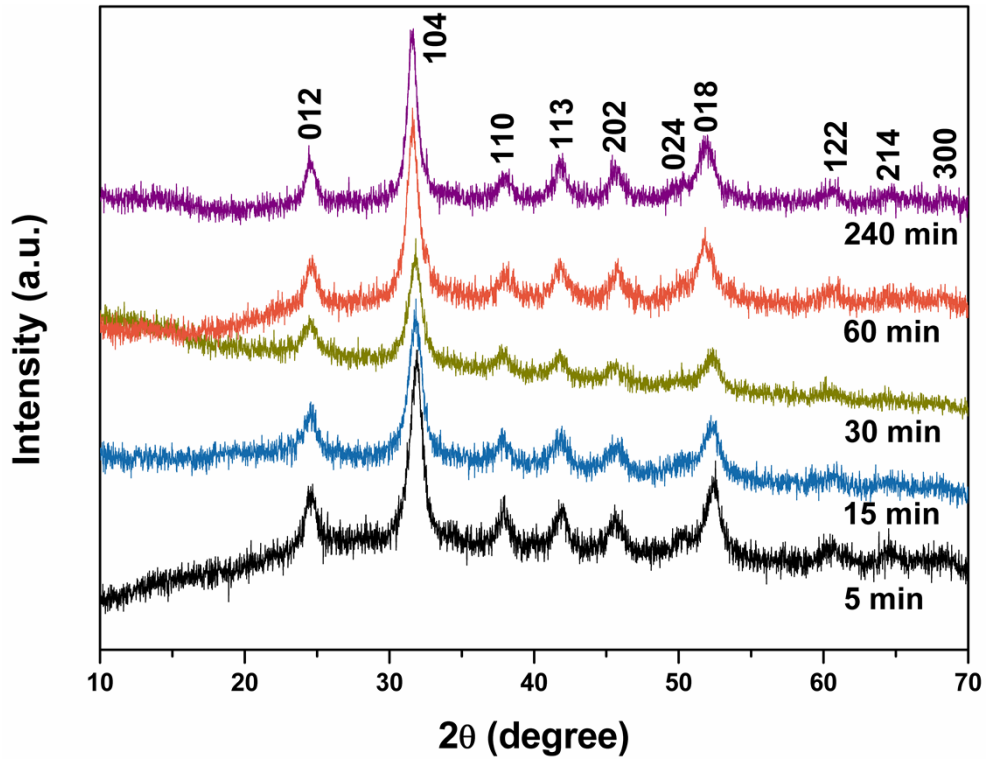

Figure S1. XRD pattern of the corresponding precursor obtained at different reaction time.

Note: By comparison with $MnCO_3$, all the diffraction peaks could be indexed as hexagonal phase with space group *R-3c* (no.167). $Co_{0.33}Mn_{0.67}CO_3$ was confirmed to form within 5 min, and the products evolved to have a better crystallinity with the elongation of reaction time in the current synthetic system.

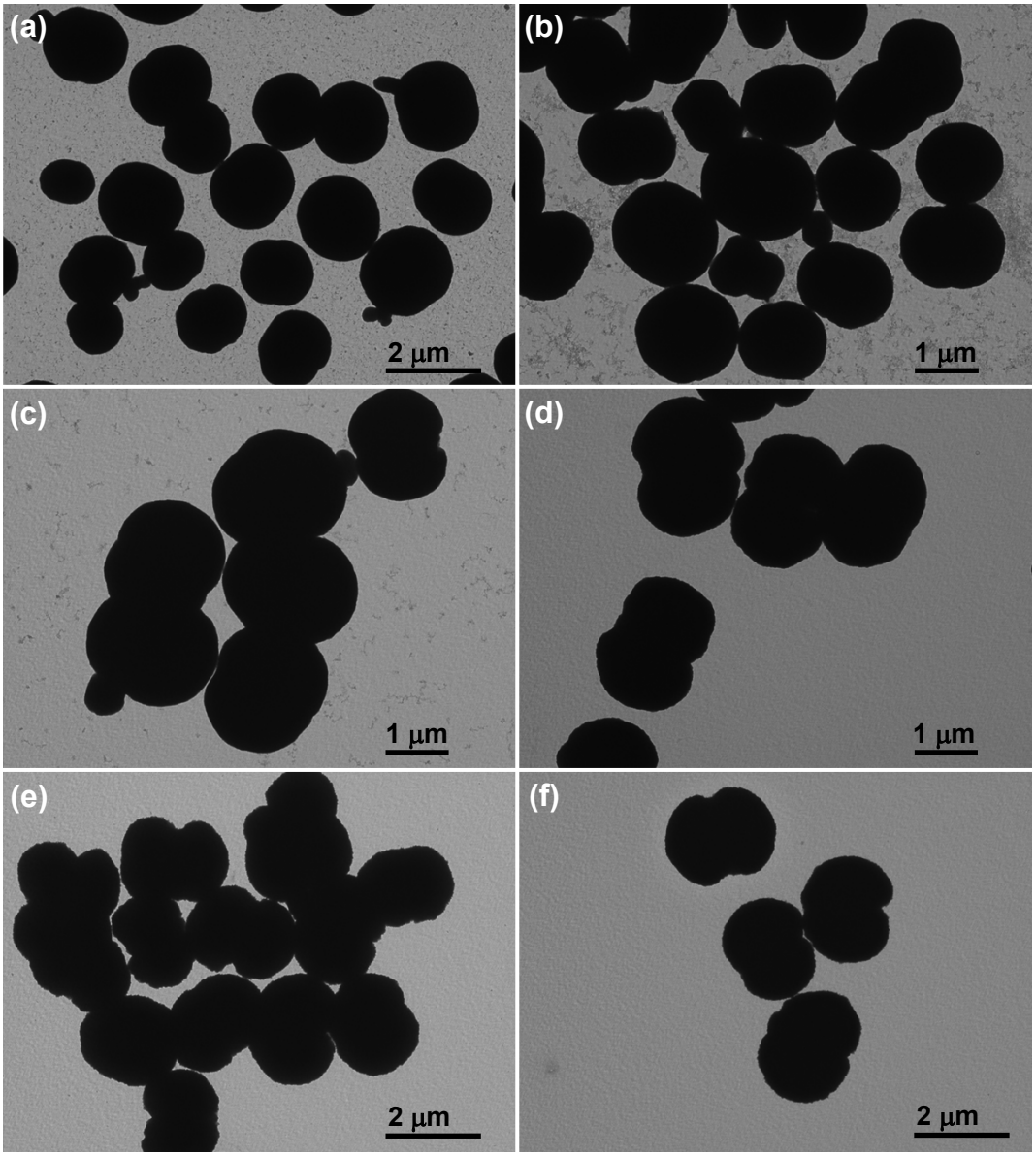

Figure S2. TEM images of the precursors synthesized at 200 °C for 5 min (a); 15 min (b); 30 min (c); 1h (d); 2 h (e); and 4 h (f).

Note: according to time-dependant experiments, the morphology of carbonate phase evolved upon the reaction time, gradually transforming from individual sphere-like particles to twin-spheres accompanied by Ostwald ripening.

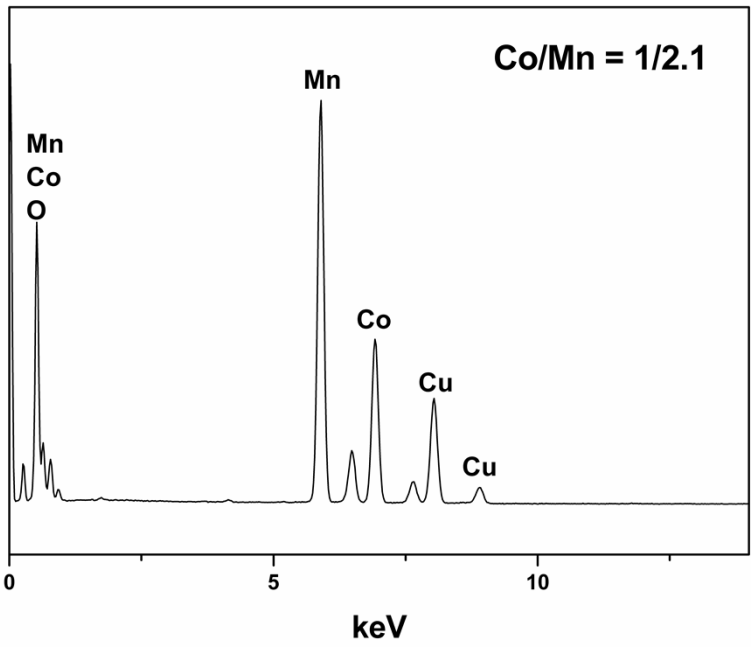

Figure S3. EDX result for $CoMn_2O_4$ twin microspheres. The atomic ratio of two metal elements is presented here.

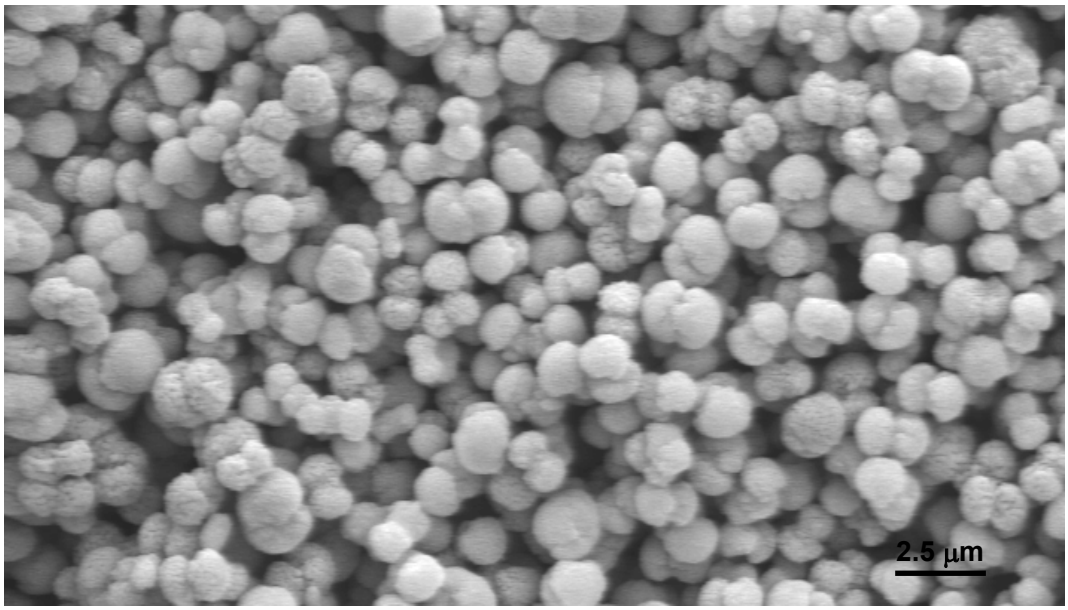

Figure S4. A panoramic FESEM image of the $CoMn_2O_4$ twin microspheres.

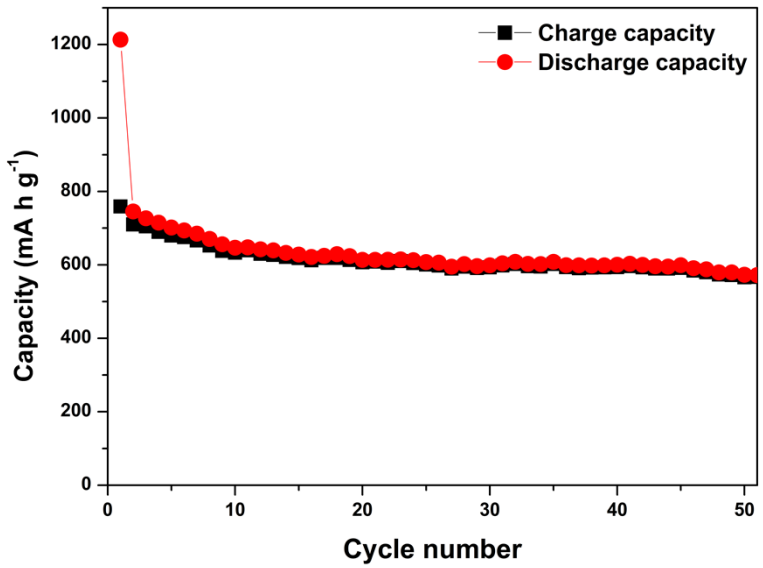

Figure S5. Cycling performance of $CoMn_2O_4$ twin microspheres at a current density of 1000 mA g^{-1}.

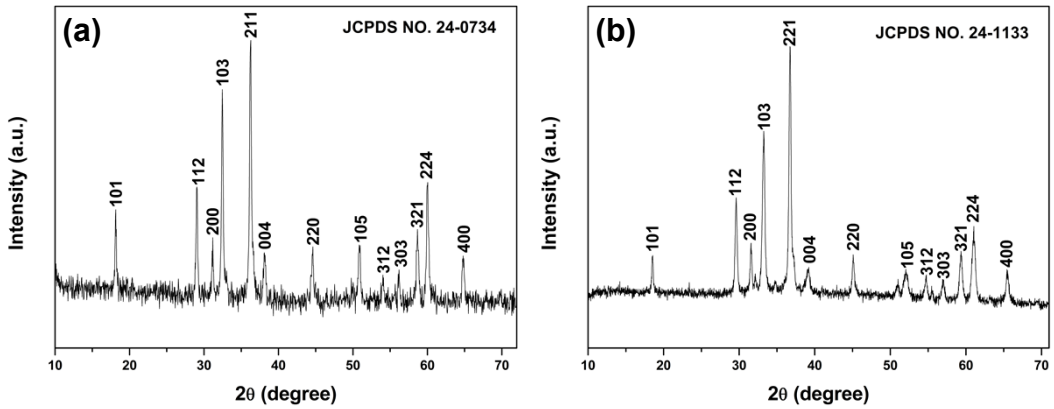

Figure S6. XRD patterns of (a) Mn_3O_4 twin-microspheres and (b) $ZnMn_2O_4$ twin-microspheres.

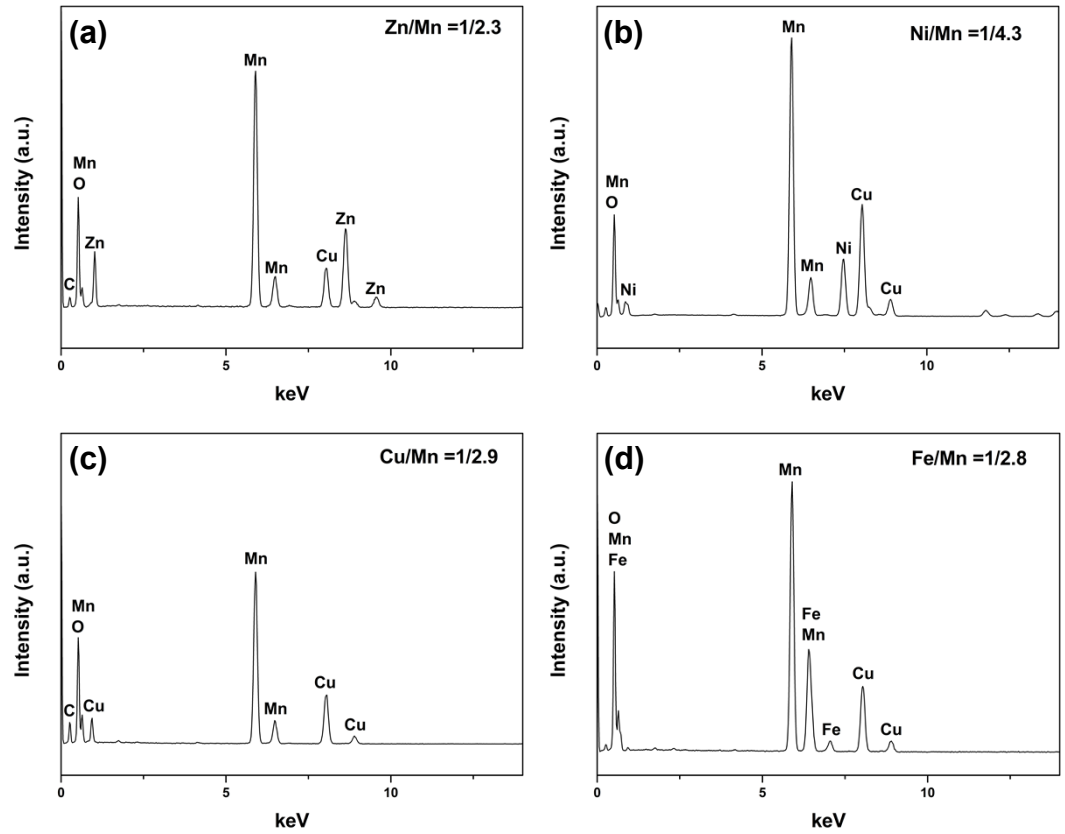

Figure S7. EDX results for (a) $ZnMn_2O_4$; (b) $Ni_xMn_{3-x}O_4$, (c) $Cu_xMn_{3-x}O_4$ and (d) $Fe_xMn_{3-x}O_4$ twin-microspheres. The relative atomic ratios of two metal elements are approximately calculated.