Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

A Simple Method for Industrialization to Enhance Tap Density of $LiNi_{0.5}Co_{0.2}Mn_{0.3}O_2$ Cathode Material for High-Specific Volumetric Energy Lithium-ion Batteries

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Table S1 Tap density of NCM523 with different weight ratios.

Sample Numbe	Weight Ratio	Tap Density
1	10:0:0	2.56
2	9:1:0	2.61
3	8:2:0	2.66
4	8:0:2	2.55
5	8:1:1	2.61
6	7:3:0	2.54
7	7:2:1	2.57
8	7:1:2	2.54
9	6:4:0	2.56
10	6:0:4	2.23
11	6:3:1	2.55
12	6:2:2	2.54
13	6:1:3	2.54
14	4:2:4	2.17
15	4:4:2	2.31
16	2:6:2	2.30
17	2:4:4	2.09
18	2:2:6	2.00
19	2:8:0	2.43
20	0:8:2	2.24
21	0:10:0	2.10
22	0:0:10	1.50
23	0:2:8	1.87

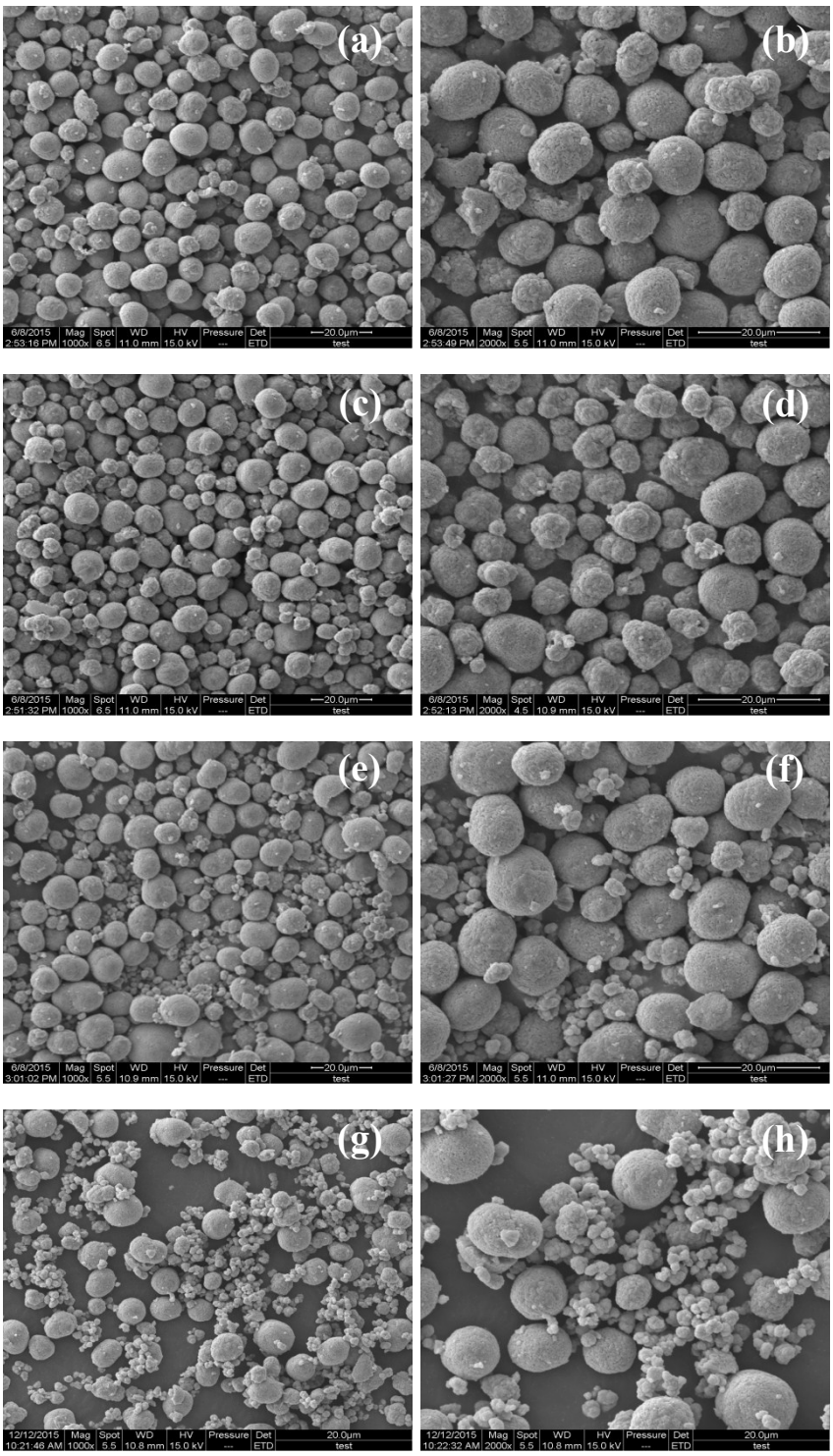

Fig. S1 SEM images and magnifications of mixed NCM523 materials: M2 (a, b), M3 (c, d), M5 (e, f) and M8 (g, h).

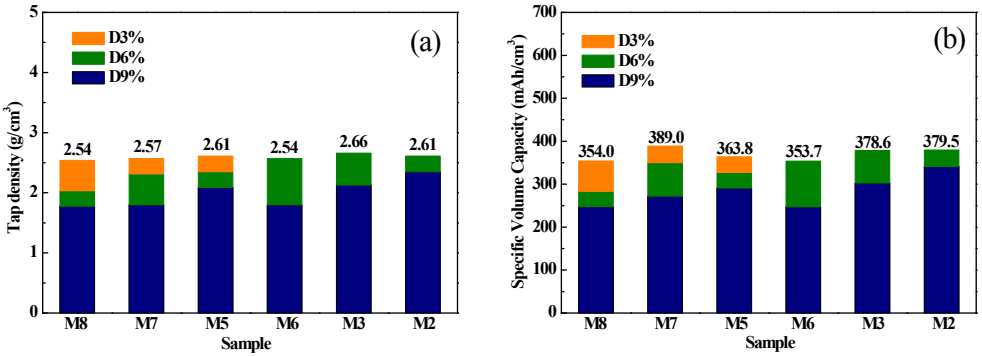

Fig. S2 Tap density and specific volume capacity of samples with different weight ratios, (a) is tap density of samples; (b) is specific volume capacity of samples.

Table S2 Particle size distribution of NCM523 samples with different weight ratios.

Sample	D10	D50	D90
M8	4.0920	8.7790	14.6100
M7	4.7226	8.1743	12.2451
M5	5.0728	9.2542	13.1708
M6	5.7159	8.5951	12.5917
M3	5.8500	8.7236	12.5041
M2	6.6990	9.4760	12.8993

Table S3 Cycle performance of NCM523 samples for a voltage range of 3.0-4.3 V with 1 C rate.

Sample	First 10 cycles average capacity (mAh/cm^3)	First 10 cycles average capacity (mAh/cm^3)	Capacity retention（%）
M7	394.3	379.4	96.2
M8	374.1	369.6	98.8
M5	360.5	357.7	99.2
M6	349.1	350.3	100.4
M3	382.1	374.5	98.0
M2	384.3	370.3	96.4

Table S4 Cycle performance of NCM523 samples for a voltage range of 3.0-4.3 V with 1 C rate.

Sample	First 10 cycles average capacity (mAh/cm^3)	Last 10 cycles average capacity (mAh/cm^3)	Capacity retention（%）
M7	394.3	379.4	96.2
M8	374.1	369.6	98.8
M5	360.5	357.7	99.2
M6	349.1	350.3	100.4
M3	382.1	374.5	98.0
M2	384.3	370.3	96.4

Table S5 Cycle performance of NCM523 samples for a voltage range of 3.0-4.3 V with 1 C rate.

Sample	First 10 cycles average capacity (mAh/cm^3)	First 10 cycles average capacity (mAh/cm^3)	Capacity retention（%）
D3	234.1	232.4	99.3
D6	306.9	313.6	102.2
D9	360.6	369.1	102.4
M7	394.3	379.4	96.2

Table S6 Capacity of NCM523 samples with different rates charge-discharge from 3.0-4.3 V.

Sample	1 C (mAh/cm^3)	2 C (mAh/cm^3)	5 C (mAh/cm^3)	5 C/1 C (%)	1 C (mAh/cm^3)
D3	230.4	214.7	189.7	82.3	230.1
D6	314.5	290.8	255.0	81.1	318.6
D9	371.5	335.3	291.0	78.3	365.0
M7	371.5	354.5	327.2	88.1	375.0

Table S7 CV data of samples after 3 activation process with low current rate of 0.1 C.

Samples	Eoxidation (V)	Ereduction (V)	ΔE (V)
D9	3.851	3.706	0.146
M7	3.825	3.700	0.125
M8	3.809	3.713	0.096
M5	3.814	3.704	0.110
M6	3.803	3.714	0.089
M3	3.811	3.706	0.105
M2	3.822	3.696	0.126