Supporting Information

An Efficient Synthetic Method to Prepare High-Performance Ni-rich $LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$ for Lithium-Ion Batteries

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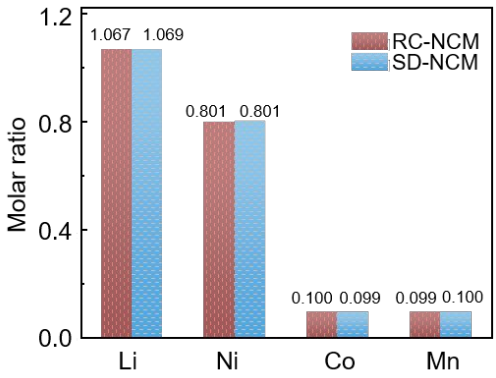

Figure S1. ICP-OES result for the chemical composition analysis of the as-prepared samples.

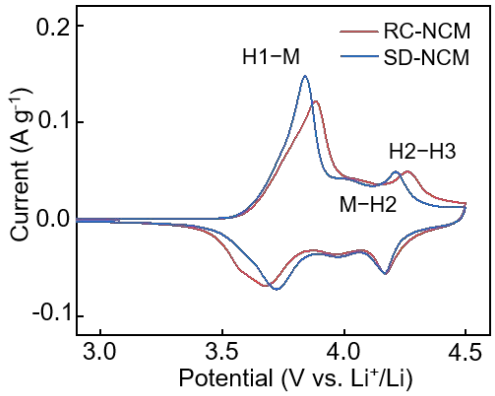

Figure S2. Cyclic voltammograms of RC-NCM and SD-NCM within the voltage window of 2.8-4.5 V at a sweep rate of 0.05 mVs^{-1} for the 1st cycle.

The relationship of the cathodic and anodic peak current density (I_p) and the scan rate of CV ($v^{1/2}$) can be expressed by the following equation, from which the diffusion coefficient could be calculated as follows:

$$I_p = 2.69\times10^5 \times n^{3/2} \times A \times D^{1/2} \times v^{1/2} \times C_o$$

where n is the numbers of electrons for specific electrochemical reactions, A is the area of the electrode (cm^2), D is the diffusion coefficient of lithium ($cm^2\ s^{-1}$), v is the scan rate ($V\ s^{-1}$), and C_o is the initial concentration of lithium ion ($mol\ cm^{-3}$).

Table S1. Comparison of the electrochemical performance of Ni-rich NCM prepared via traditional methods and our method.

Samples	Method	Temperature (℃)	Capacity	Capacity	Electrochemical	References
Al_2O_3@ $Li[Ni_{0.8}Co_{0.2}]_{0.7}[Ni_{0.2}Mn_{0.8}]_{0.3}O_2$	Coprecipitation	RT	195 (0.2 C)	87.5 (0.2 C, 100 cycles)	2.7-4.5	(1)
		55	205~210 (0.2 C)	89 (0.2 C, 50 cycles)		
Concentration gradient- $LiNi0_{.75}Co_{0.15}Mn_{0.15}O_2$	Coprecipitation	25	197.4 (0.2 C)	88.3 (0.2 C, 100 cycles)	2.7-4.5	(2)
$LiNi_{0.81}Co_{0.10}Al_{0.09}O_2$	Coprecipitation	24	188 (0.2 C)	85 (1 C, 200 cycles)	3.0-4.5	(3)
		60	206 (1 C)	59 (1 C, 200 cycles)		
$LiNi_{0.72}Co_{0.10}Mn_{0.18}O_2$	Coprecipitation	25	190 (0.2 C)	85.7 (0.2 C, 100 cycles)	2.7-4.5	(4)
		55	218 (0.5 C)	70.2 (0.5 C, 100 cycles)		
Li_2MnO_3@$LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$	Coprecipitation	25	207 (0.1 C)	75 (0.1 C, 100 cycles)	2.0-4.5	(5)
$LiAlO_2$@$LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$	Spray drying	RT	177.6 (1C)	81.1 (1 C, 150 cycles)	2.8-4.5	(6)
		55	181.7 (1C)	85.14 (1 C, 150 cycles)	2.8-4.3	
$LiNi_{0.76}Mn_{0.14}Co_{0.10}O_2$	Coprecipitation	30	215 (0.1 C)	79.0 (0.33 C, 200 cycles)	2.7-4.5	(7)
		60	230 (0.2 C)	84.0 (0.5 C, 100 cycles)		
Core-Shell $LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$	Coprecipitation	25	116 (10 C)	73.7 (10 C, 200 cycles)	3.0-4.3	(8)
		55	181 (at 0.2 C)	65.1 (1 C, 100 cycles)		
$LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$	Coprecipitation	30	212 (0.5 C)	90 (0.5C, 100 cycles)	2.7-4.5	(9)
$LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$	**Rapid coprecipitation with spray drying**	**25**	**190.5 (0.2 C)**	**86.0 (1 C, 200 cycles)**	**2.8-4.5**	**This work**
		60	**206.1 (at 0.2 C)**	**81.9 (1 C, 200 cycles)**	**2.8-4.3**	

Table S2. Atomic concentration of each element on the surface of the as-synthesized NCM materials before and after the cycling process.

Samples	C 1s	O 1s	F 1s	P 2p
RC-Before	65.10	17.99	16.75	0.16
RC-After	30.49	19.76	45.28	4.47
SD-Before	73.48	6.58	19.84	0.10
SD-After	59.47	14.85	24.32	1.36

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