Supporting Information

Hierarchical Porous $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ with Yolk-shell-like Architecture as Stable Cathode Material for Lithium-Ion Batteries

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Figures.

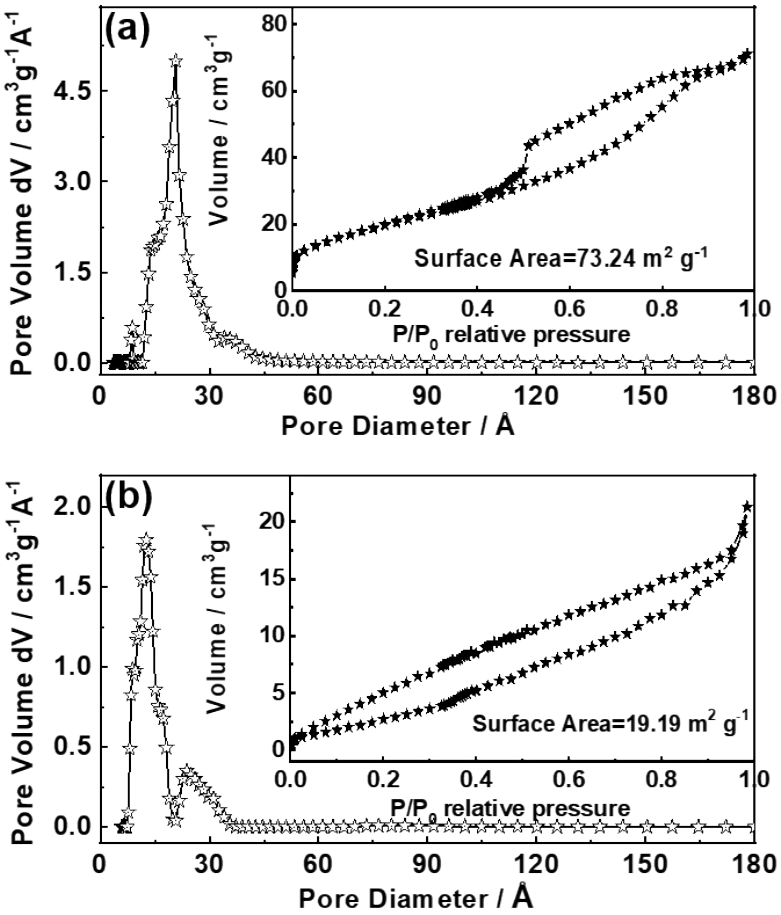

Fig. S1 The pore size distribution and N_2 adsorption/desorption isotherms (insert) of (a) $Ni_{1/3}Co_{1/3}Mn_{1/3}CO_3$ and (b) YS-NCM.

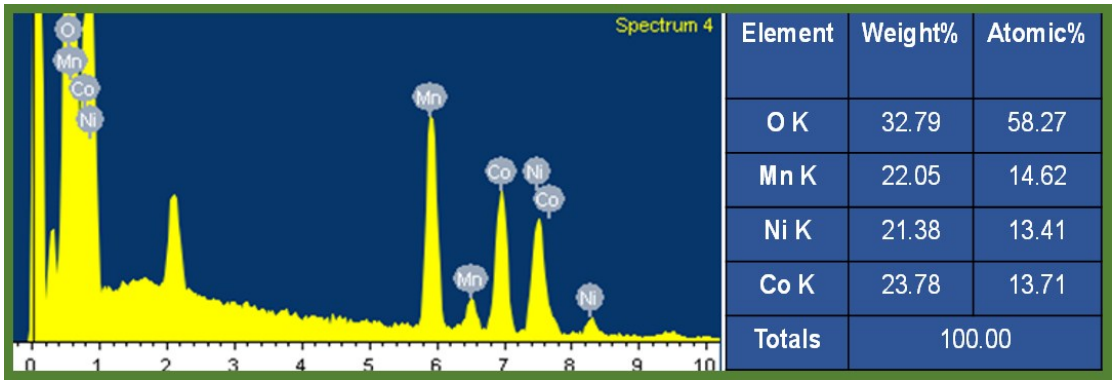

Fig. S2 EDS elemental mapping results of YS-NCM.

Tab. S1 Comparison of electrochemical performance (capacity, rate capability and cycling stability) of the best performing NCM materials.

Ref.	**Electrode mass loading / mg/cm^2**	**Electrode composition (NCM:binder: PVDF)**	**Voltage range / V**	**Specific capacity / mAh g^{-1}**	**Rate capability / mAh g^{-1}**	**Cycling retention**
Pinecone-like NCM333[1]	2-3	80:10:10	3.0-4.3 V; 3.0-4.6 V;	161.6 (0.2C); 199.9 (0.2C);	159.4 (2C); 159.2 (2C);	91% (100 cycles at 0.2C); 77% (40 cycles at 0.2 C);
1D NFM333[2]	1.5	80:10:10	2.0-4.5	109 (0.1C)	40 (15C)	80% (100 cycles at 0.1C);
Dummbbell-like NCM333[3]	1.7	85:8:7	2.5-4.5	171 (0.1C)	120.0 (7C)	87.7% (50 cycles at 0.1C);
Hierarchical microspherical NCM333[4]	2	80:10:10	2.5-4.5	203.6 (0.1C)	120.0 (5C)	90.3% (50 cycles at 0.1C);
Hierarchical NCM333 nanosheets[5]	1.5	80:10:10	2.5-4.5	190.1 (0.1C)	177.0 (5C); 166.7 (10C); 137.7 (20C);	93.9% (100 cycles at 1C); 92.6% (100 cycles at 2C); 92.1% (100 cycles at 5C);
This work	2	80:10:10	2.5-4.5	187.1 (0.1C)	109.6 (5C); 93.6 (10C); 79.2 (15C); 69.2 (20C); 64.50 (30C);	86.0% (100 cycles at 0.1C); 91.1% (100 cycles at 1C); 93.2% (100 cycles at 2C);

References

1 Y. Shao, B. Huang, Z. Lu, Y. Liu, X. Meng, L. Du, H. Song, S. Liao, *Energy Technol.*, 2019, **7**, 1800769-1800776.

2 S. Kalluri, W.K. Pang, K.H. Seng, Z. Chen, Z. Guo, H.K. Liu, S.X. Dou, *J. Mater. Chem. A*, 2015, **3**, 250-257.

3 W.-H. Ryu, S.-J. Lim, W.-K. Kim, H. Kwon, *J. Power Sources*, 2014, **257**, 186-191.

4 Z. Chen, J. Wang, D. Chao, T. Baikie, L. Bai, S. Chen, Y. Zhao, T.C. Sum, J. Lin, Z. Shen, *Sci. Rep.*, 2016, **6**, 25771-25781.

5 J. Li, X. Wang, J. Zhao, J. Chen, T. Jia, C. Cao, *J. Power Sources*, 2016, **307**, 731-737.