Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

A stable surface construction of Ni-rich $LiNi_{0.8}Mn_{0.1}Co_{0.1}O_2$ cathode material for high performance lithium-ion batteries

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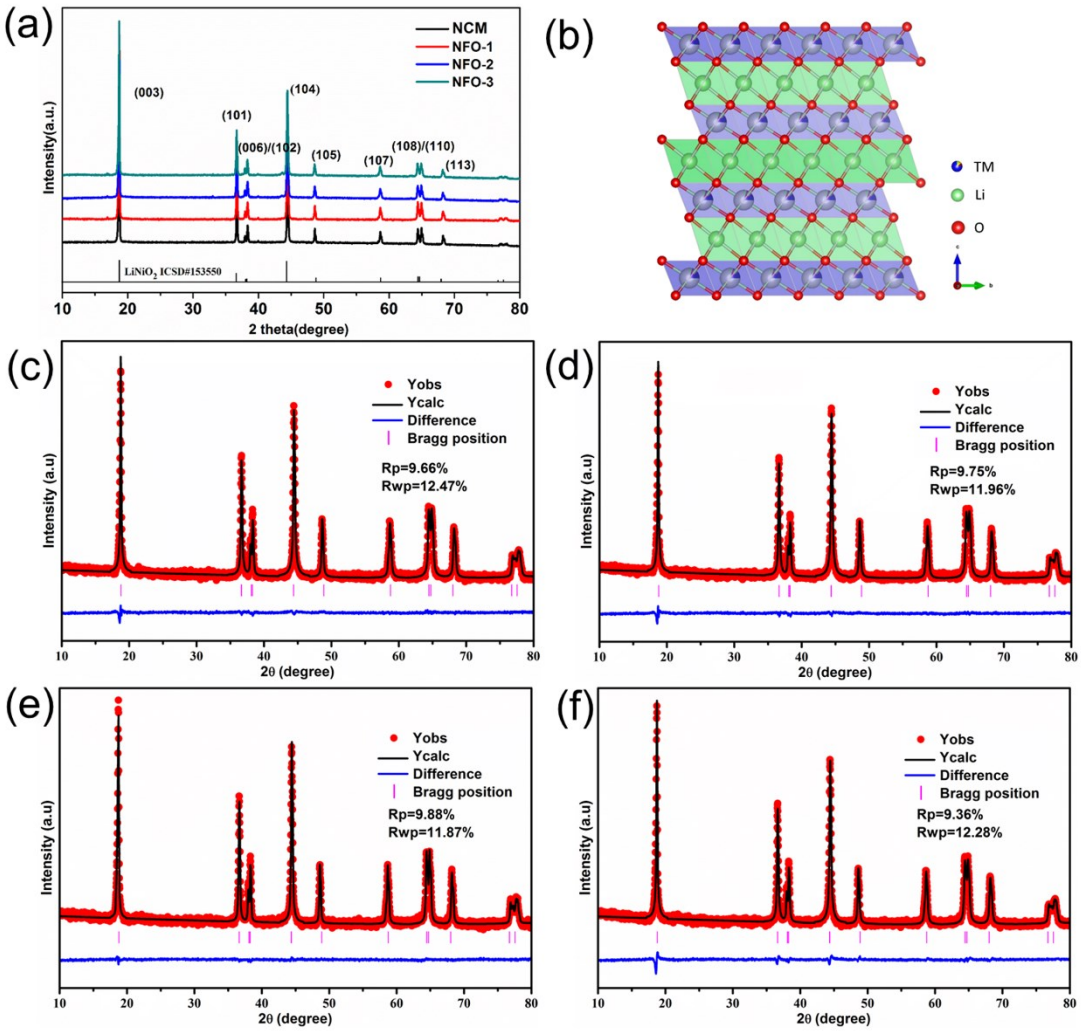

Figure S1. (a) XRD patterns of NCM and all modified samples; (b) The crystal structure diagram of NCM; Rietveld refinement plot of (c) NCM, (d) NFO-1, (e) NFO-2 and (f) NFO-3, respectively.

Table S1. Crystal structural parameters of NCM, NFO-1, NFO-2 and NFO-3, respectively.

Samples	a(Å)	c(Å)	volume(Å^3)	c/a	Rp(%)	Rwp(%)
NCM	2.8717	14.1997	101.4156	4.9447	9.66	12.47
NFO-1	2.8724	14.2011	101.4696	4.9440	9.75	11.96
NFO-2	2.8742	14.2024	101.6056	4.9413	9.88	11.87
NFO-3	2.8736	14.1973	101.5306	4.9405	9.36	12.28

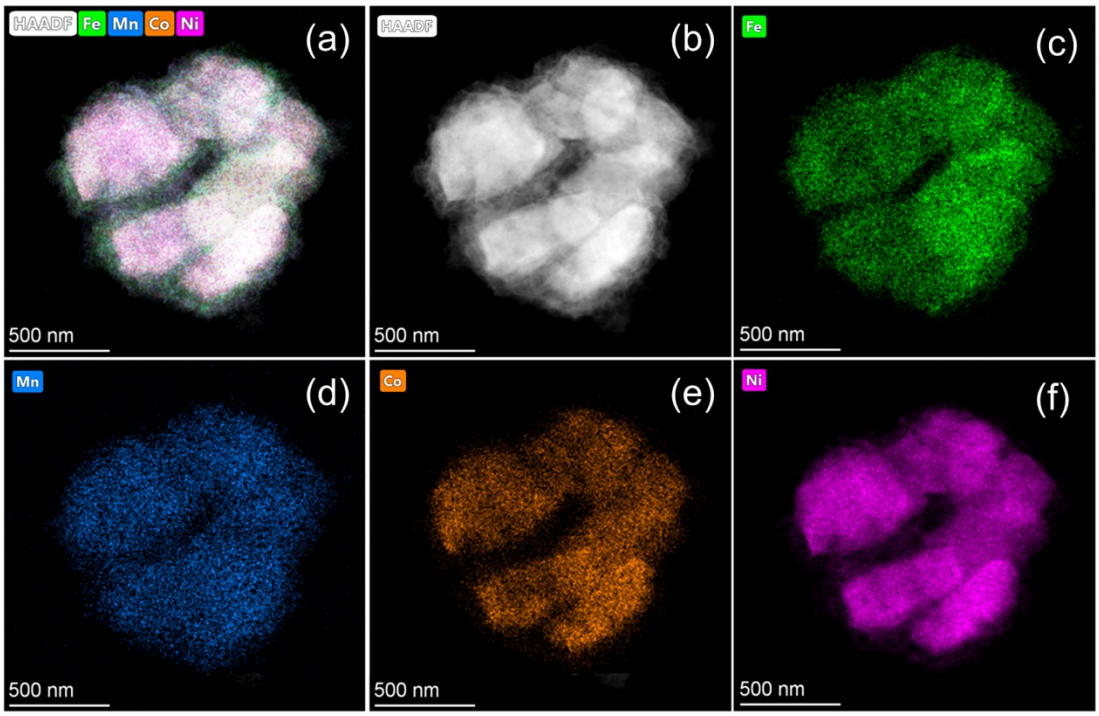

Figure S2. STEM-EDS mapping results for NFO-2 samples, corresponding to the detected elements (c) Fe, (d) Mn, (e) Co, and (f) Ni elements.

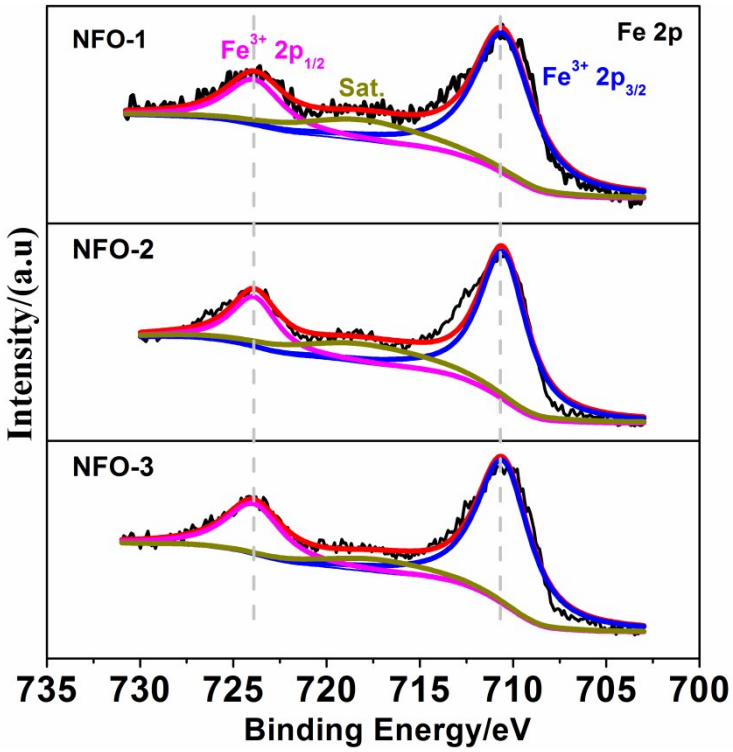

Figure S3. XPS spectra of Fe 2p of NFO-1, NFO-2 and NFO-3, respectively.

Table S2 PH value and residual lithium content of NCM, NFO-1, NFO-2 and NFO-3, respectively.

Samples	PH	Residual lithium (ppm)
NCM	11.48	2176.3
NFO-1	11.35	1588.9
NFO-2	11.26	1476.2
NFO-3	11.21	1395.2

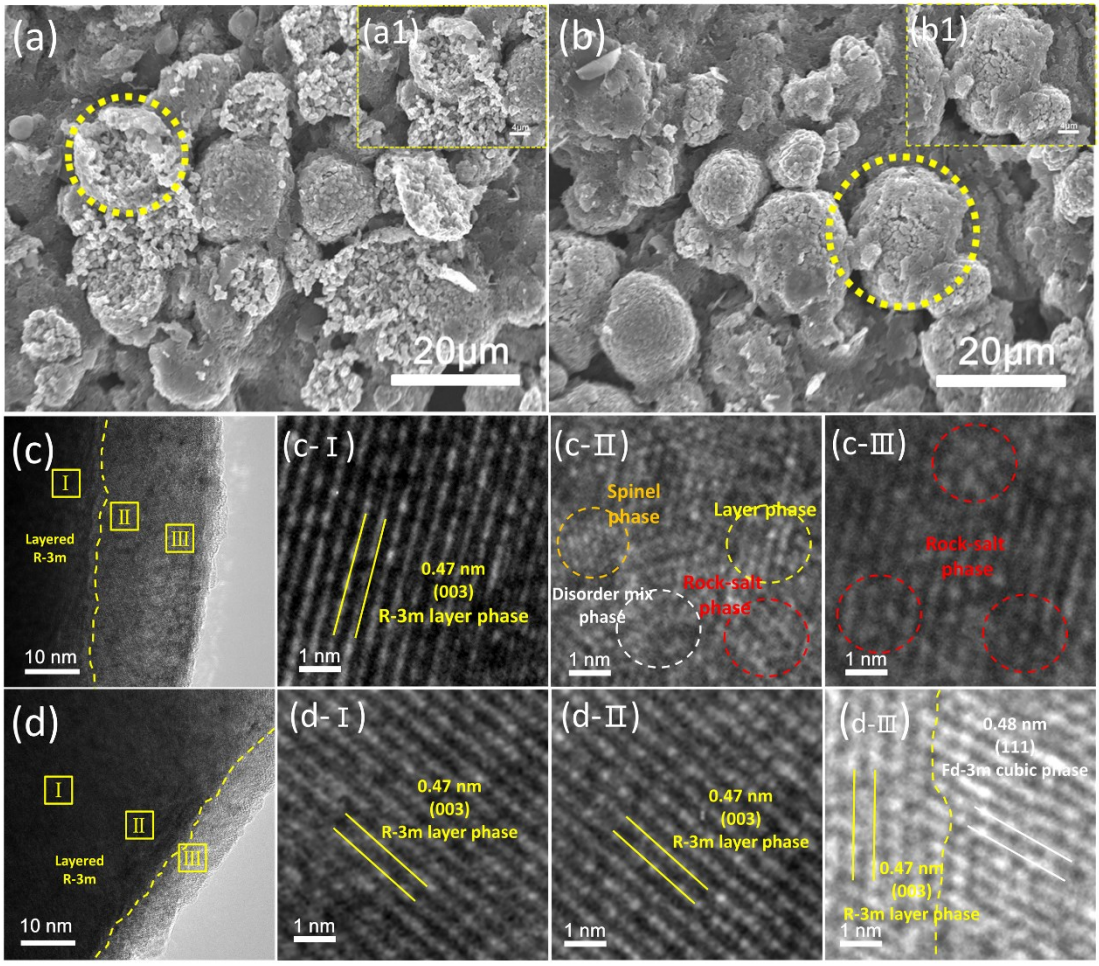

Figure S4. The SEM and HR-TEM of (a, c) NCM and (b, d) NFO-2 after 250 cycles.

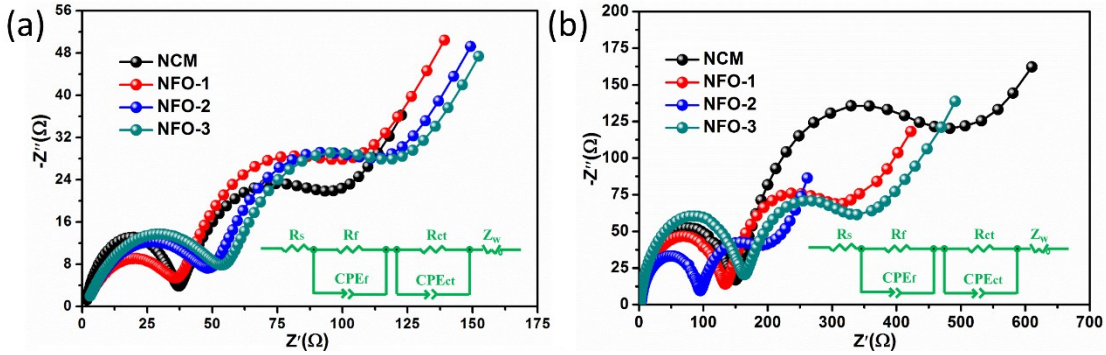

Figure S5. Impedance spectra of NCM and modified samples at 4.4 V during the charging process after (a) 1st and (b) 250th cycles. The insert shows the corresponding equivalent circuit of the fitting.

Table S3. EIS fitting data of NCM and all $NiFe_2O_4$ modified samples.

samples	Initial cycle		After 250 cycles	
	Interfacial Resistance			
	R_f/Ω	R_{ct}/Ω	R_f/Ω	R_{ct}/Ω
NCM	36.3	53.9	342.2	141
NFO-1	36.4	54	184	127.7
NFO-2	51.9	49.7	94.1	89.0
NFO-3	54.7	51.1	152.9	198.6

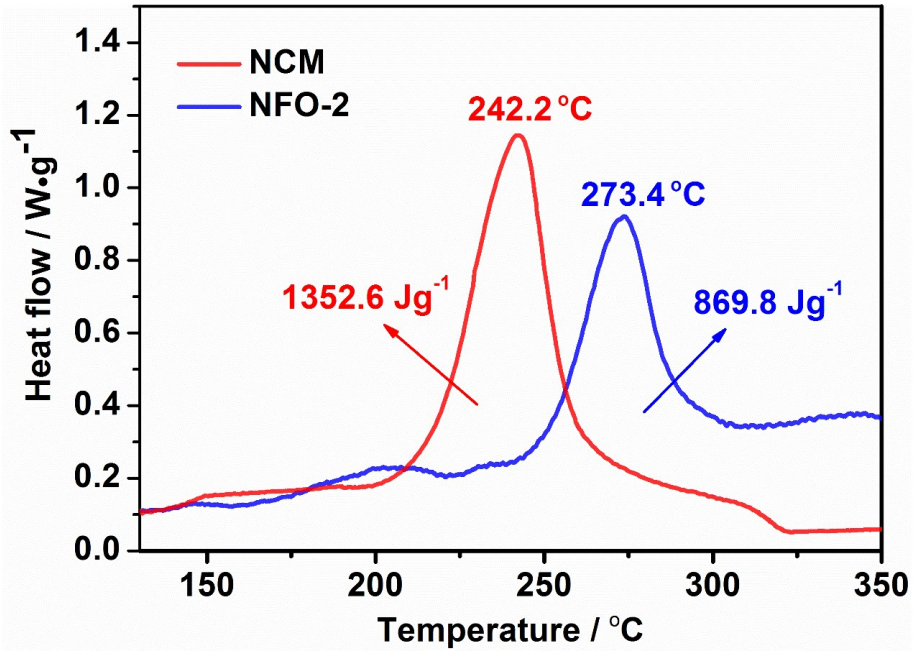

Figure S6. DSC profiles of NCM and NFO-2 cathodes at charged state to 4.4 V.

Table S4. The electronic conductivity of NCM and NFO coating samples.

Samples	Electrical conductivity (S/cm-1)
NCM	2.04×10-4
NFO-1	2.56×10-4
NFO-3	3.43×10-4
NFO-3	1.95×10-4

Table S5. The electrochemical properties of our work and other literatures about NCMs.

Rate properties / mAh•g^{-1}		Capacity retention rate / %		References
5C	10C	100th	200th	
161.1	/	/	81.2	S1
177.1	/	90	/	S2
120.5	/	/	80.38	S3
161.5	125.0	88	/	S4
148.0	135.2	/	85.8	S5
165.0	143.5	91.6	/	S6
158.5	137.06	/	89.43	S7
147.5	107.1	87.3%	/	S8
131.02	/	76.07%	/	S9
177.3	140.56	97.8	90.75	Our work

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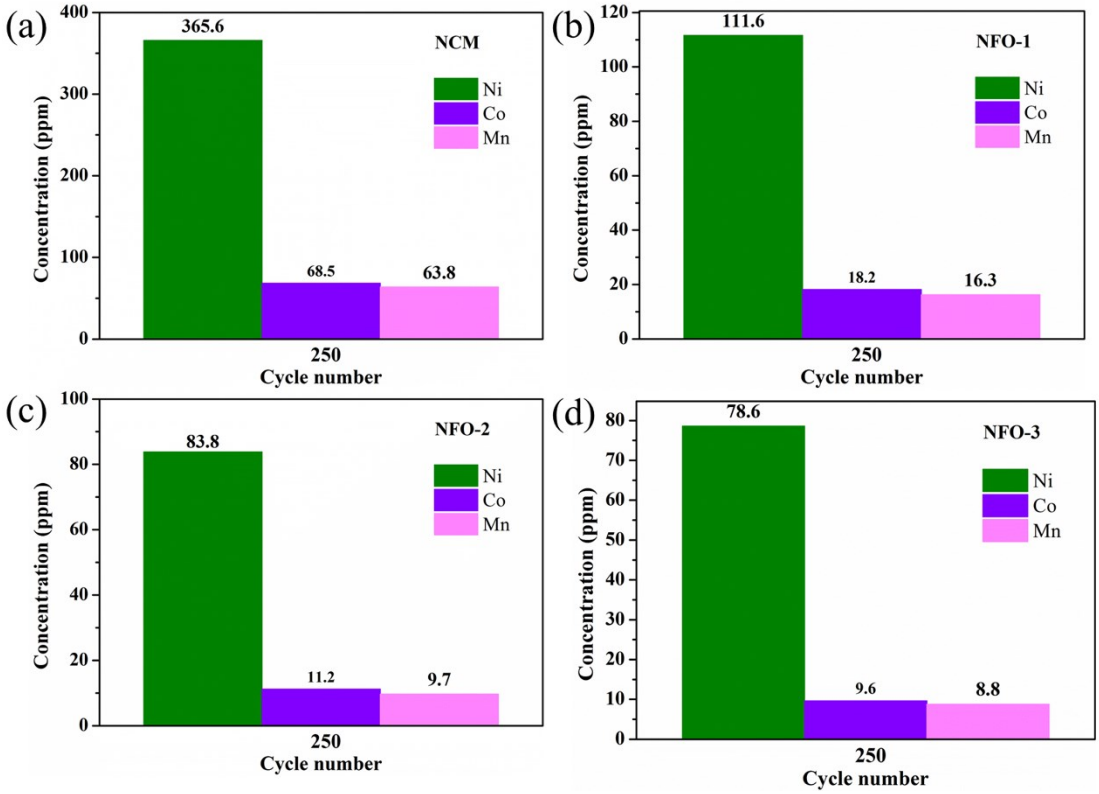

Figure S7. The ICP-OES quantification results for dissolved transition metal

component after 250 cycles of (a) NCM and (b-d) NFO-coated samples.