High-performance full sodium cells based on MgO-treated P2-type $Na_{0.67}(Mn_{0.5}Fe_{0.5})_{1-x}Co_xO_2$ cathodes

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Citation: To be added by editorial staff during production.

Academic Editor: Firstname Lastname

Received: date
Revised: date
Accepted: date
Published: date

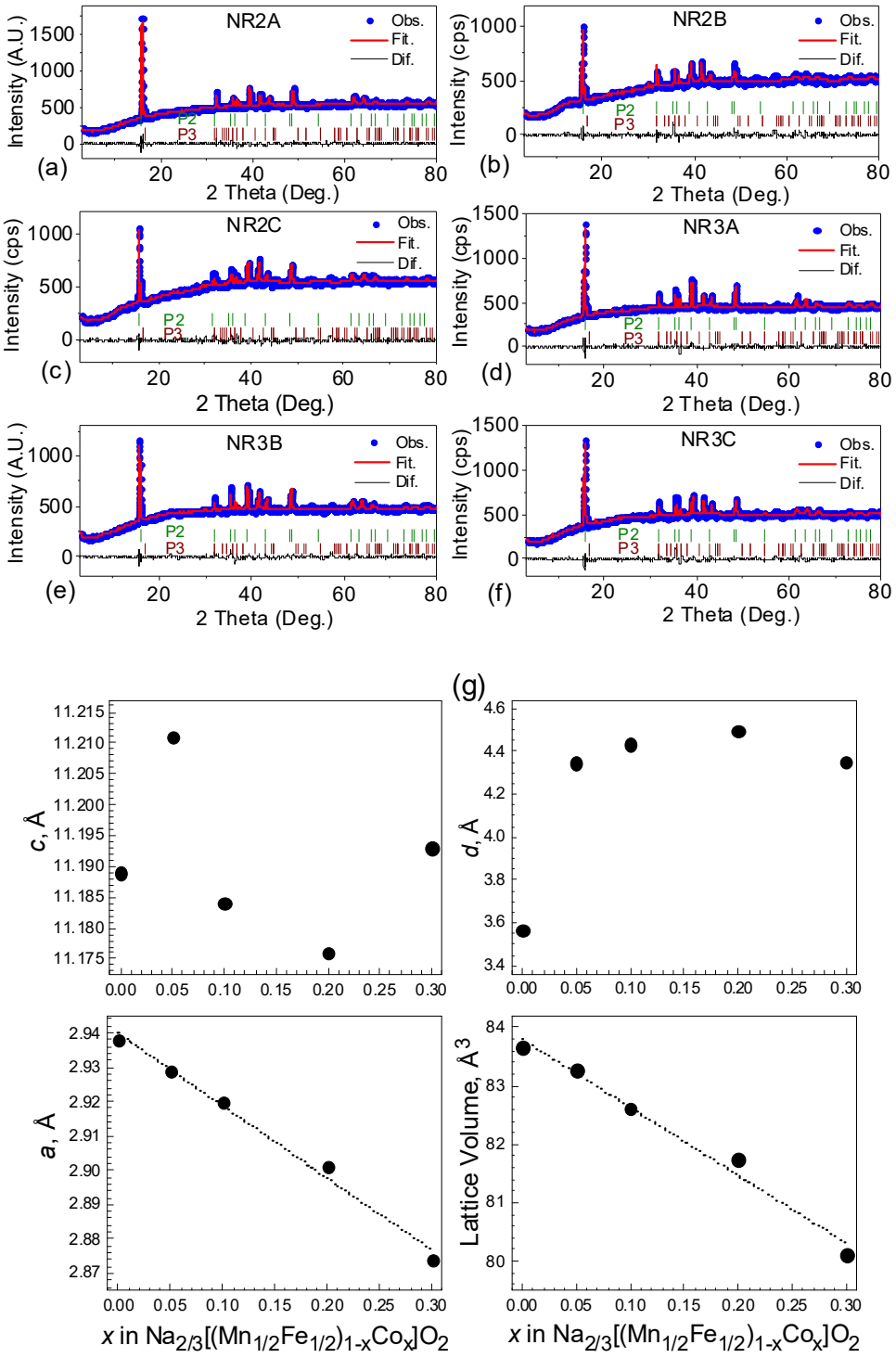


Figure S1: Rietveld-refined x-ray diffraction patterns (a) NR2A, (b) NR2B, (c) NR2C and (d)NR3A, (e)NR3B (f) NR3C, (g) the dependence of the lattice parameters (a, c, and volume) and the interlayer distance (denoted as *d*) of the P2-oxides on the Co content

Table S1. The calculated lattice parameters, Na-layer distance, and weighted R (wR%) factor for Co-doped and MgO-treated oxides.

Sample Code	Phase	a (Å)	b (Å)	c (Å)	V(Å^3)	Na layer dist.(Å)	Phase Ratio %	wR %
P2 struc. [32]	P2	2.878		11.163		3.635	-	-
P3 struc.*	P3	5.63	2.86	5.77	85.58		-	-
NR-0	P2	2.938 (±3)		11.189 (±2)	83.66 (±21)	3.567	-	2.85
NR-1	P2	2.929 (±3)		11.211 (±1)	83.27 (±18)	4.345	99.87	2.76
	P3	2.862 (±2)	5.631 (±2)	5.779 (±4)	85.85 (±14)		0.13	
NR-2	P2	2.920 (± 3)		11.184 (±2)	82.61 (±21)	4.434	99.56	3.15
	P3	2.863 (±2)	5.633 (±1)	5.781 (±3)	86.06 (±15)		0.44	
NR-2A	P2	2.917 (±3)		11.210 (±1)	82.61 (±17)	4.438	98.15	2.58
	P3	2.871 (±4)	5.623 (±2)	5.791 (±4)	86.13 (±21)		1.85	
NR-2B	P2	2.914 (±3)		11.184 (±2)	82.28 (±20)	4.367	97.73	2.38
	P3	2.862 (±4)	5.643 (±3)	5.811 (±2)	86.61 (±23)		2.27	
NR-2C	P2	2.901 (±4)		11.208 (±2)	82.18 (±27)	4.296	98.36	2.59
	P3	2.871 (±2)	5.633 (±1)	5.821 (±4)	87.23 (±26)		1.64	
NR-3	P2	2.906 (±4)		11.176 (±2)	81.74 (±22)	4.497	99.35	2.73
	P3	2.841 (±2)	5.613 (±3)	5.831 (±4)	85.66 (±21)		0.65	
NR-3A	P2	2.899 (±5)		11.166 (±3)	81.29 (±32)	4.317	97.98	3.23
	P3	2.851 (±3)	5.633 (±2)	5.851 (±3)	83.81 (±22)		2.02	
NR-3B	P2	2.888 (±0.5)		11.253 (±4)	81.28 (±32)	4.432	98.44	2.71
	P3	2.858 (±1)	5.643 (±4)	5.891 (±3)	83.18 (±26)		1.56	
NR-3C	P2	2.889 (±5)		11.208 (±3	81.02 (±29)	4.291	96.53	2.49
	P3	2.866 (±2)	5.666 (±4)	5.874 (±2)	85.07 (±21)		3.47	
NR-4	P2	2.874 (±3)		11.193 (±7)	80.11 (±10)	4.349	98.93	2.84
	P3	2.886 (±4)	5.686 (±4)	5.844 (±4)	88.34 (±16)		1.07	

*

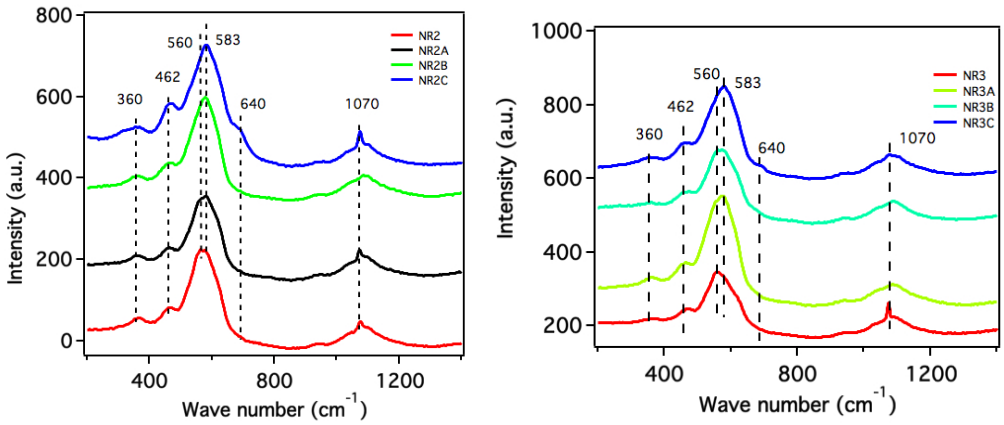
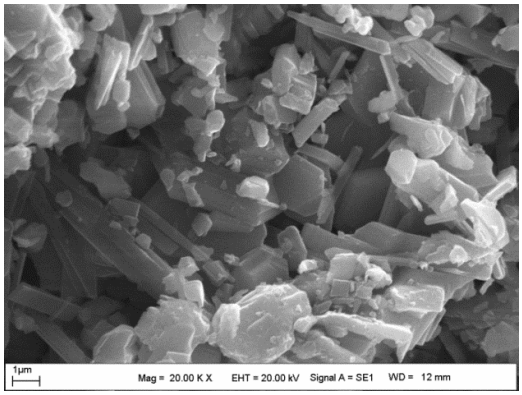
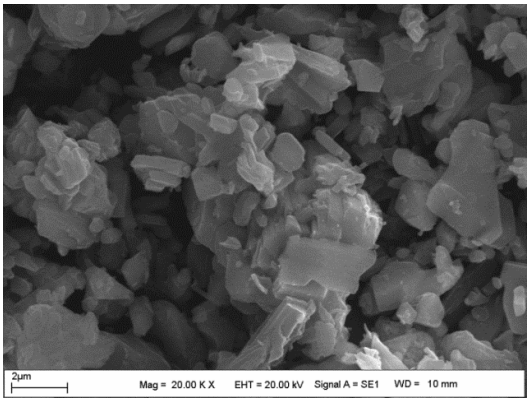


Figure S2. Raman Spectrum of the sample produced.



(a)



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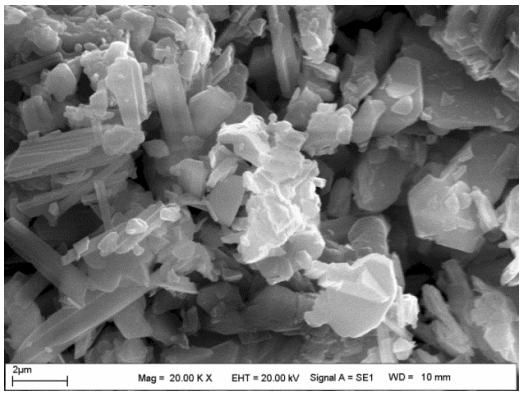

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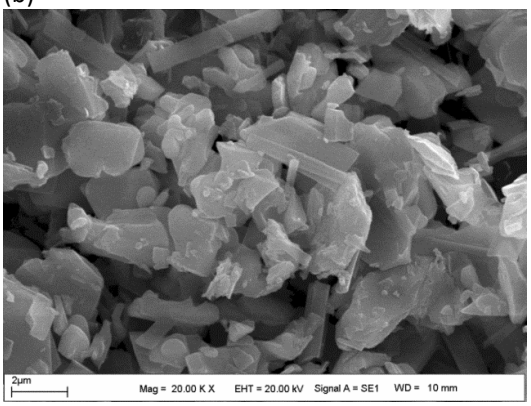

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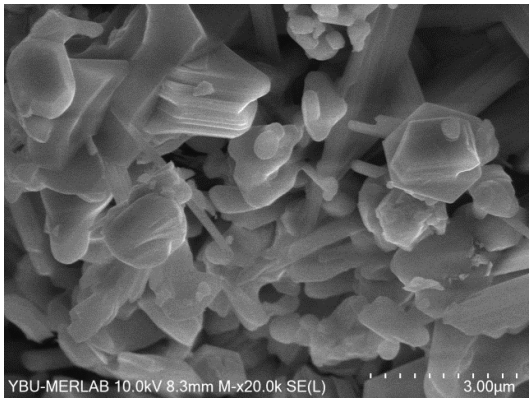
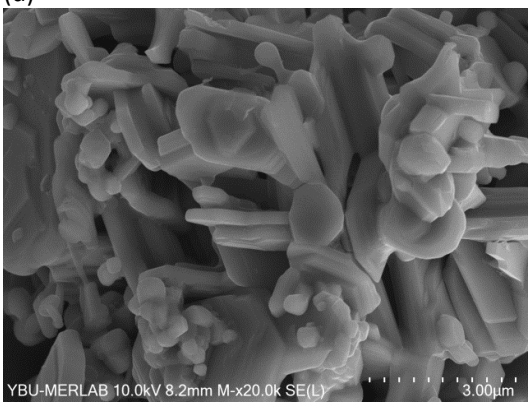


(e)



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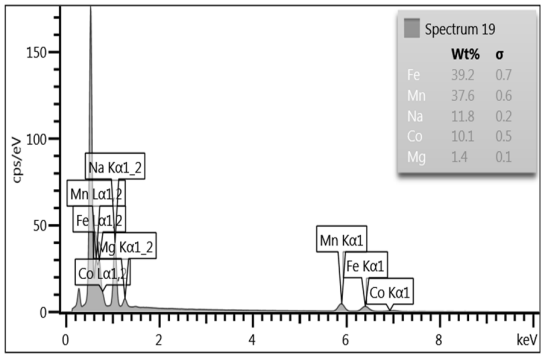
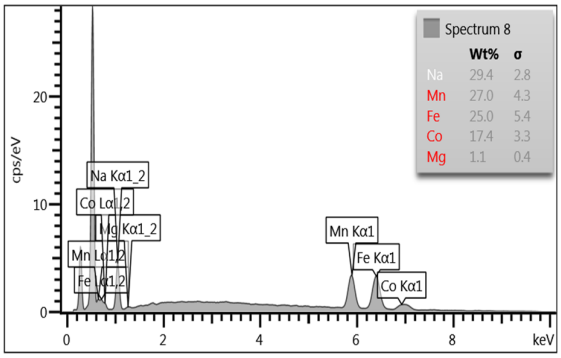


(g)



(h)

Figure S3. SEM images of (a) NR1, (b) NR2, (c) NR3, (d) NR4, (e)NR2B (f)NR3A, and EDX data of (g) NR2B and NR3A

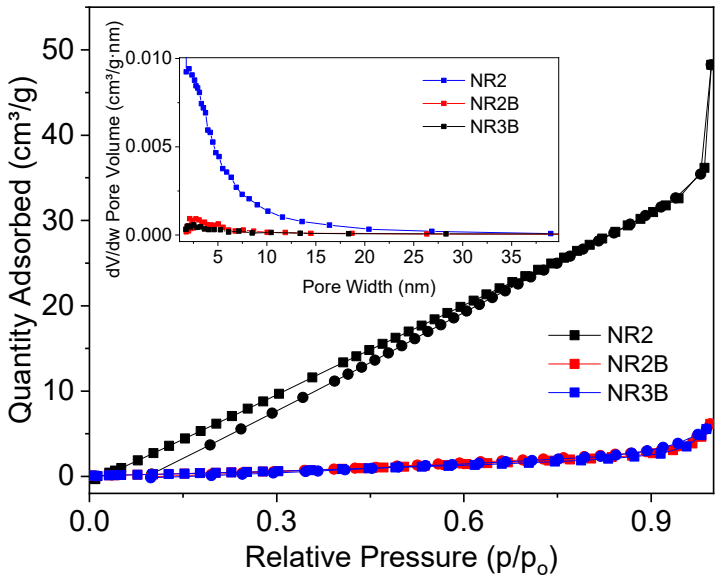


Figure S4. BET analysis results of NR2, NR2B and NR3B

Table S2. BET data of NR2, NR2B and NR3B

Sample	BET surface area, m^2/g
NR2	32.0
NR2B	2.4
NR3B	2.1

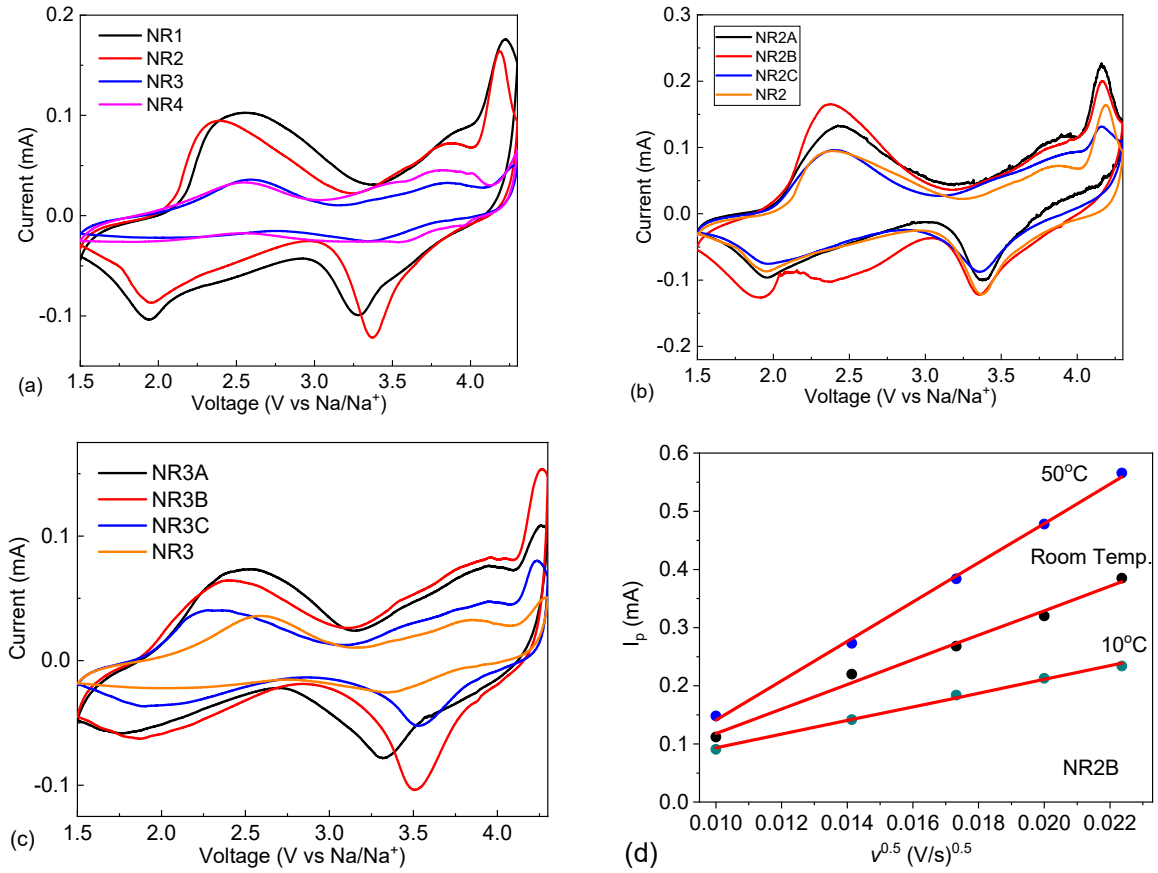


Figure S5. CV graphs of (a) NR0, NR1, NR2, NR3 and NR4, (b) NR2, NR2A, NR2B and NR2C and (c) NR3, NR3A, NR3B and NR3C

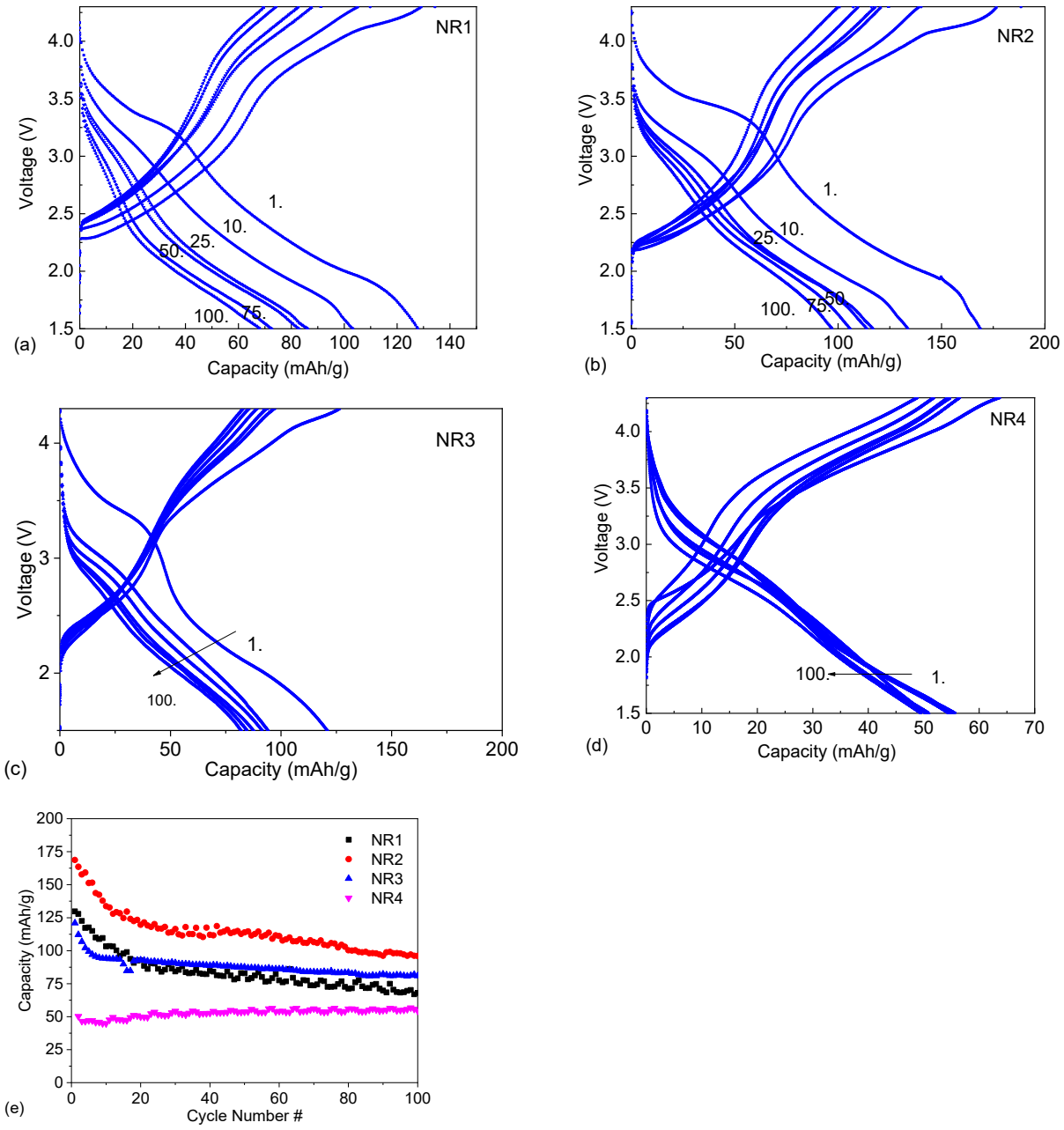


Figure S6. Charge-discharge curves for (a) NR1, (b) NR2, (c) NR3, (d) NR4 and (e) their cycling stability.

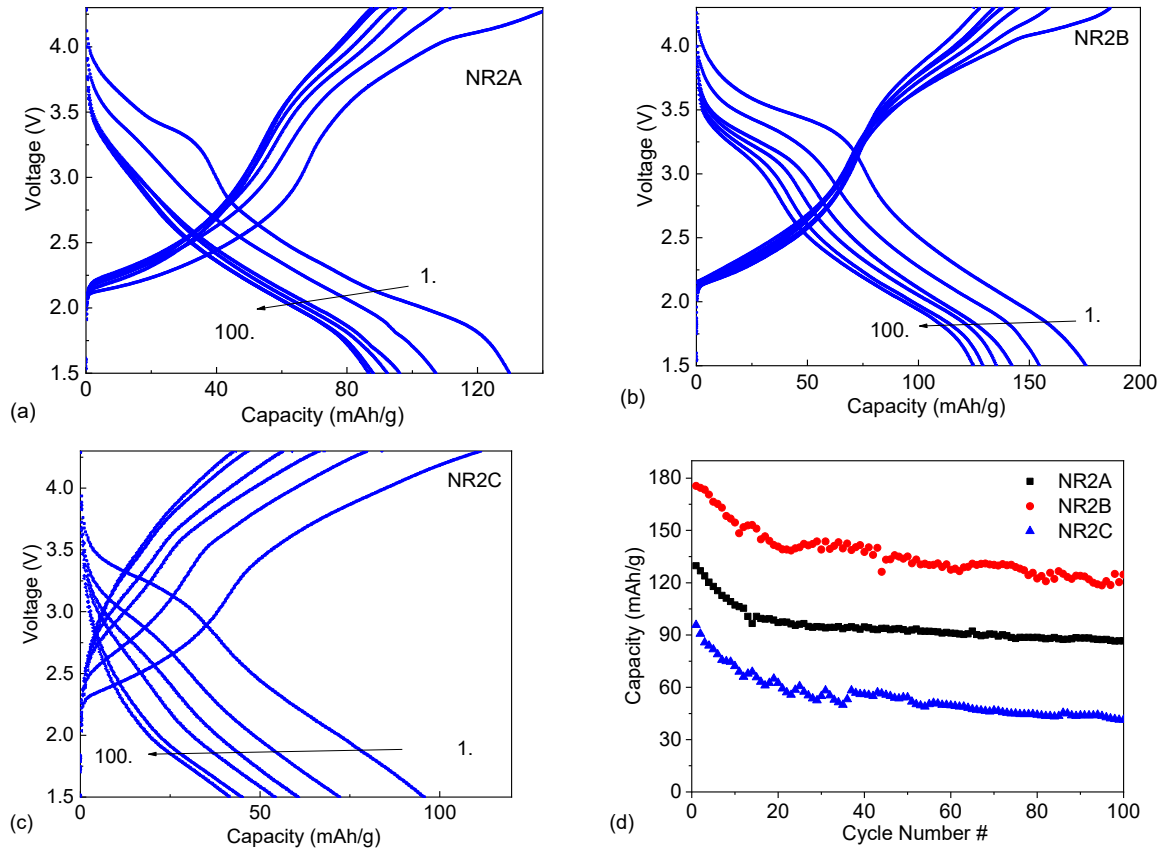
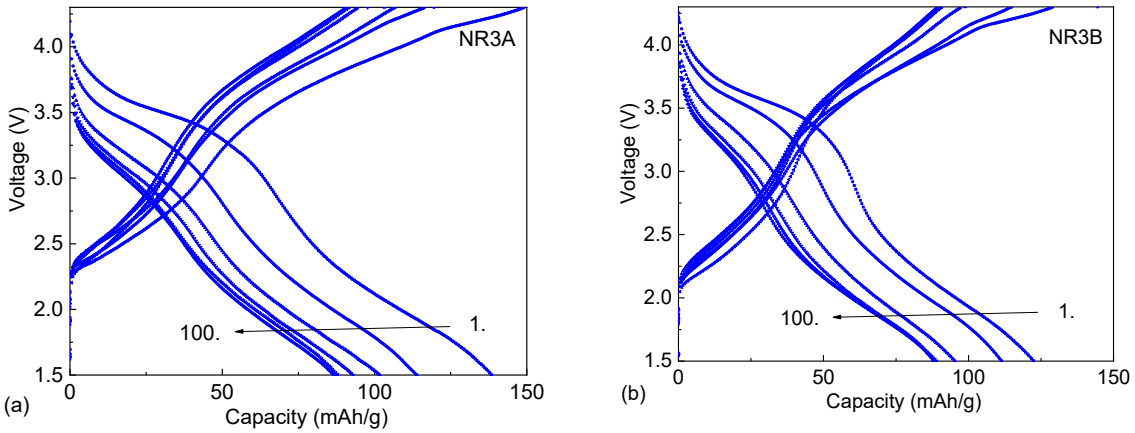


Figure S7. Charge-discharge curves for (a) NR2A, (b) NR2B, (c) NR2C, and their (d) cycling stability.



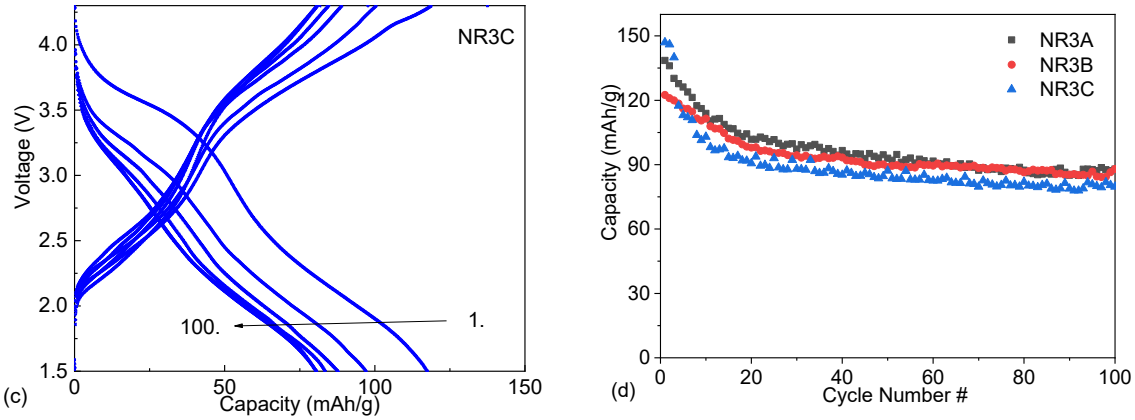
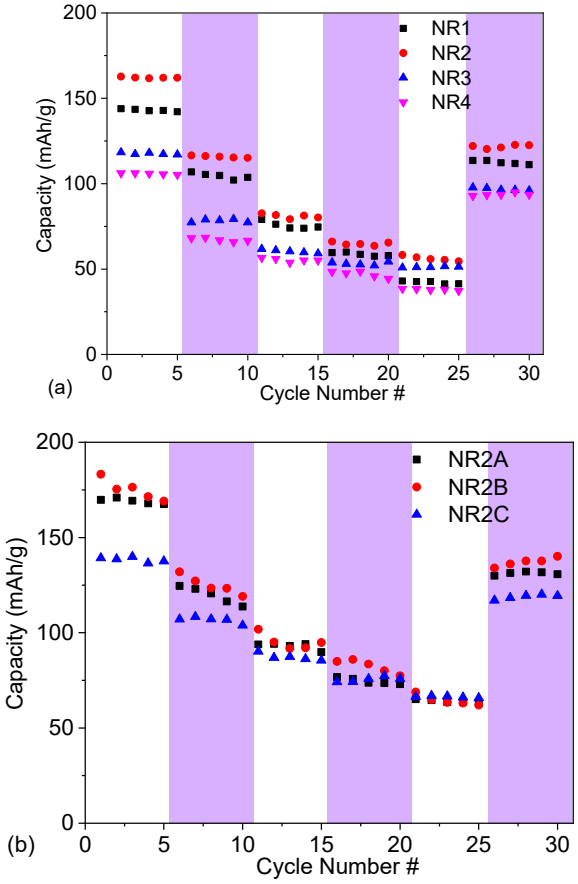


Figure S8. Charge-discharge curves for (a) NR3A, (b) NR3B, (c) NR3C, and their (d) cycling stability.



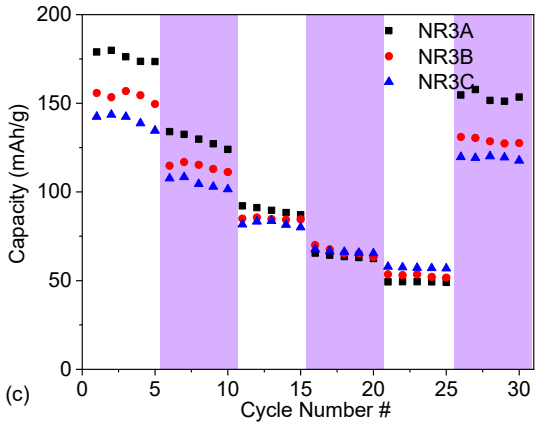


Figure S9. C-rate graphs of (a) NR0, NR1, NR2, NR3 and NR4, (b) NR2, NR2A, NR2B and NR2C and (c) NR3, NR3A, NR3B and NR3C for 10-40-80-120-150-10 mA/g current rate respectively.

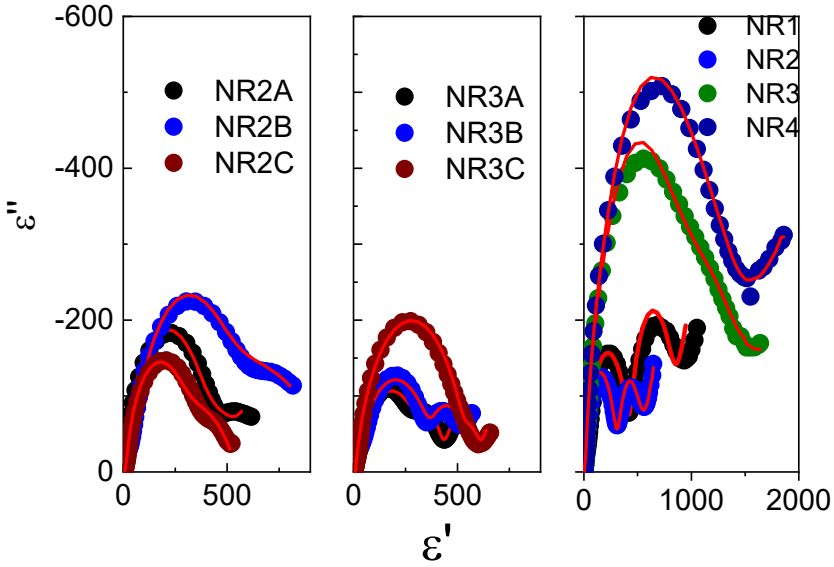


Figure S10. EIS graphs of the cells.

Table S3: EIS fitting parameters of the cells. $Q=\frac{1}{Q_y}\frac{1}{s^{Q_a}}$

Parameters	Rs	Rc	C x 10^{-3}	Rq	Qy	Qs	W
NR1	7.32	343	1.76	419	1.16 10^{-5}	0.803	1.57 10^{-2}
Nr2	7.85	1902	1.58	298	1.57 10^{-5}	0.903	1.89 10^{-2}
NR3	5.28	562	1.68	937	26.7 10^{-5}	0.567	1.59 10^{-2}
NR4	4.28	1150	1.47 10^{-3}	1800	8.84 10^{-5}	0.639	1.94 10^{-3}
NR2A	5.46	3010	6.49 10^{-6}	2350	0.51 10^{-5}	0.560	9.451 0^{-3}
NR2B	7.09	2970	1.52 10^{-5}	7250	0.43410^{-5}	0.434	4.39 10^{-3}
NR2C	6.49	2050	9.71 10^{-6}	3340	0.498 10^{-5}	0.527	5.18 10^{-3}
NR3A	5.92	84	0.883	323	4.54 10^{-5}	0.716	2.07 10^{-2}
NR3B	8.25	109	2.3	372	4.51 10^{-5}	0.718	1.93 10^{-2}
NR3C	8.72	50.7	3.65	530	2.15 10^{-5}	0.813	2.55 10^{-2}

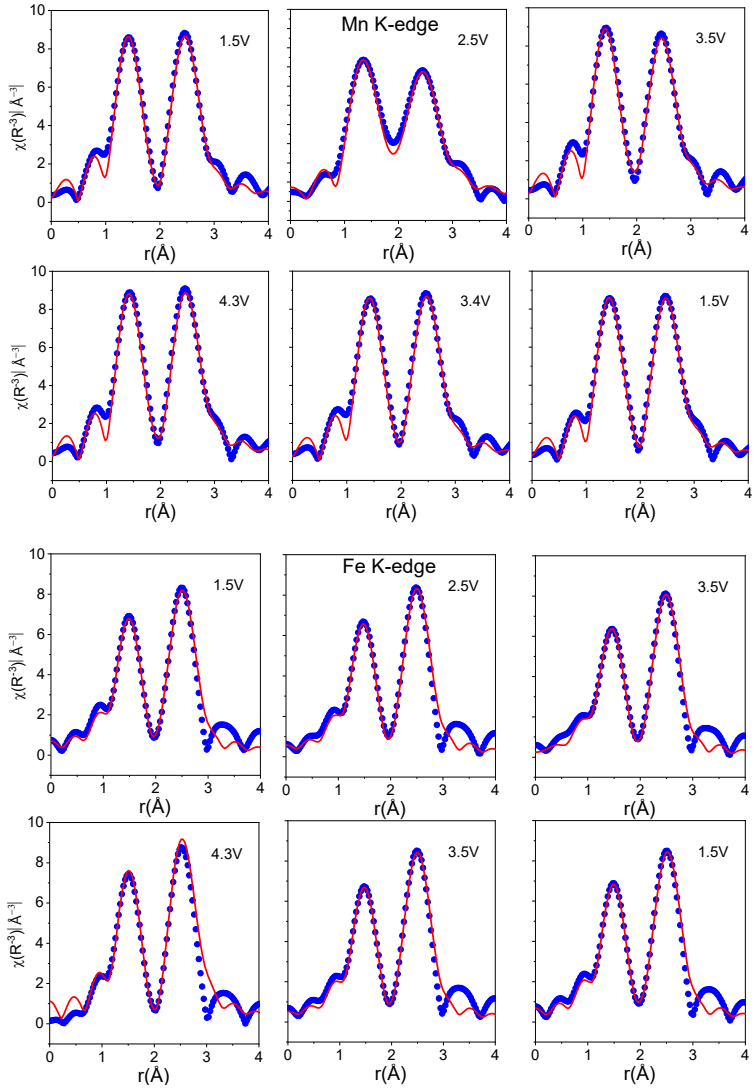


Figure S11. Artemis fitting of NR2B cells for Mn and Fe k edge for different voltage values