

## Supplementary Information

# Insight on capacity fading and failure mechanism of O3-NaNi<sub>1/3</sub>Fe<sub>1/3</sub>Mn<sub>1/3</sub>O<sub>2</sub> layered oxide cathode material for sodium ion battery

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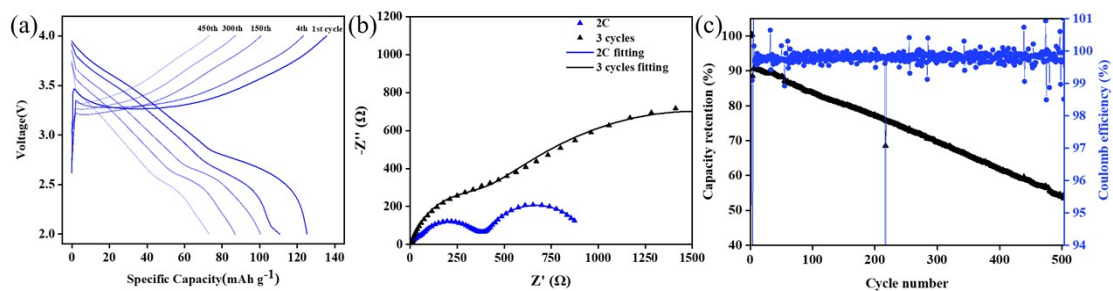


Fig. S1. Electrochemical characterization of NFM333 half-cell. (a) Charge-discharge curves of the 1st, 4th, 150th, 300th and 450th cycles; (b) Nyquist plots and fitting curves after 3 pre-cycles and 500 cycles at 2 C; (c) Capacity retention and Coulombic efficiency.

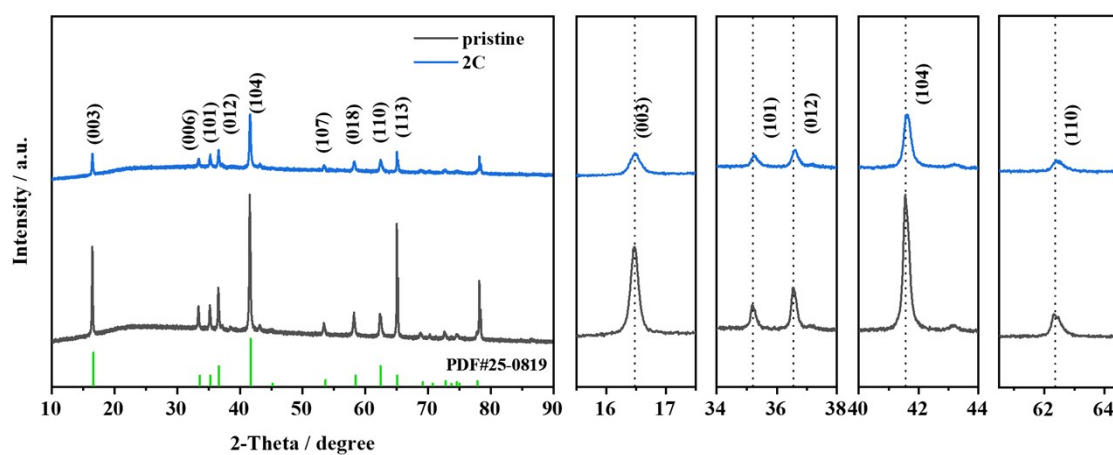


Fig. S2. XRD spectra and partial enlargements of the NFM333 cathode of the original and after 500 cycles at 2C.

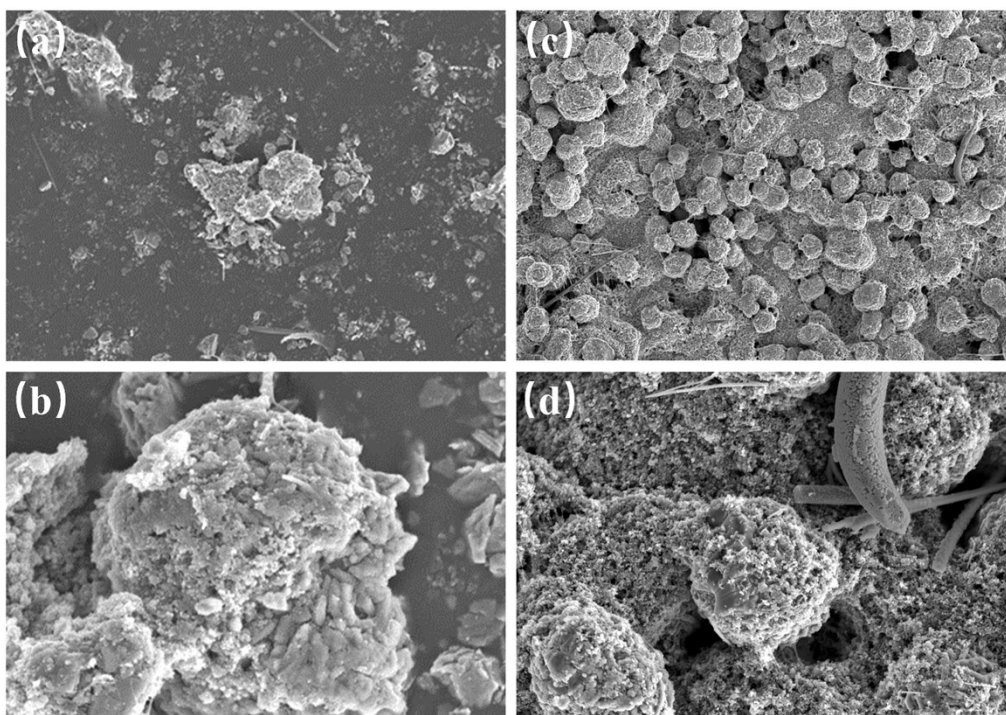


Fig. S3. SEM images of the 2C-cycled cathode (a-b) particles and (c-d) sheet.

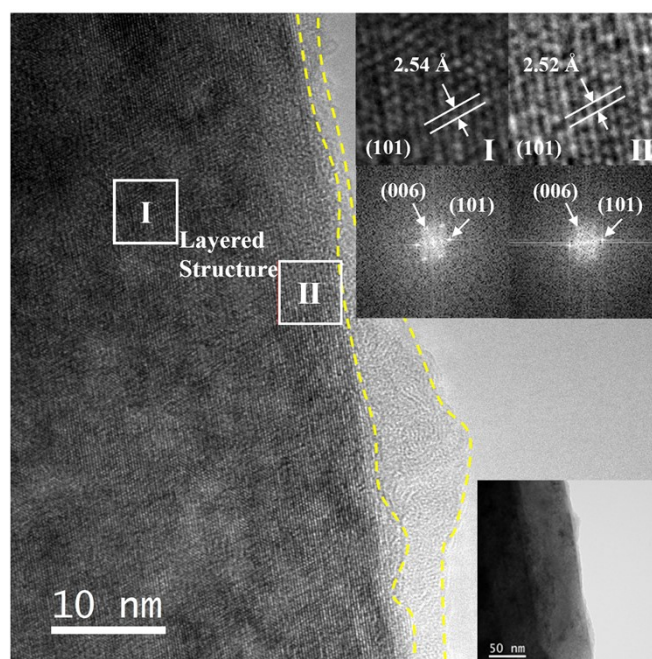


Fig. S4. Microcrystalline TEM image and its SAED pattern of 2C-cycled NFM333 cathode.

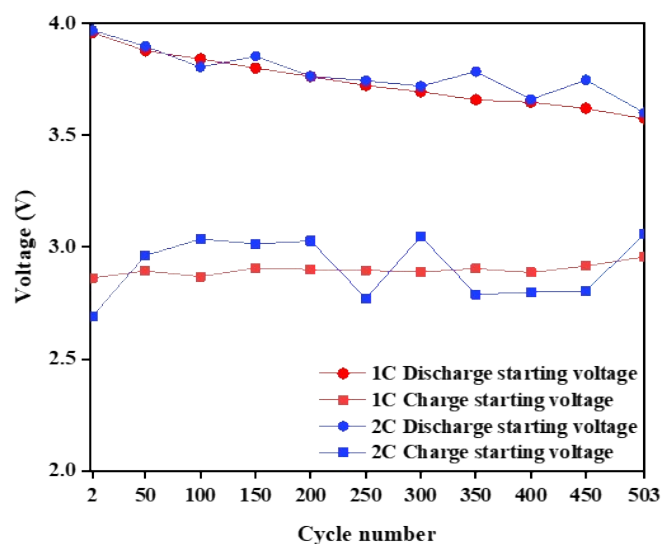


Fig. S5. Charging and discharging starting voltages of 1C and 2C batteries at different cycle number.

Table S1. Impedance fitting results of NFM333 after pre-cycling and 500 cycles at different current densities.

C-rate	$R_b$ ( $\Omega$ )	$R_f$ ( $\Omega$ )	$R_{ct}$ ( $\Omega$ )
0.5C 3 cycles	3.91	250.4	2493
1C	7.77	476.8	1071
2C	3.68	333.4	586

Table S2. Calibrated dissolution content of transition metal ions in cathode materials under different current densities.

C-rate	Correction concentration (ppb)		
	Ni	Fe	Mn
1C	70.14	245.75	$\approx 0$
2C	12.91	169.68	$\approx 0$