

Supporting Information

Effect of titanium-copper co-substitution in O3-Type layered oxide cathodes on the electrochemical performances of Sodium-Ion batteries

Hefang Fan[#], Haikong Jin[#], Mingfang Ma, Haifeng Chen, Run Ma, De Yan*

School of Materials & Energy, Lanzhou University, Lanzhou 730000, P. R. China

[#]These authors contributed equally to this work and should be considered co-first authors.

*Corresponding author, E-mail: yand@lzu.edu.cn (De Yan)

Table S1. Summary of refined structural parameters of NNM, NNMT-0.15 and NNCMT-0.03.

Sample	O3: NiO	a/Å	c/Å	R _{wp} /%	χ^2
NNM	95.4%: 4.6%	2.9581	16.0172	6.226	5.31
NNMT-0.15	96.4%: 3.6%	2.9752	16.0358	4.742	4.23
NNCMT-0.03	99.5%: 0.5%	2.9813	16.0436	4.769	4.35

Table S2. ICP-OES result of NaNi_{0.5}Mn_{0.5}O₂ (NNM), NaNi_{0.5}Mn_{0.35}Ti_{0.15}O₂ (NNMT-0.15) and NaNi_{0.47}Cu_{0.03}Mn_{0.35}Ti_{0.15}O₂ (NNCMT-0.03).

Sample	Na	Ni	Cu	Mn	Ti
NaNi _{0.5} Mn _{0.5} O ₂	0.998	0.502	0	0.495	0
NaNi _{0.5} Mn _{0.35} Ti _{0.15} O ₂	0.997	0.503	0	0.351	0.147
NaNi _{0.47} Cu _{0.03} Mn _{0.35} Ti _{0.15} O ₂	0.998	0.469	0.029	0.348	0.151

Table S3. Fitting parameters for the equivalent circuit (R_s and R_{ct}) of three samples (NNCMT-0.03, NNMT-0.15, NNM).

Sample	R _s /Ω	R _{ct} /Ω
NNM	4.924	216.5
NNMT-0.15	4.853	201.2
NNCMT-0.03	3.212	97.8

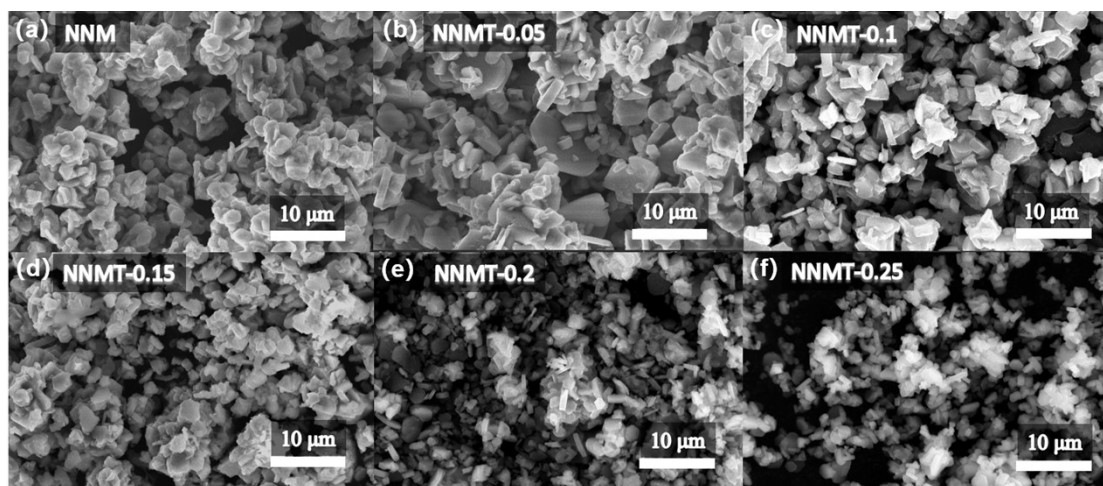


Figure S1. SEM images of a) NNM, b) NNMT-0.05, c) NNMT-0.1, d) NNMT-0.15, e) NNMT-0.2 and f) NNMT-0.25.

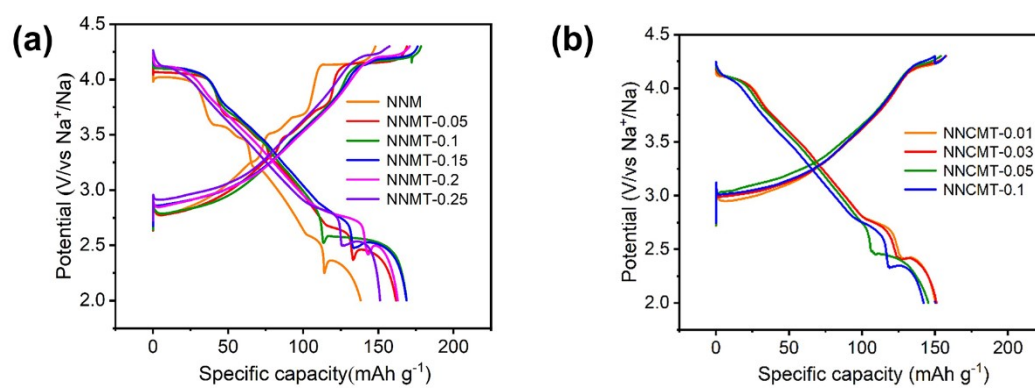


Figure S2. The first GCD cycle curves of a) Ti-substitution cathodes and b) Cu/Ti co-substitution cathodes.

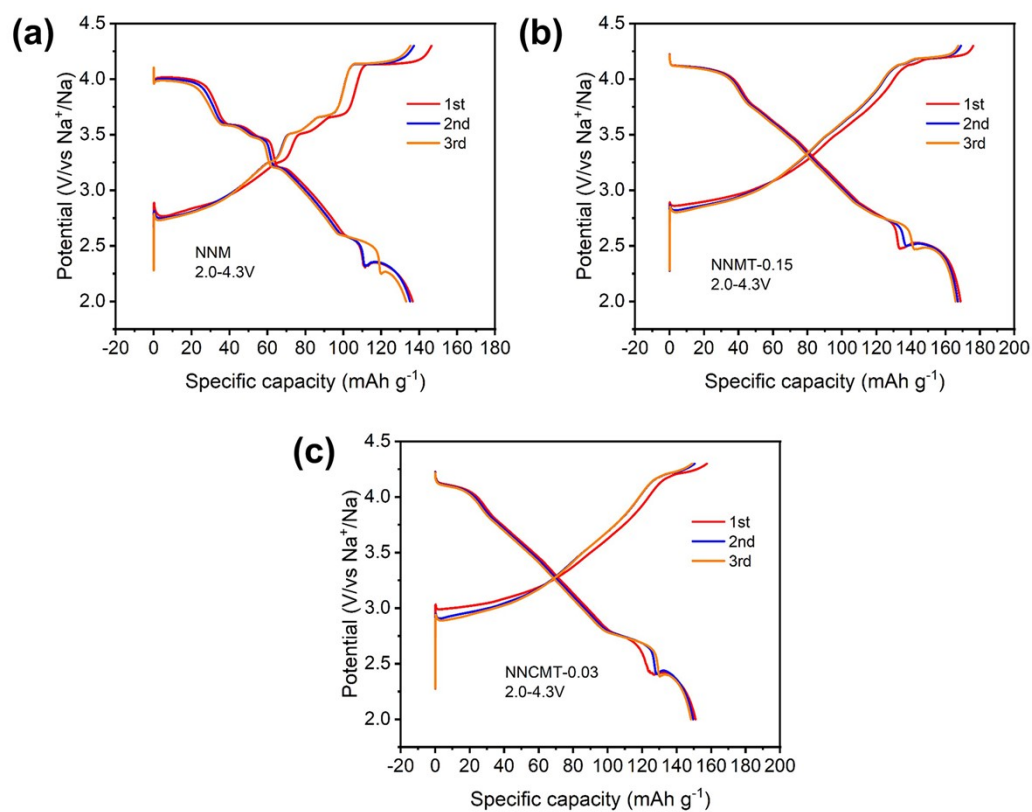


Figure S3. The first three GCD cycle curves of a) NNM, b) NNMT-0.15 and c) NNCMT-0.03.

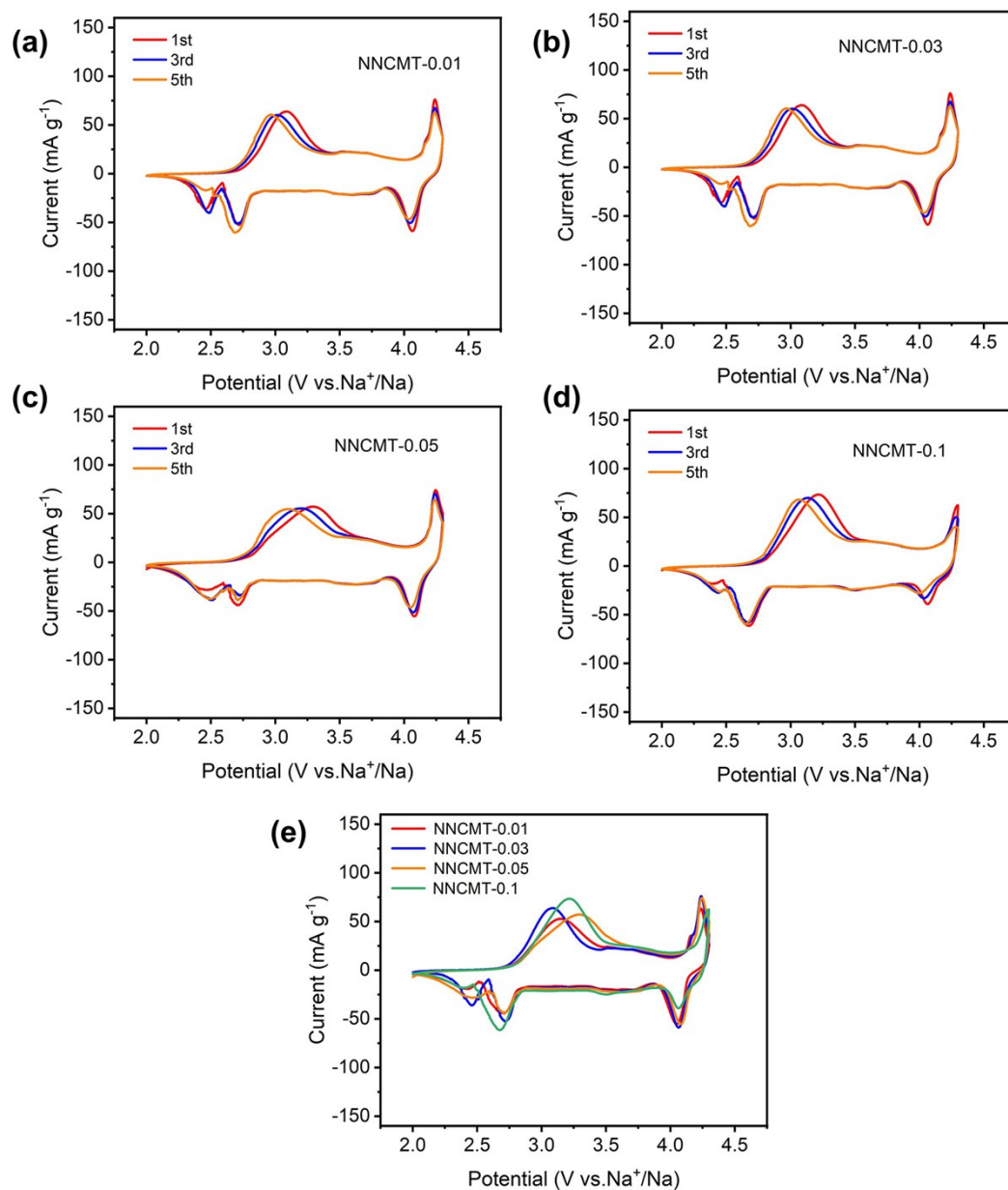


Figure S4. CV curves of a) NNCMT-0.01, b) NNCMT-0.03, c) NNCMT-0.05 and d) NNCMT-0.1 at a scan rate of 0.1 mV s^{-1} in 2.0–4.3 V. e) Comparison of CV of four cathodes in the first cycle.

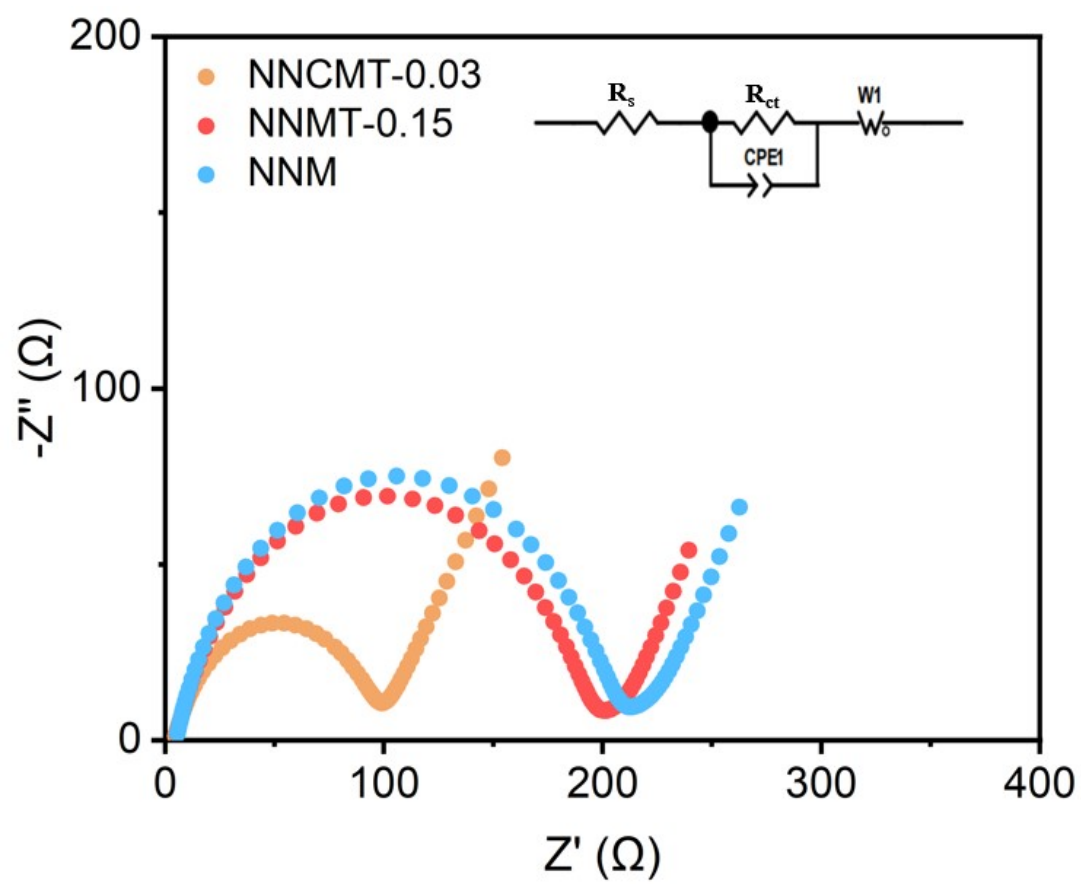


Figure S5. Nyquist plots of NNM, NNMT-0.15 and NNCMT-0.03.