Supporting Information

Electrospun interconnected bead-like P2-$Na_xCo_yMn_{1-y}O_2$ (x=0.66 y=0.1) cathode material for stable sodium-ion storage

Anupriya K. Haridas [1,3], Milan K. Sadan [1,4], Joo-Hyung Kim [1], Younki Lee [1,*] and Jou-Hyeon Ahn [1,2,*]

[1] Department of Materials Engineering and Convergence Technology, Gyeongsang National University, 501 Jinju-daero, Jinju 52828, Republic of Korea

[2] Department of Chemical Engineering, Gyeongsang National University, 501 Jinju-daero, Jinju 52828, Republic of Korea

[3] Department of Engineering, King's College London, London WC2R 2LS, UK

[4] Department of Chemical and Biological Engineering, University of Sheffield, Sheffield S1 3JD, UK

[*] Corresponding author.

E-mail address: jhahn@gnu.ac.kr (J.H. Ahn)

ylee@gnu.ac.kr (Y. Lee)

Figure S1. Digital photograph of electrospun NaCM-*iB* nanofiber mat.

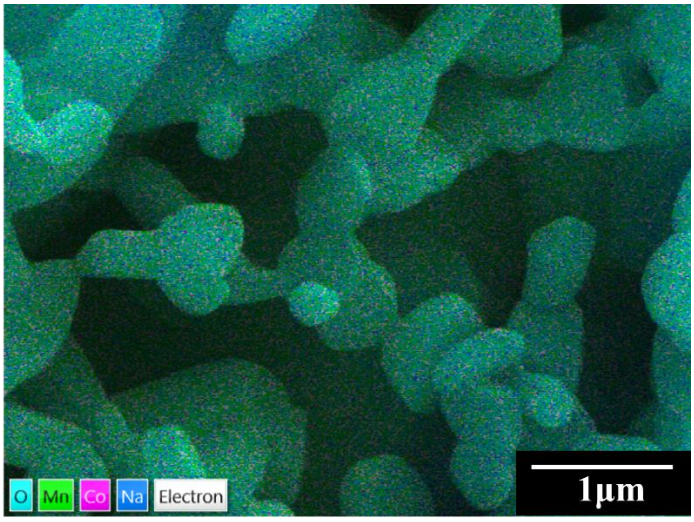

Figure S2. Elemental mapping image of NaCM-*iB* composite indicating the distribution of Na, Co, Mn and O elements.

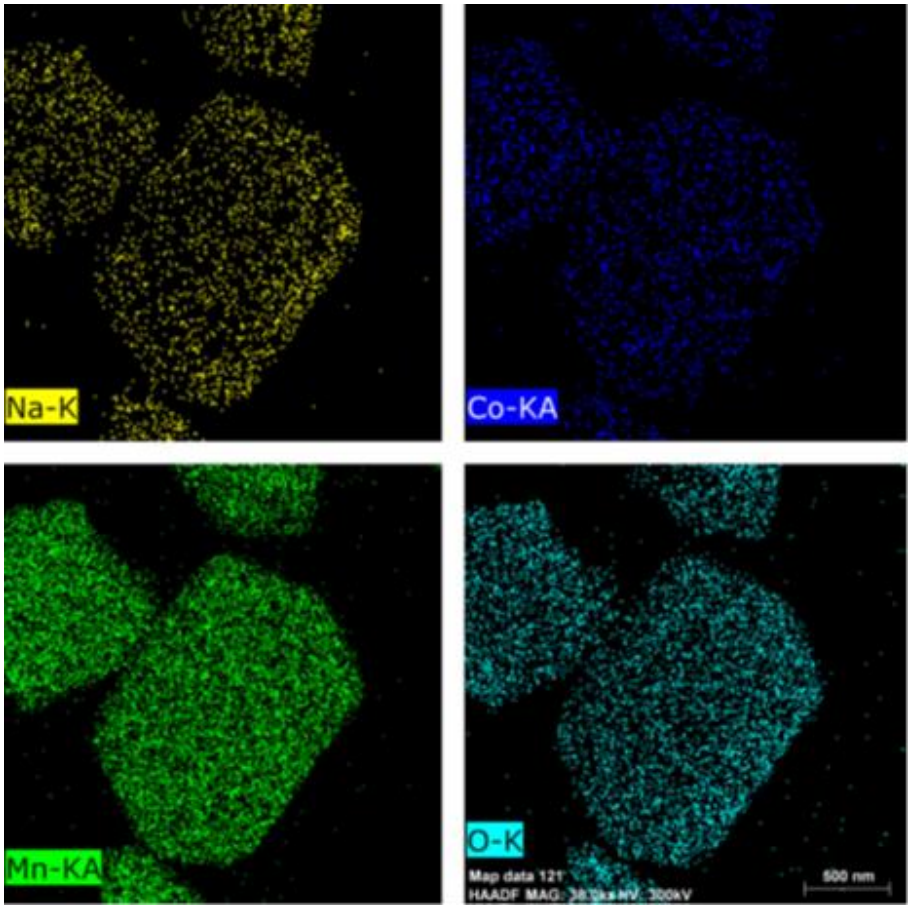

Figure S3. Elemental mapping image of NaCM-*f* composite indicating the distribution of Na, Co, Mn and O elements.

Table S1. Summary of Rietveld refinement of (a) NaCM-*iB* and (b) NaCM-*f* samples.

Atom	Wyckoff position	X	Y	Z
Na1	2b	0	0	1/4
Na2	2d	2/3	1/3	1/4
Mn	2a	0	0	0
Co	2a	0	0	0
O	4f	2/3	1/3	0.913

(a) NaCM-*iB*: Space group=*P63/mmc*, a=b=2.8598 Å, c=10.9687 Å, d=3.8053, R_{wp}=8.7, R_p= 5.3

Atom	Wyckoff position	X	Y	Z
Na1	2b	0	0	1/4
Na2	2d	2/3	1/3	1/4
Mn	2a	0	0	0
Co	2a	0	0	0
O	4f	2/3	1/3	0.912

(b) NaCM-*f*: Space group=*P63/mmc*, a=b=2.8513 Å, c=11.1659 Å, d=3.7379, R_{wp}=13.5, R_p= 9.2

Composite	Na	Co	Mn
NaCM-*iB*	0.658	0.090	0.91
NaCM-*f*	0.651	0.13	0.87

Table S2. Elemental distribution in NaCM-*iB* and NaCM-*f* from ICP analysis.

Composite	C (%)	Tap density (g cm^{-3})
NaCM-*iB*	2	1.46
NaCM-*f*	0.6	1.98

Table S3. Carbon content in NaCM-*iB* and NaCM-*f* cathodes along with the respective tap densities.

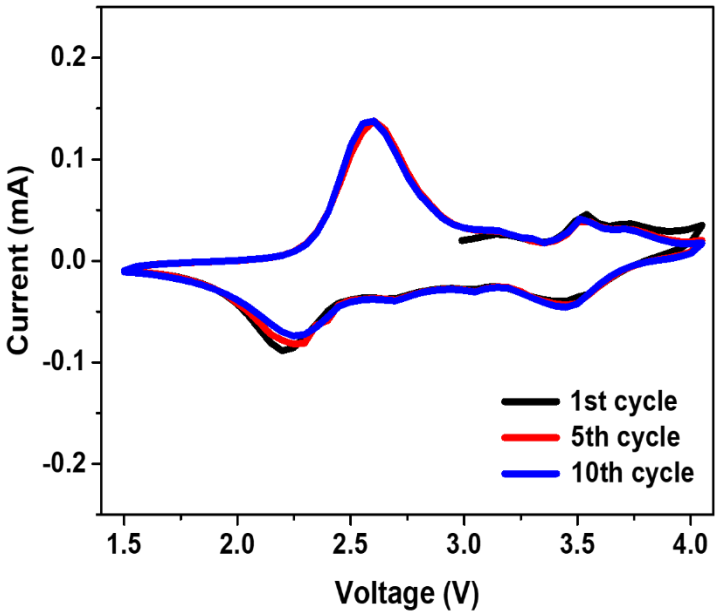

Figure S4. Cyclic voltammetry curves of NaCM-*iB* electrode vs. Na/Na^+ at 0.05 mV s^{-1}.

Preparation of carbon nanofiber (CNF) electrode

Typically, polyvinyl pyrrolidone (PVP, average Mw =13,000,000, Sigma Aldrich) was dissolved in an ethanol/water mixture (12 wt%, 1:1 v/v) by stirring thoroughly overnight. The solution was directly electrospun with an applied voltage of 20 kV, the distance between the collector to the tip of the needle as 15 cm distance, a flow rate of 0.1 ml $h^{-1,}$ and 26% humidity to yield nanofibers. The obtained fiber mat was peeled-off and heat-treated at 400 °C for 5 h to stabilize the fiber mat, followed by the second stage of heat-treatment at 800 °C for 6 h in a compressed air atmosphere, maintaining a slow ramp rate of 3 °C min^{-1}. The carbonized fibers (CNF) were mixed with a binder (PVDF) and conductive agent (Super P) in an 8:1:1 ratio using NMP as the solvent. The viscous slurry was cast on an Al current collector and dried in a vacuum atmosphere at 100 °C for 10 h to eradicate the residual solvent prior to employing it as the electrode.

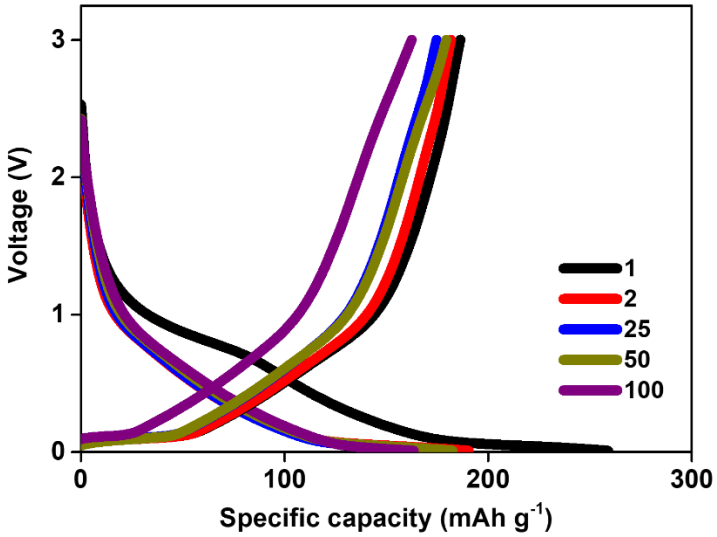

Figure S5. Voltage profile of CNF *vs.* Na/Na^+ cells at 50 mA g^{-1}.

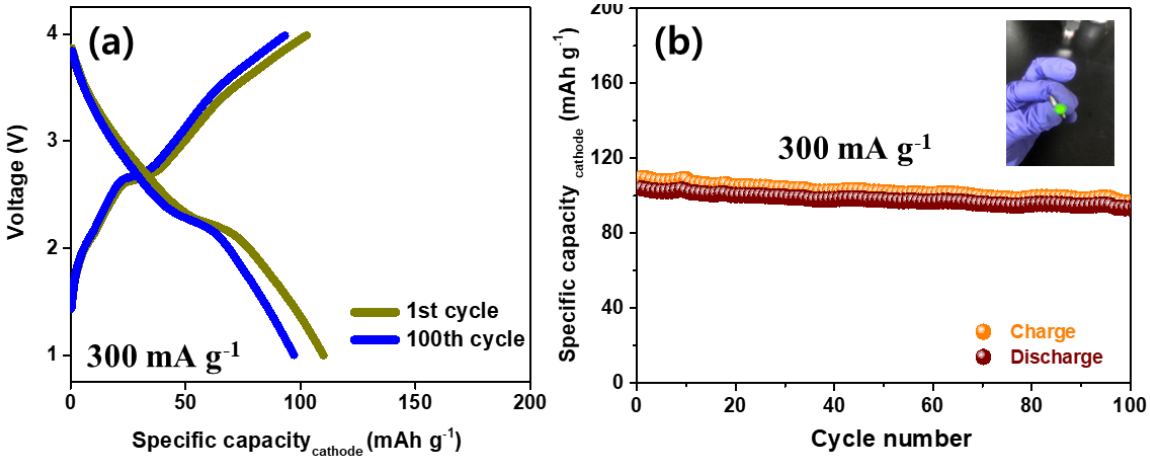

Figure S6. (a) Voltage profile and (b) cycle performance of NaCM-*iB*||CNF full cell at a current density of 300 mA g^{-1}. Inset: green led lighted with NaCM-*iB*||CNF cell.