

Supporting information for

Hierarchical Cathode Constructed by Carbon Coated $\text{Na}_{3.5}\text{VMn}_{0.5}\text{Cr}_{0.5}(\text{PO}_4)_3$

Nanoparticles on rGO for High-Capacity and Long-Cycle-Life Sodium Storage

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Table S1. The refinement reliability factors of XRD.

Composition	R_{wp} (%)	R_p (%)	R_{Bragg} (%)
VMC@C	1.86	1.18	0.15
VMC@C/rGO	1.87	1.27	0.20

Table S2. Structural information of VMC@C/rGO derived from Rietveld refinement.

Atom	Site	x	y	z	Occupancy
Na1	6b	0	0	0	1
Na2	18e	0.6221(9)	0	0.25	0.855(2)
V	12c	0	0	0.1467(1)	0.5
Mn	12c	0	0	0.1467(1)	0.25
Cr	12c	0	0	0.1467(1)	0.25
P	18e	0.2955(7)	0	0.25	1
O1	36f	0.0507(2)	0.2304(1)	0.1906(5)	1
O2	36f	0.2047(1)	0.1604(9)	0.0926(4)	1

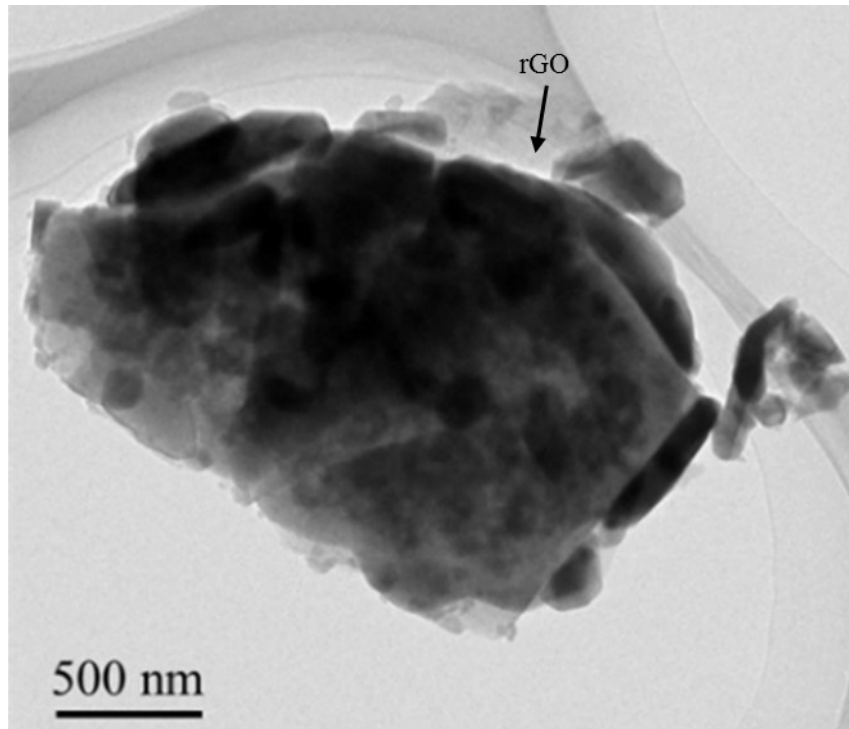


Fig. S1. TEM image of VMC@C/rGO.

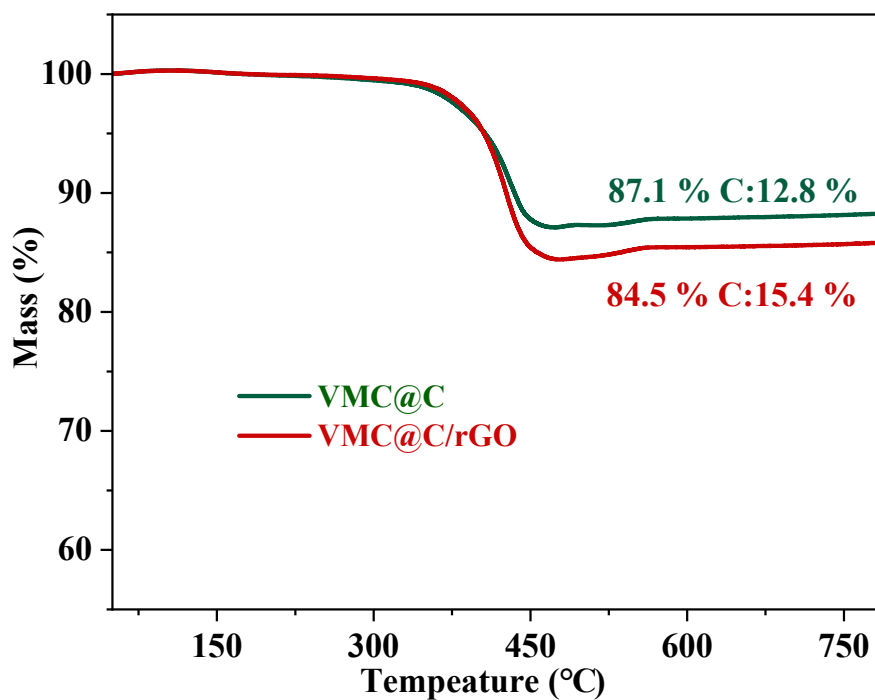


Fig. S2. TG curves of VMC@C and VMC@C/rGO.

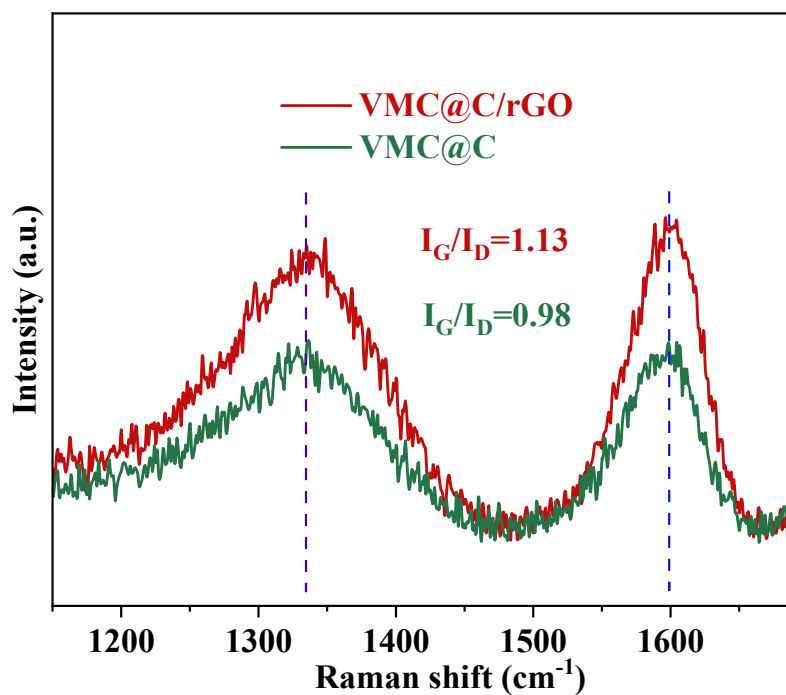


Fig. S3. Raman spectra of VMC@C and VMC@C/rGO.

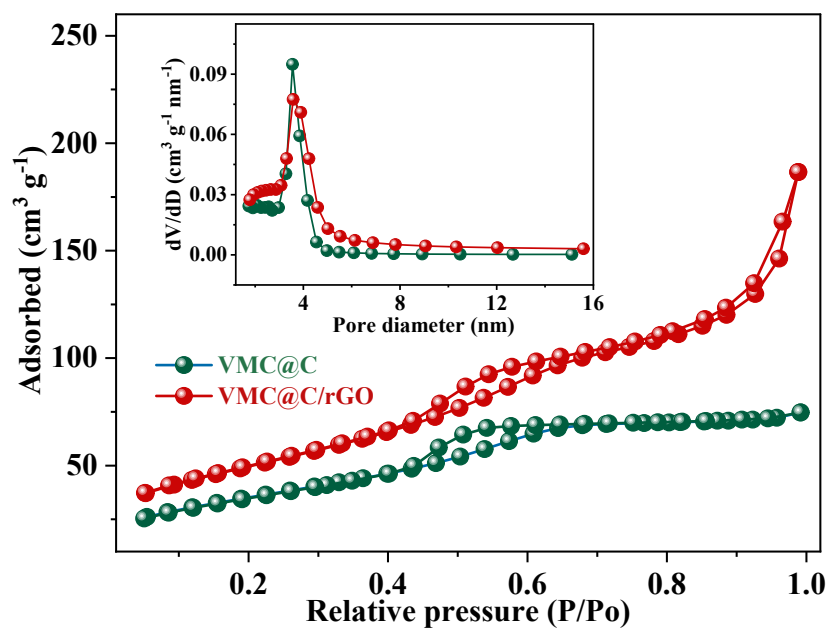


Fig. S4. The nitrogen adsorption-desorption curve and pore-size distribution of VMC@C and VMC@C/rGO.

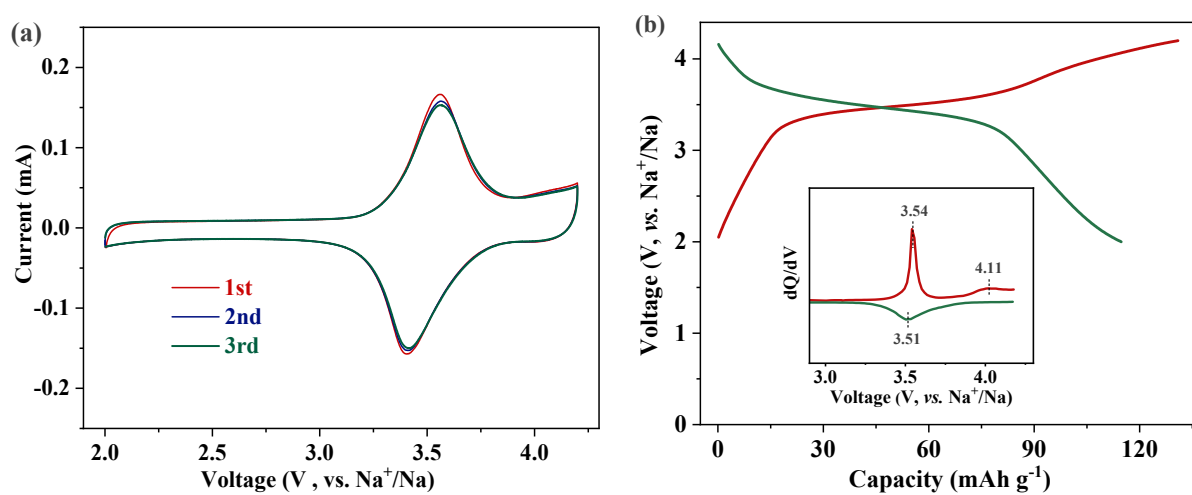


Fig. S5. (a) CV curves of VMC@C at 0.2 mV s⁻¹, (b) charge-discharge curve of VMC@C/rGO at 0.2 C, inset is the corresponding dQ/dV plot.

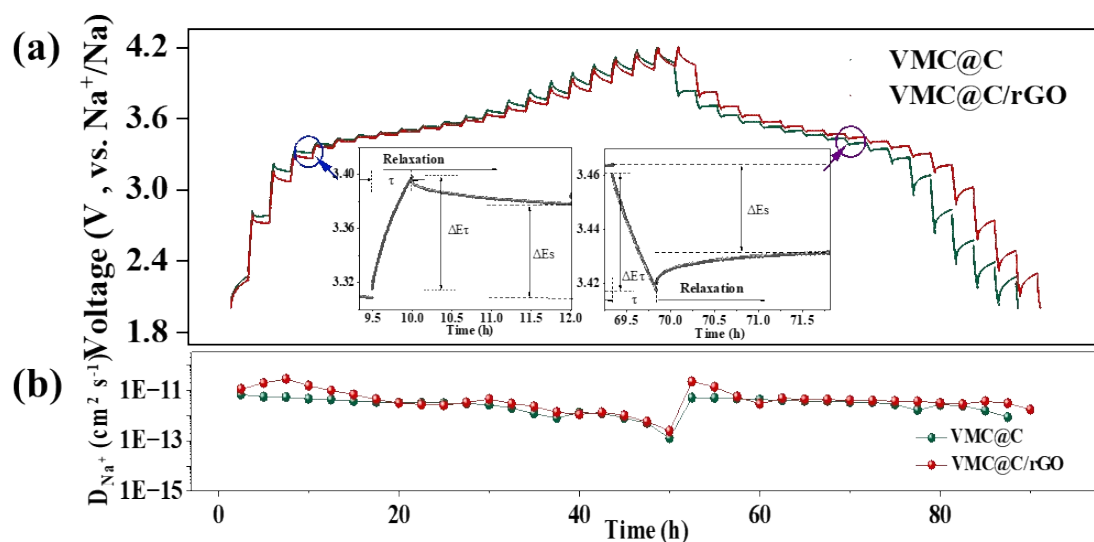


Fig. S6. GITT profiles (a) and overall trends of Na ion diffusion coefficient (b) during the sodiation/desodiation process of VMC@C and VMC@C/rGO.

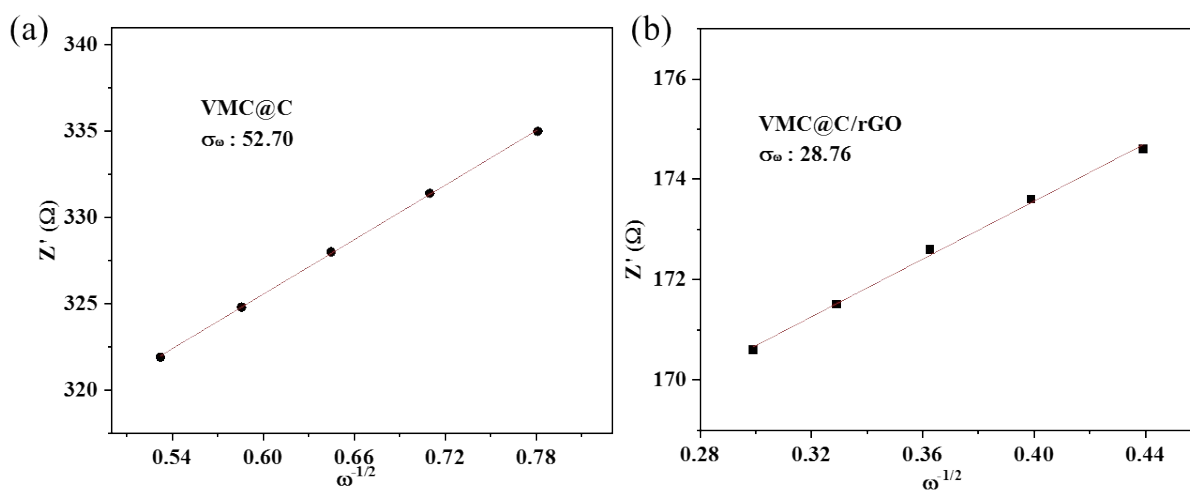


Fig. S7. Real impedance versus the reciprocal square root of frequency plots to determine the Warburg coefficients (σ_ω).

Table S3. Comparison of the cycling stability of VMC@C/rGO electrode in this work with recent publications on NASICON-type cathode materials.

Composite	Cycle number	retention	Ref.
$\text{Na}_{3.5}\text{VMn}_{0.5}\text{Cr}_{0.5}(\text{PO}_4)_3@\text{C}/\text{rGO}$	8000	81%	This work
$\text{Na}_3\text{V}_2(\text{PO}_4)_3@\text{C}@\text{CMK-3}$	1000	67.3%	54
$\text{Na}_3\text{V}_2(\text{PO}_4)_2\text{O}_2\text{F-hs}$	2000	66.2%	55
$\text{rGO}@\text{Na}_3\text{MnTi}(\text{PO}_4)_3\text{-C}$	3500	74.5 %	56
$\text{Na}_4\text{MnV}(\text{PO}_4)_3@\text{C}@\text{Ga}$	4000	68.8 %	57
$\text{Na}_4\text{Fe}_3(\text{PO}_4)_2(\text{P}_2\text{O}_7)/\text{C}$	4400	69 %	58
$\text{Na}_3\text{Fe}_{0.5}\text{V}_{1.5}(\text{PO}_4)_3$	5000	77.7 %	59
Ru-doped $\text{Na}_3\text{V}_2\text{O}_2(\text{PO}_4)_2\text{F}$	7500	77.3 %	60

Table S4. Diffusion coefficients of Na^+ ion calculated from CV method.

D_{Na^+}	VMC@C	VMC@C/rGO
O1	3.85E-12	2.26E-11
R1	3.74E-12	1.69E-11

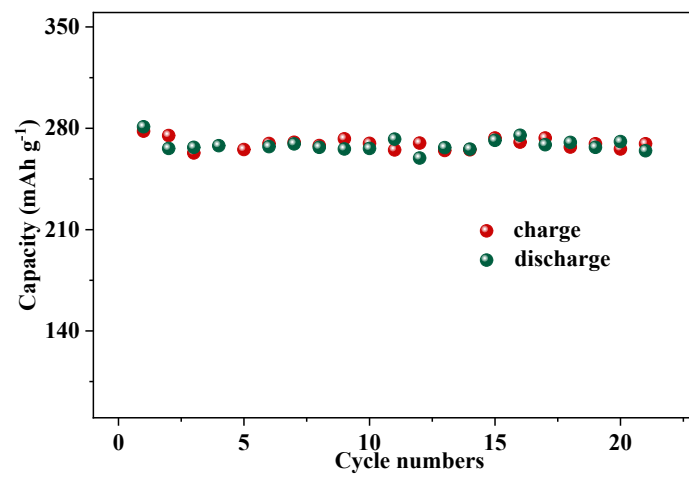


Fig. S8. Cycle performance of hard carbon at 0.2 C.