

## Supporting information

# **Three-Dimensional Electric Micro-Grid Network for High-Energy-Density Lithium-Ion Battery Cathodes**

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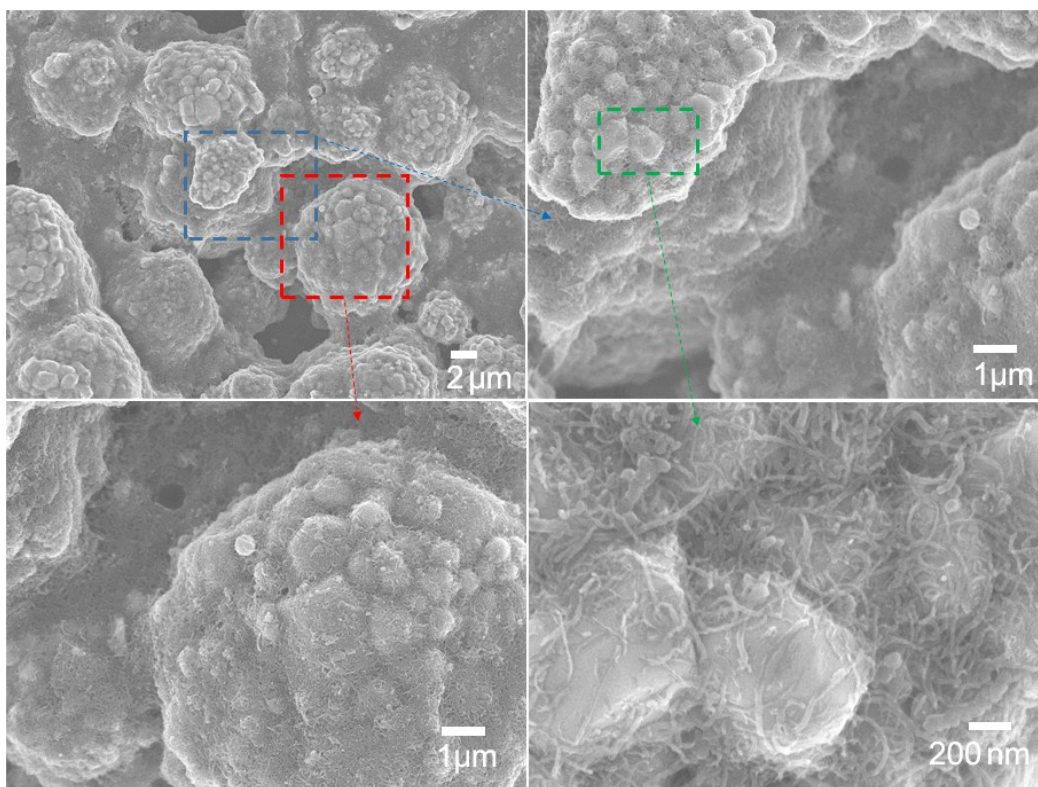


Fig. S1 FE-SEM images of the CNT/NCM95 composite electrode surface.

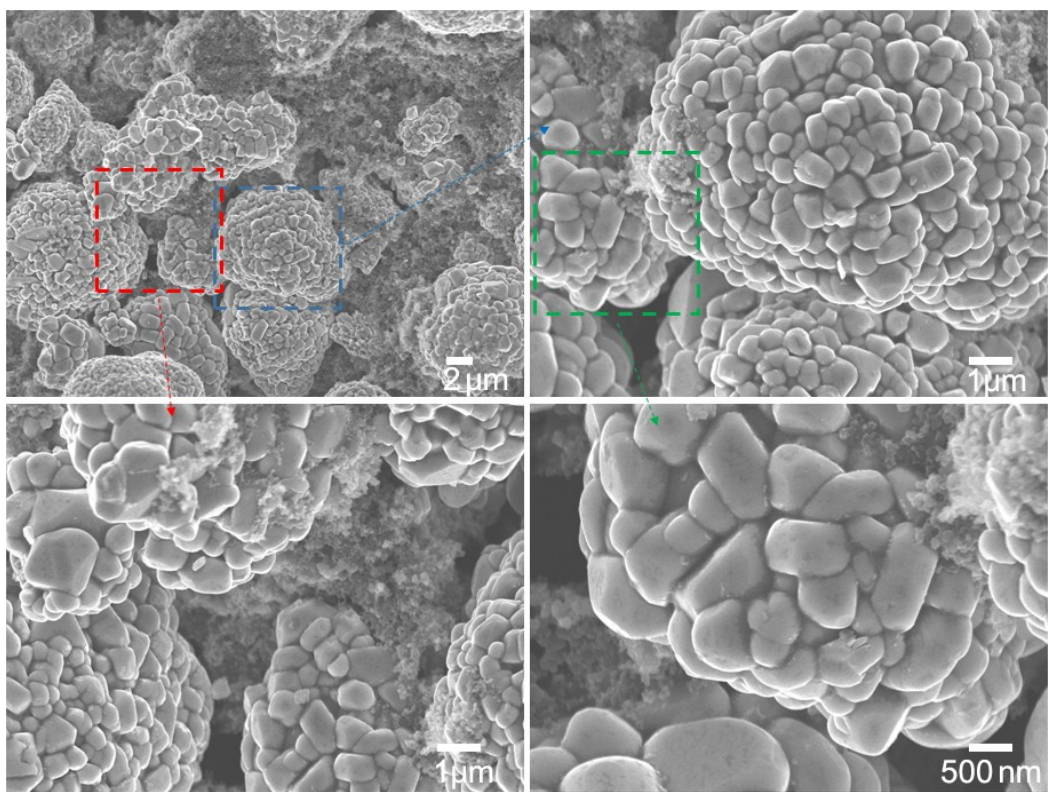


Fig. S2. FE-SEM images of the ABs/NCM electrode surface.

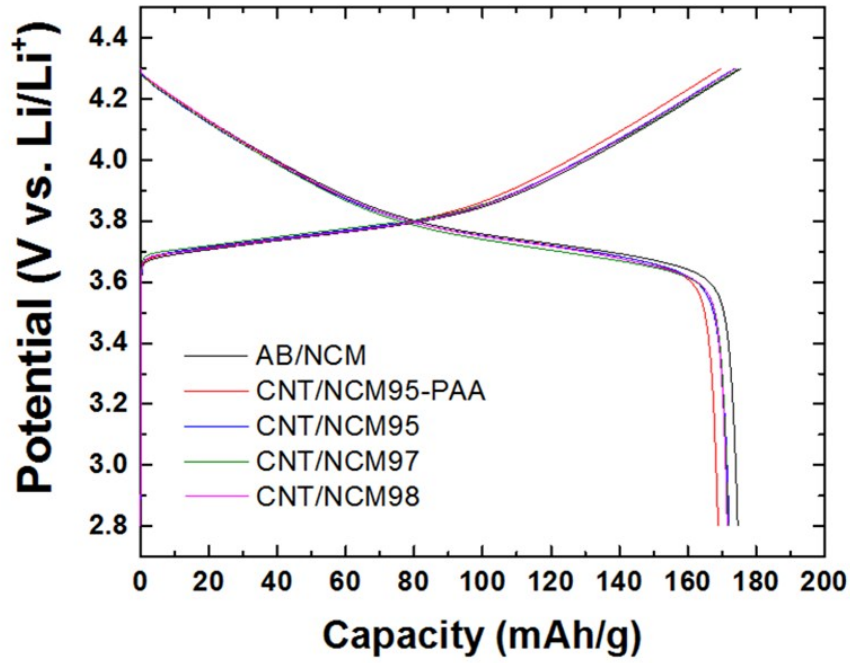


Fig. S3 Galvanostatic charge–discharge curves for the MW-CNT/NCM523 composite electrodes and ABs/NCM523 electrode; the capacities are based on the mass of NCM523

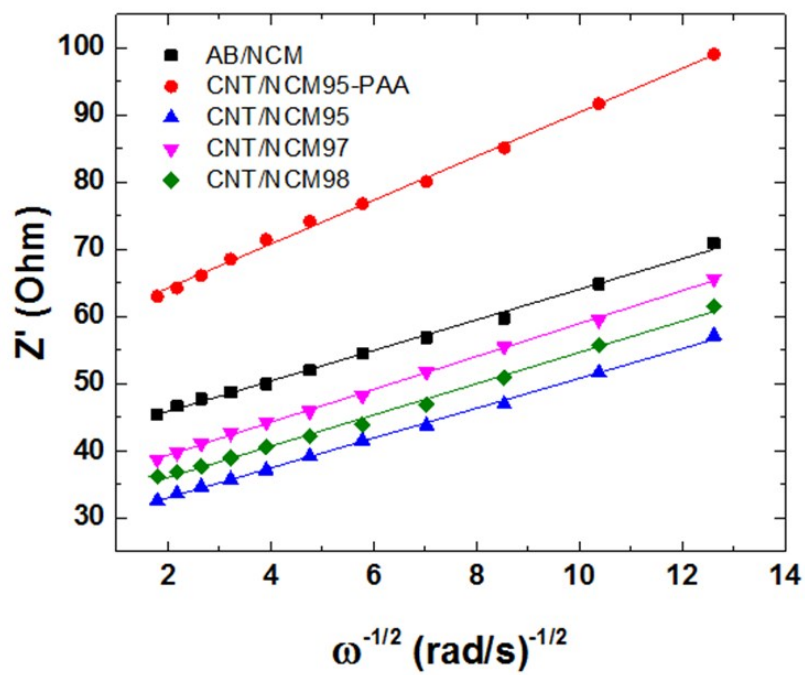


Fig. S4 Plots of  $Z'$  vs  $\omega^{-1/2}$  in the low-frequency region of the EIS spectra recorded for the MW-CNT/NCM523 composite electrodes and ABs/NCM523 electrode.

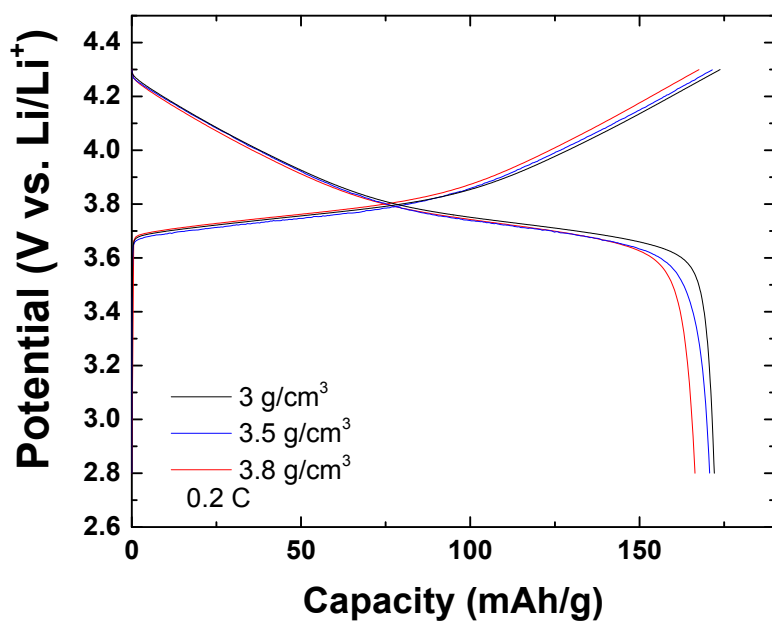


Fig. S5 The effect of the tap density of the MW-CNT/NCM523 composite electrodes on the galvanostatic charge–discharge characteristics.

Table. S1 Compositions of the prepared cathode materials.

Electrode	Active materials	Conductive agents	Binder
	NCM523 (wt%)	CNT (wt%)	PAA in H <sub>2</sub> O (wt%)
CNT/NCM95-PAA	95	2	3
CNT/NCM95	95	5	.
CNT/NCM97	97	3	.
CNT/NCM98	98	2	.
AB/NCM	90	5 wt% AB	5 wt% (PVDF in NMP)

Tabl2. S2 Loading and tap density of the prepared cathodes.

Electrode	Loading density (mg/cm <sup>2</sup> )	Tap density (g/cm <sup>3</sup> )
CNT/NCM95-PAA	3.96	3.07
CNT/NCM95	4.27	3.05
CNT/NCM97	4.29	3.11
CNT/NCM98	4.18	3.05
AB/NCM	3.85	2.82

Table. S3 Electrical resistivity of the MW-CNT/NCM523 composite electrodes and ABs/NCM523 electrode.

	AB/NCM	CNT/NCM95-PAA	CNT/NCM95	CNT/NCM97	CNT/NCM98
Resistivity (Ω cm)	8.21	4.72	1.18	1.39	1.48

Table. S4 Discharge capacity of the MW-CNT/NCM523 composite electrodes and ABs/NCM523 electrode.

	AB/NCM	CNT/NCM95-PAA	CNT/NCM95	CNT/NCM97	CNT/NCM98
Capacity (m Ah g <sup>-1</sup> )	157.13	160.42	163.50	166.67	171.57

Table. S5 Interfacial electrical resistivity between the composite electrodes and Al current collector.

	AB/NCM	CNT/NCM95-PAA	CNT/NCM95
Interfacial resistivity ( $\Omega \text{ cm}^2$ )	$6.08 \pm 0.58 \times 10^{-3}$	$2.39 \pm 0.31 \times 10^{-3}$	$7.57 \pm 0.63 \times 10^{-4}$

Table. S6 Kinetic parameters of the MW-CNT/NCM523 composite electrodes and AB/NCM523 electrode.

	$R_{\text{sf}}$ ( $\Omega$ )	$R_{\text{ct}}$ ( $\Omega$ )	$D_{\text{Li}}$ ( $\text{cm}^2 \text{ s}^{-1}$ )
AB/NCM	18.83	20.97	$2.55 \times 10^{-10}$
CNT/NCM95	11.37	16.31	$2.68 \times 10^{-10}$
CNT/NCM97	13.74	18.08	$2.44 \times 10^{-10}$
CNT/NCM98	15.77	18.85	$2.20 \times 10^{-10}$

Table. S7 Capacity retention of the MW-CNT/NCM523 composite electrodes and AB/NCM523 electrode after 300 cycles.

	AB/NCM	CNT/NCM95-PAA	CNT/NCM95	CNT/NCM97	CNT/NCM98	CNT/NCM95 w/o treatment
Capacity retention (%)	65	21	74	69	67	63