Electronic Supplementary Material (ESI) for Materials Chemistry Frontiers.

Supporting Information

Copper Surface Doping to Improve Structure and Surface Properties of Manganese-Rich Cathode Materials for Sodium Ion Batteries

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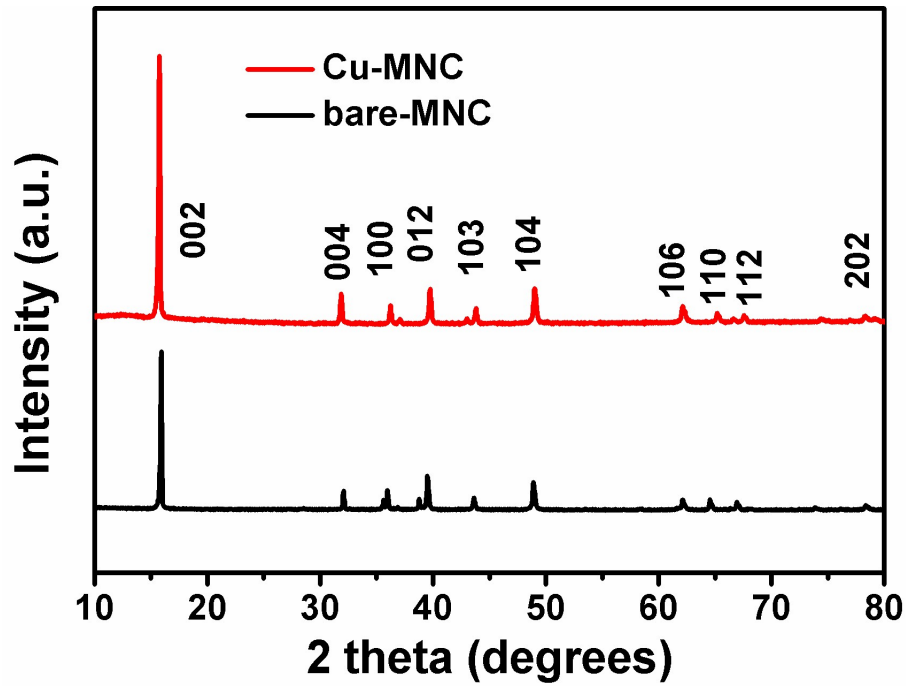

Figure S1 XRD patterns of Cu-MNC and bare-MNC samples.

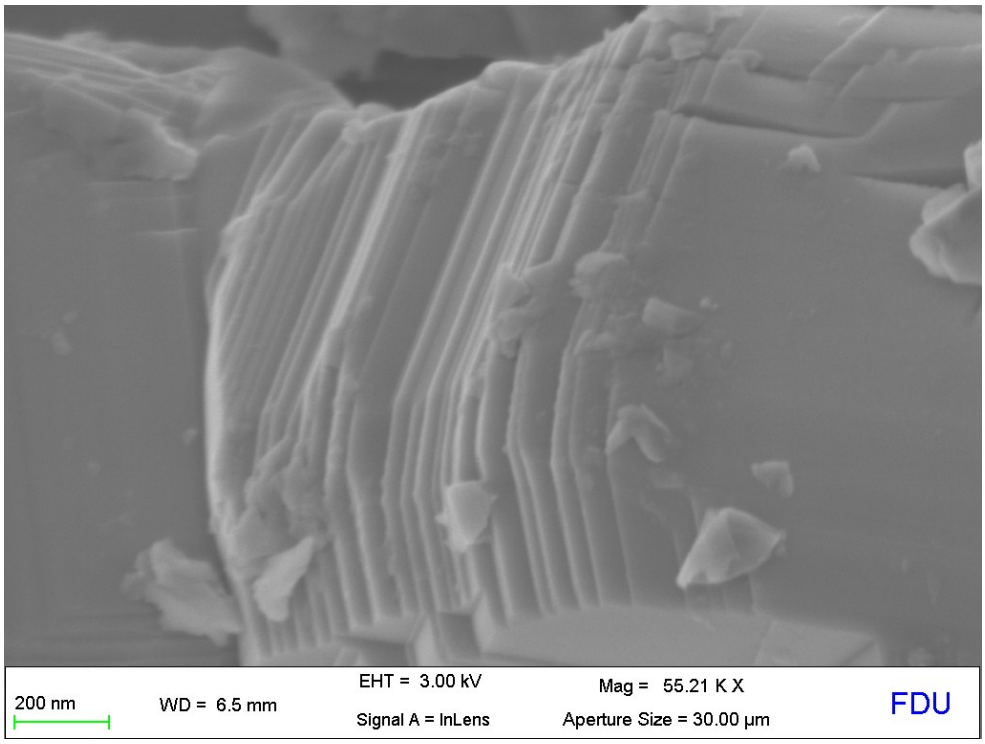

Figure S2. SEM image of Cu-MNC sample.

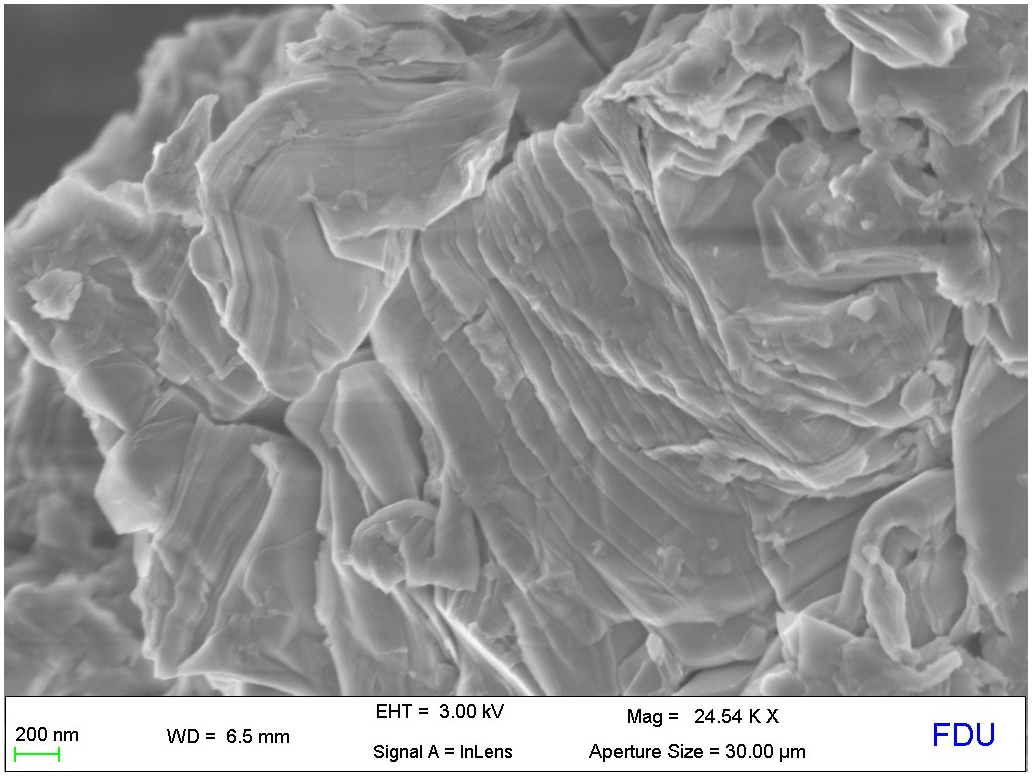

Figure S3. SEM image of bare-MNC sample.

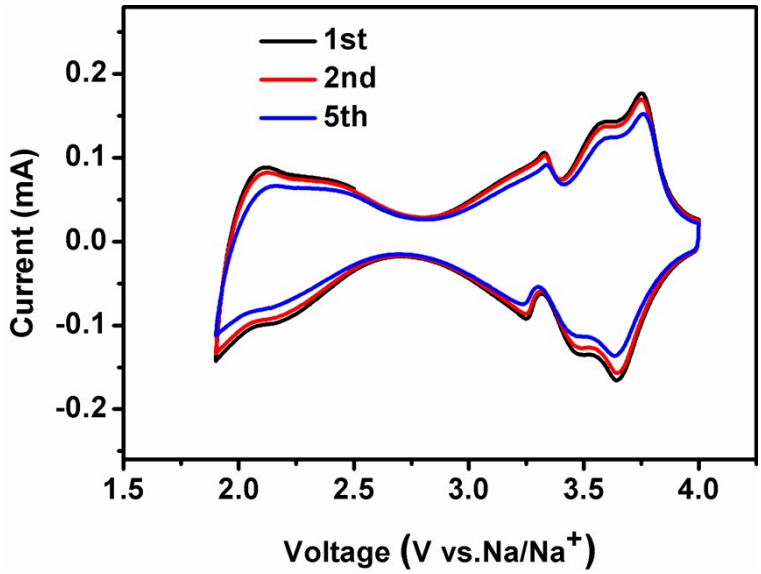

Figure S4. CV curves of bare-MNC at 0.2 mV/s for different cycles.

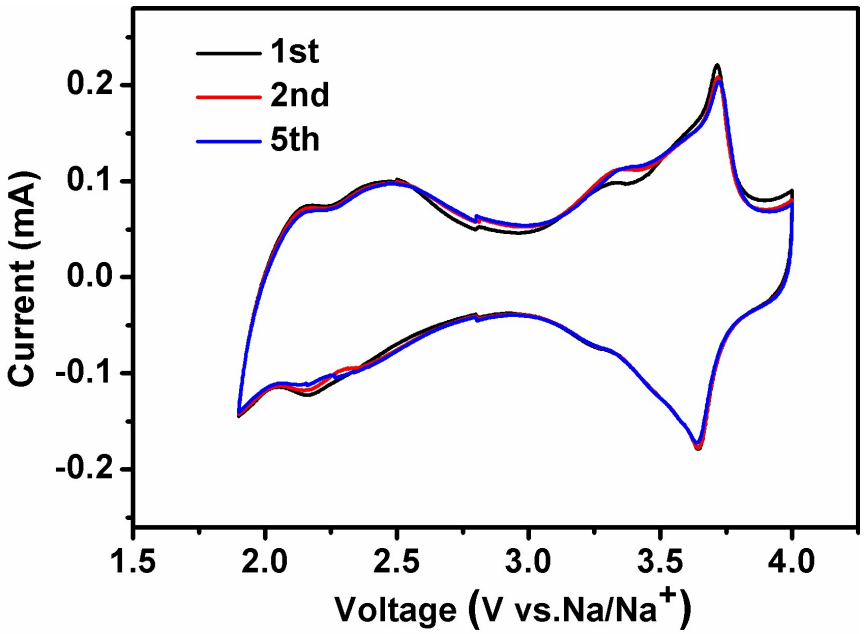

Figure S5. CV curves of Cu-MNC for different cycles.

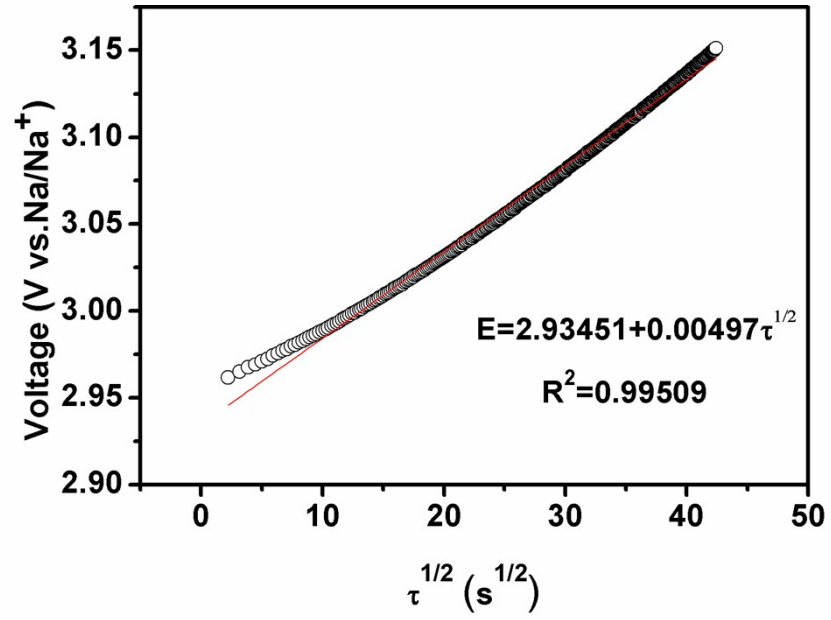

Figure S6. A linear relationship between the cell voltage and $\tau^{1/2}$ for bare-MNC.

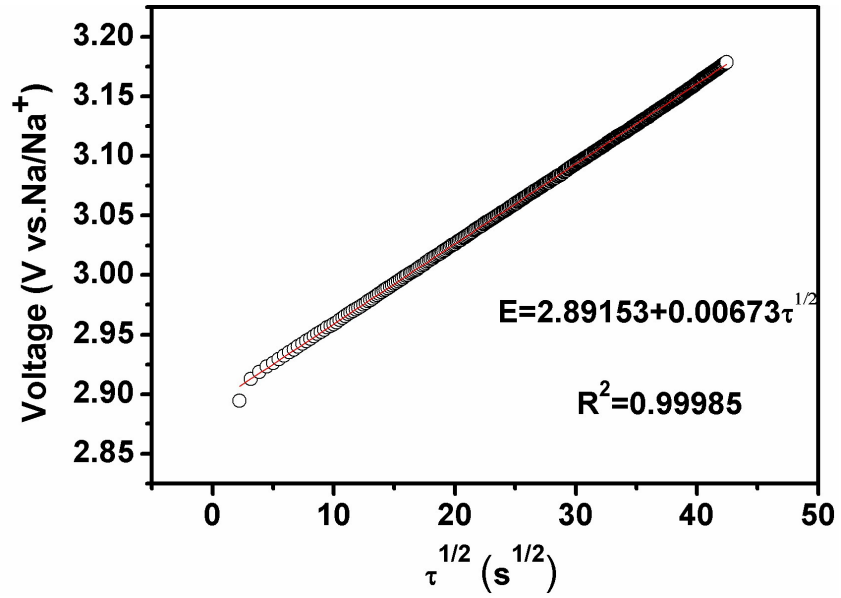

Figure S7. A linear relationship between the cell voltage and $\tau^{1/2}$ for Cu-MNC.

Table S1. ICP results for the samples.

	samples	Measured atomic ratio				
		Na	**Mn**	**Ni**	**Co**	**Cu**
1	Bare-MNC	0.6835	0.6025	0.1953	0.2022	0
2	Cu-MNC	0.6795	0.5934	0.2014	0.1902	0.016

Table S2. Crystallographic parameters of bare-MNC refined by the Rietveld method.

Atom	$P6_3$ /mmc(No.194) site	x	y	z	Occupancy
Na_f	2b	0	0	0.25	0.35
Na_e	2d	0.6667	0.3333	0.25	0.32
Mn	2a	0	0	0	0.6
Ni	2a	0	0	0	0.2
Co	2a	0	0	0	0.2
O	4f	0.6667	0.3333	0.079	0.975
a=b=2.8557(2)Å, c=11.2093(6)Å, $\alpha = \beta = 90$, $\gamma = 120$, Rp=3.36 % Rwp=5.54 % χ^2 =3.08					

Table S3. Crystallographic parameters of Cu-MNC refined by the Rietveld method.

Atom	$P6_3$ /mmc(No.194) site	x	y	z	Occupancy
Na_f	2b	0	0	0.25	0.35
Na_e	2d	0.6667	0.3333	0.25	0.32
Mn	2a	0	0	0	0.584
Ni	2a	0	0	0	0.2
Co	2a	0	0	0	0.2
Cu	2a	0	0	0	0.016
O	4f	0.6667	0.3333	0.079	0.975
a=b=2.8569(9)Å, c=11.1772(6)Å, $\alpha = \beta = 90$, $\gamma = 120$, Rp=4.39 % Rwp=5.39 % χ^2 =7.84					

Table S4 Fitting parameters for the equivalent circuit model.

Cycle number	bare-MNC			Cu-MNC		
	R_Ω (Ω)	R_f (Ω)	R_{ct} (Ω)	R_Ω(Ω)	R_f (Ω)	R_{ct} (Ω)
0	2.553	277.5	22.78	3.35	245.2	35.43
50	4.336	389.2	180.3	4.86	353.6	112.5