

### *Electronic Supplementary Information*

## Design and synthesis of a stable-performance P2-type layered cathode material for sodium ion batteries

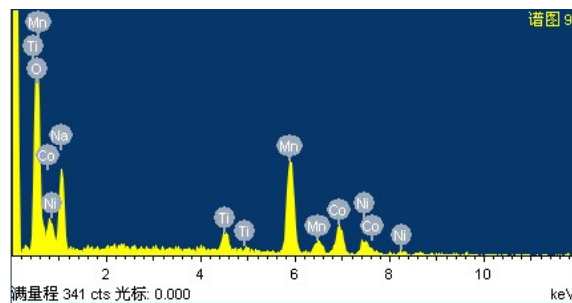
Shuo Liu,<sup>a</sup> Xiaolei Jiang,<sup>a</sup> Junshu Zhang,<sup>a</sup> Jian Yang,<sup>\*a</sup> Yitai Qian,<sup>ab</sup>

<sup>a</sup> Key Laboratory of Colloid and Interface Chemistry, Ministry of Education School of Chemistry and Chemical Engineering, Shandong University, Jinan, 250100, P.R. China

<sup>b</sup> Hefei National Laboratory for Physical Science at Microscale, Department of Chemistry, University of Science and Technology of China, Hefei, 230026, P.R. China

For electrochemical performance tests, positive electrodes were made from the mixture of 70 wt% active material, 20 wt% acetylene black and 10 wt% poly(vinylidene fluoride) using N-methylpyrrolidone as solvent on Al foil and then dried under vacuum at 60 °C for 12 h. Sodium foil was used as a negative electrode and a glass membrane was used as a separator. The electrolyte solution was 1 M NaClO<sub>4</sub> dissolved in diethyl carbonate (DEC), ethylene carbonate (EC) and fluoroethylene carbonate (FEC) (49/49/2, v/v). Coin-type cells (R2032) were assembled in an argon filled gloves box. The cyclic voltammetry was carried out in the voltage range of 4.5-1.5 V by an electrochemical workstation (CH instruments 760E, China). Charge/discharge performances at different currents and rate performance were measured on Land battery cyclers (Land CT2001A, China). For ex situ XRD measurements, the cell after stabilized at a particular voltage for 2 hr, was opened in the Ar-filled glove box. Then, the electrode was washed by dimethyl carbonate (DEC)

and dried in vacuum at 50 °C for 1h. Finally, it was stored in a plastic bag to avoid the surface oxidation and used for XRD patterns immediately.



Element	weight (%)	ratio (%)
O K	30.40	54.55
Na K	13.07	16.32
Ti K	6.49	3.88
Mn L	24.98	13.04
Co L	13.70	6.66
Ni L	11.35	5.55
total	100.00	

Fig. S1 EDS image of CMNT and element ratio

Table. S1 Refinement result of CMNT ( $R_{exp}=4.20\%$ ,  $R_p=3.37\%$  and  $R_{wp}=4.54\%$ )

Composite	$Na_{0.6}Co_{0.2}Ni_{0.2}Mn_{0.5}Ti_{0.1}O_2$			
Cell Parameters	a	2.8877(5) Å		
	b	2.8877(5) Å		
	c	11.0979(3) Å		
	$\alpha$	90°		
	$\beta$	90°		
	$\gamma$	120°		
	Atom Positions	Na1	0	0
Na2		1/3	2/3	3/4
Co/Mn/Ni/Ti		0	0	0
O		1/3	2/3	0.0994(2)