Electronic Supplementary Material (ESI) for Dalton Transactions.

Supplementary Information

Influence of Ni/Mn distributions on the structure and electrochemical properties of Ni-rich cathode material

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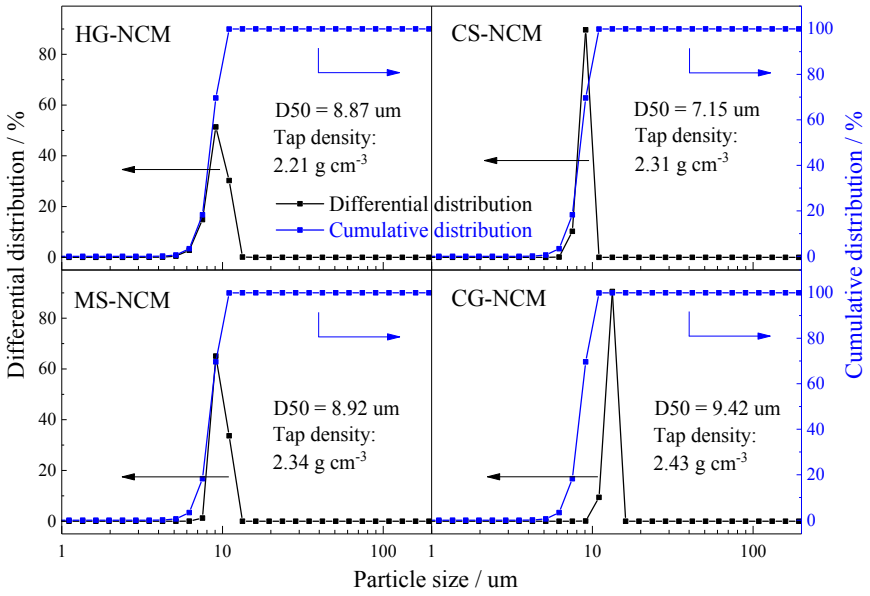

Fig. S1 Particle size distributions of NCM materials with different Ni/Mn distributions.

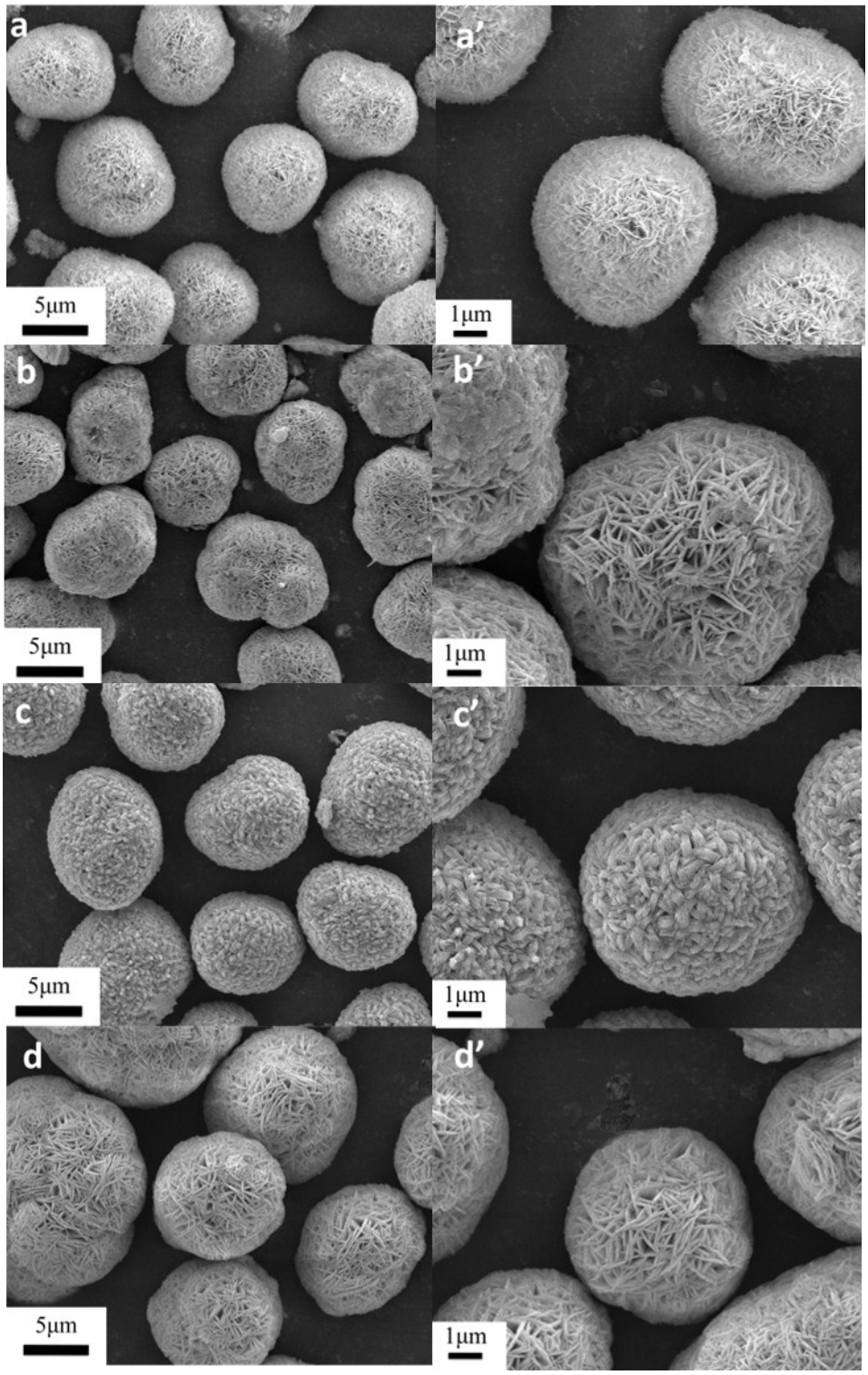

Fig. S2 SEM images of (a, a') HG-NCM, (b, b') CS-NCM, (c, c') MS-NCM and (d, d') FCG-NCM precursors.

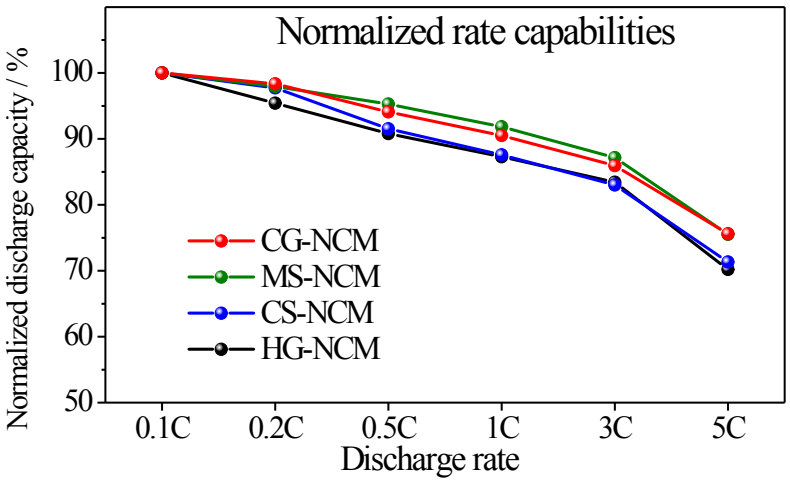

Fig. S3 Normalized rate capacity vs. discharge rate of NCM cathodes between 3.0 and 4.4 V.

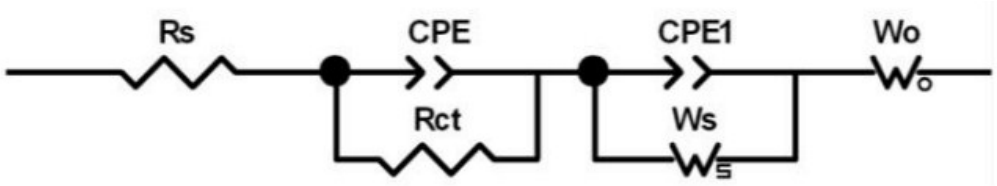

Fig. S4 Equivalent circuits used to fit the experimental data. Rs is solution resistance, Rct is interfacial charge-transfer resistance, CPE is a constant phase element, Wo is assigned to the semi-infinite Warburg diffusion impedance in the bulk.

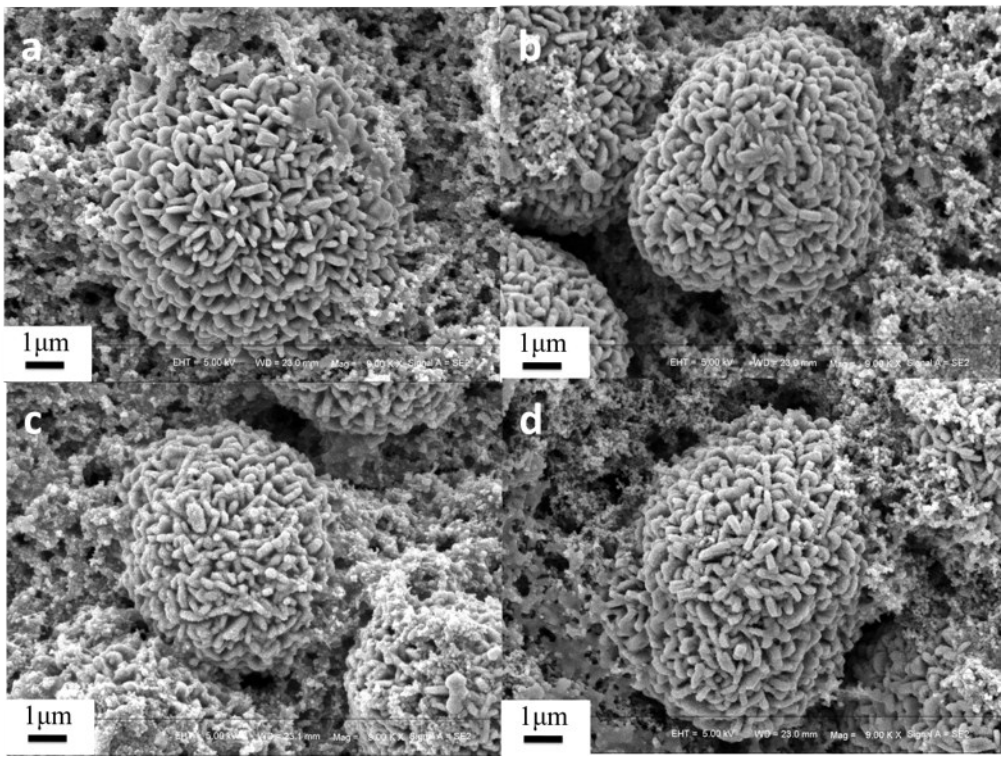

Fig. S5 SEM images of (a) HG-NCM, (b) CS-NCM, (c) MS-NCM and (d) FCG-NCM cathodes after 200 cycles.

Table S1 The simulated results from electrochemical impedance spectra and Li^+ diffusion coefficients obtained at the 10th cycle.

	Re (Ω)	Rct (Ω)	D_{Li^+} ($cm^2\ s^{-1}$)
HG-NCM	2.128	48.16	2.53×10^{-13}
CS-NCM	2.061	31.04	3.52×10^{-1}
MS-NCM	1.243	22.27	1.95×10^{-12}
CG-NCM	5.607	10.06	2.97×10^{-12}

Table S2 The simulated results of Ni $2p_{3/2}$ spectra of NCM cathode materials with different Ni/Mn distributions.

		Ni^{3+}		Ni^{2+}		$Ni^{3+}/(Ni^{3+}+Ni^{2+})$
		Peak (eV)	FWHM (eV)	Peak (eV)	FWHM (eV)	(%)
Fresh samples	HG-NCM	856.1	1.83	854.8	1.42	75.0
	CS-NCM	856.0	1.83	855.0	1.42	71.4
	MS-NCM	856.1	1.83	855.0	1.42	70.6
	CG-NCM	856.1	1.83	855.0	1.42	72.6
After 200 cycles	HG-NCM	856.1	1.83	855.0	1.42	35.3
	CS-NCM	856.1	1.83	855.0	1.42	47.5
	MS-NCM	856.1	1.83	855.0	1.42	54.3
	CG-NCM	856.1	1.83	855.0	1.42	62.0