Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

High-energy, full concentration-gradient cathode material with excellent cycle and thermal stability for lithium ion batteries

P. Y. Hou, L. Q. Zhang and X. P. Gao

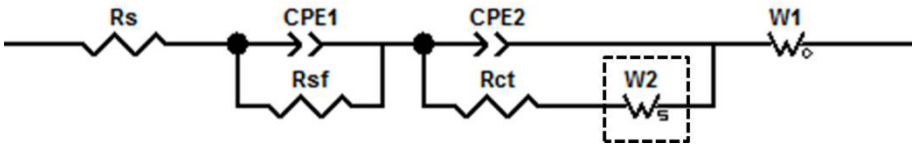

Fig. S1. Equivalent circuits used to fit the experimental data. R_s is solution resistance, R_{sf} is surface film resistance, R_{ct} is charge-transfer resistance, CPE and CPE1 are the constant phase element, Ws and Wo are assigned to the finite Nernst diffusion impedance in the thin film and semi-infinite Warburg diffusion impedance in the bulk, respectively.

Table S1. The simulated results from electrochemical impedance spectra of the full concentration-gradient and normal $LiNi_{0.6}Co_{0.2}Mn_{0.2}O_2$ electrodes after different cycles in the potential range of 3.0-4.4 V at 55 °C.

Sample	Cycle	R_{sf} (Ω)	R_{ct} (Ω)	W_s (Ω)	W_o (Ω)
Normal $LiNi_{0.6}Co_{0.2}Mn_{0.2}O_2$	0	39.78	428.6	-	348.5
	50th	22.61	39.29	106.6	1.69
	100th	29.34	49.32	236.7	2.16
Full concentration-gradient $LiNi_{0.6}Co_{0.2}Mn_{0.2}O_2$	0	17.7	293.9	-	377.2
	50th	7.12	10.94	-	1.28
	100th	17.45	28.95	-	4.35