Supporting Information

Mn-Rich NMC Cathode for Lithium-Ion Batteries at High-Voltage Operation

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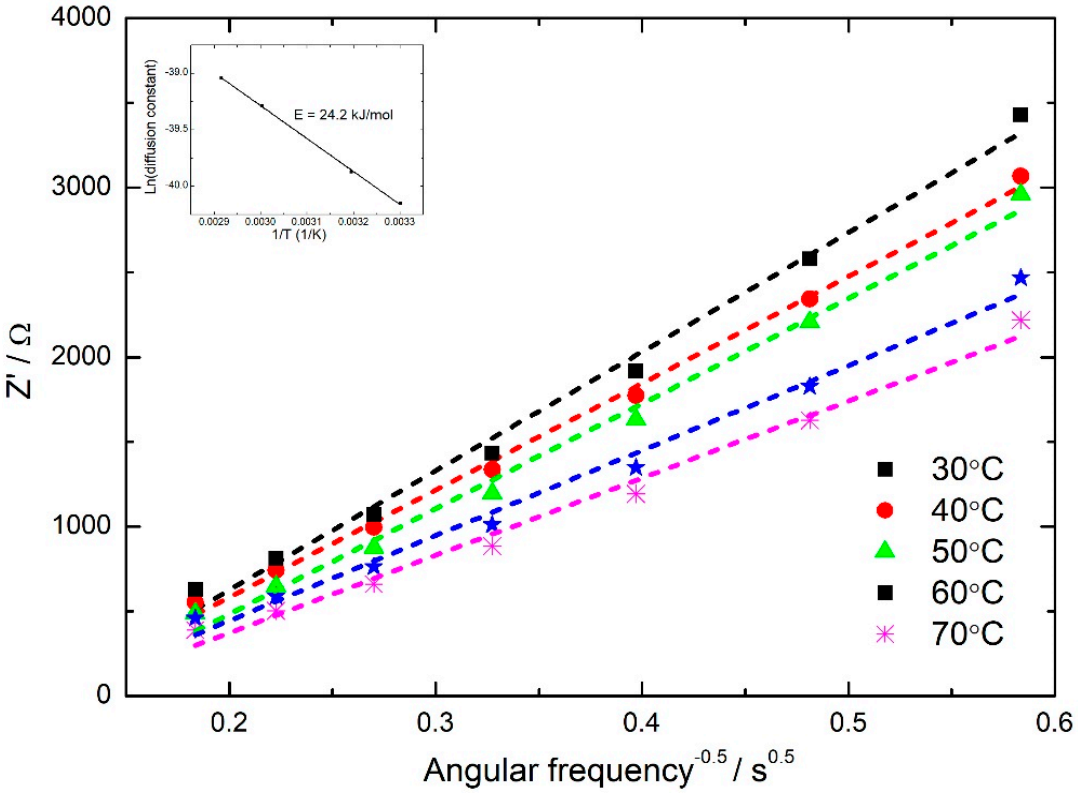

Figure S1 Graph of Warburg Impedance (Z') vs inverse square root of angular frequency at varying temperatures. (Inset: Arrhenius plot of the apparent diffusion constants).

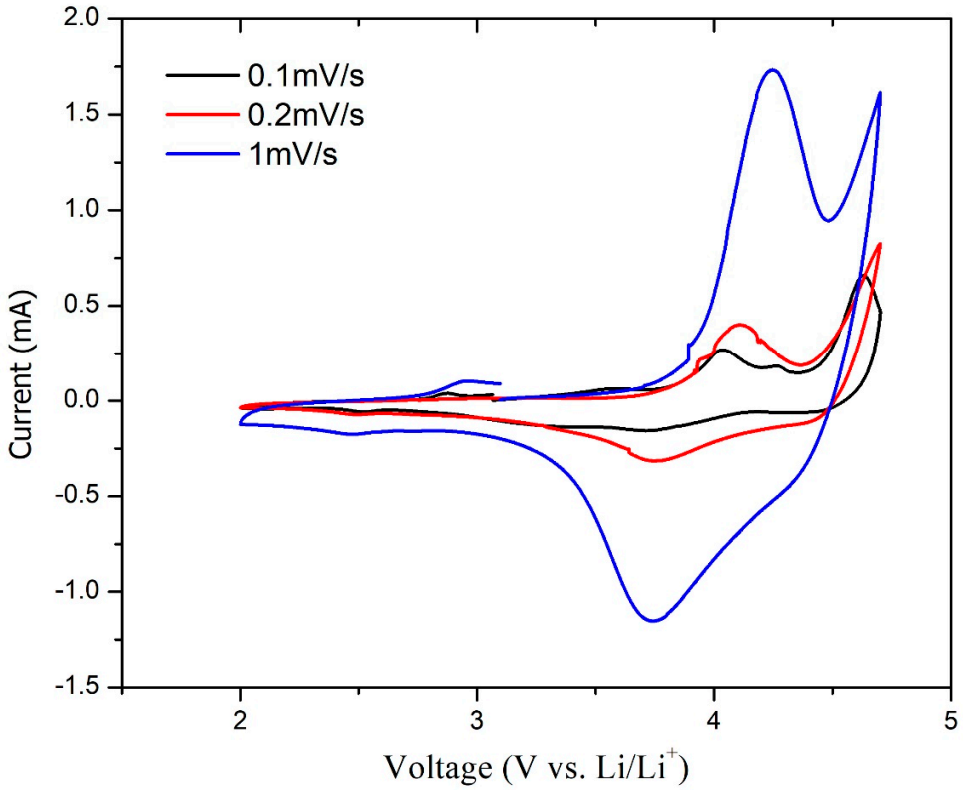

Figure S2. Cyclic Voltammetry plot for NMC262 at different scan rate (0.1mV/s, 0.2mV/s, 1mV/s) and 30°C.

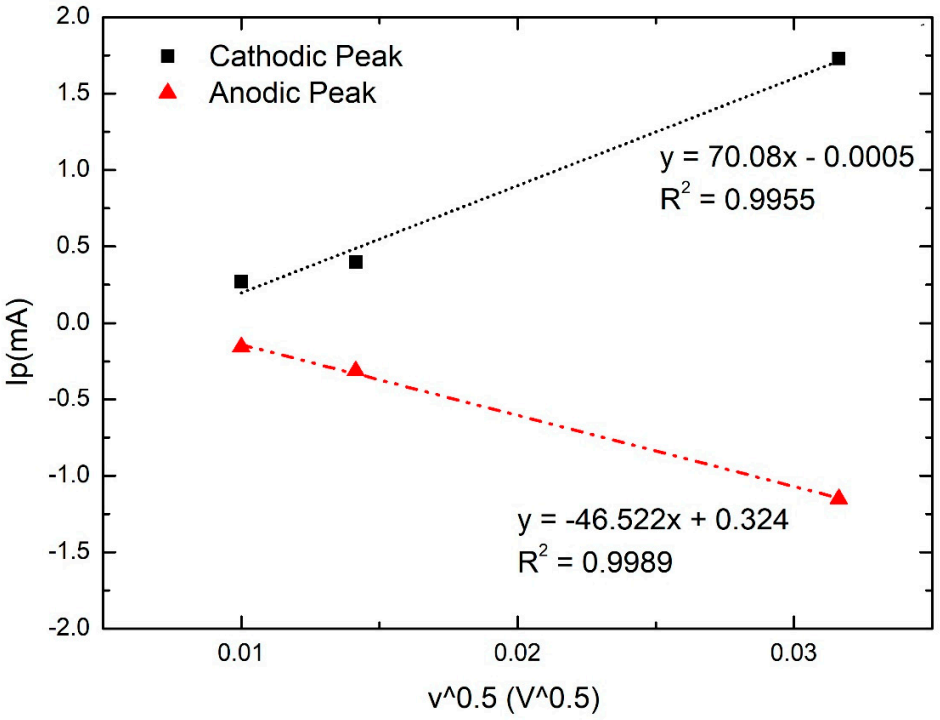

Figure S3 Graphs of cathodic and anodic peak current (Ip) vs square root of scan rate (v).

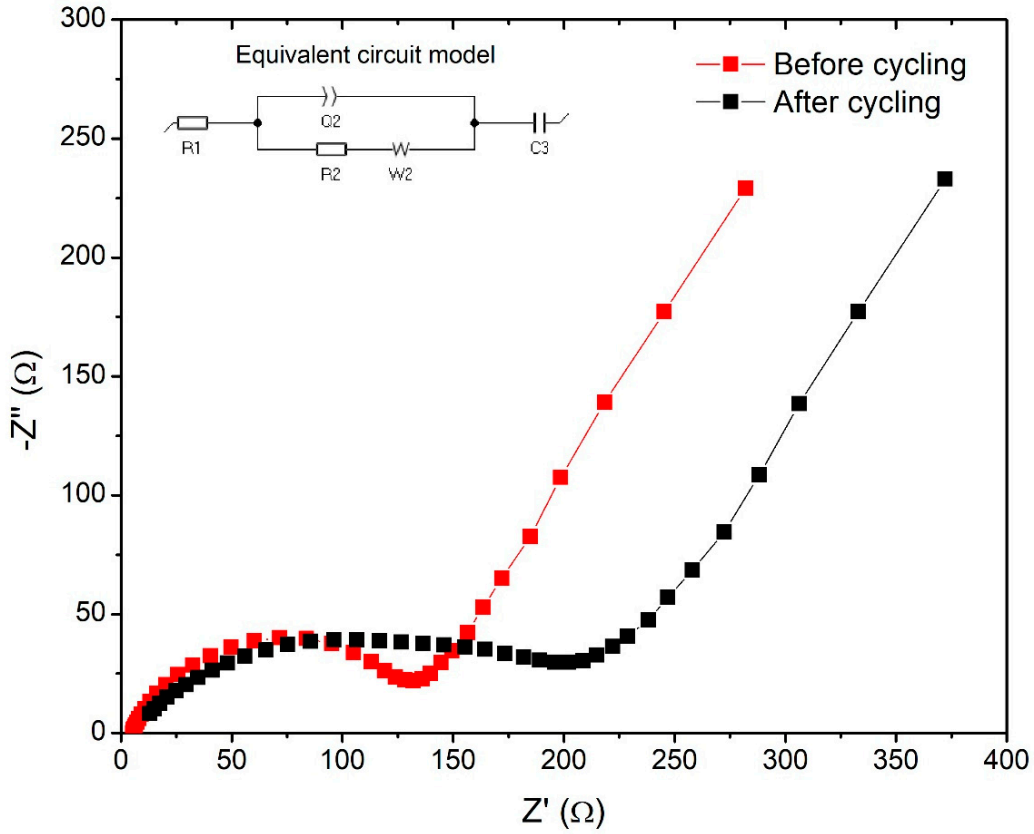

Figure S4. Impedance of half-cell with NMC262 before and after cycling. Insert is the Equivalent circuit model.

Table S1 Impedance analysis of NMC262 half-cell before and after cycling

	R_{SE} (Ω)	R_{INT} (Ω)	R_{TOTAL} (Ω)
Before cycling	5.38	117.60	122.98
After cycling	12.14	194.40	206.54

Table S2: Atomic ratios calculated based on EDS spectrums

Sample Label	*Atomic Ratio*			*Secondary particle size*
	Ni	*Mn*	*Co*	*(µm)*
NMC 262	0.17	0.63	0.20	1-3
NMC 352	0.26	0.53	0.22	3-6
NMC 442	0.37	0.42	0.21	2-5

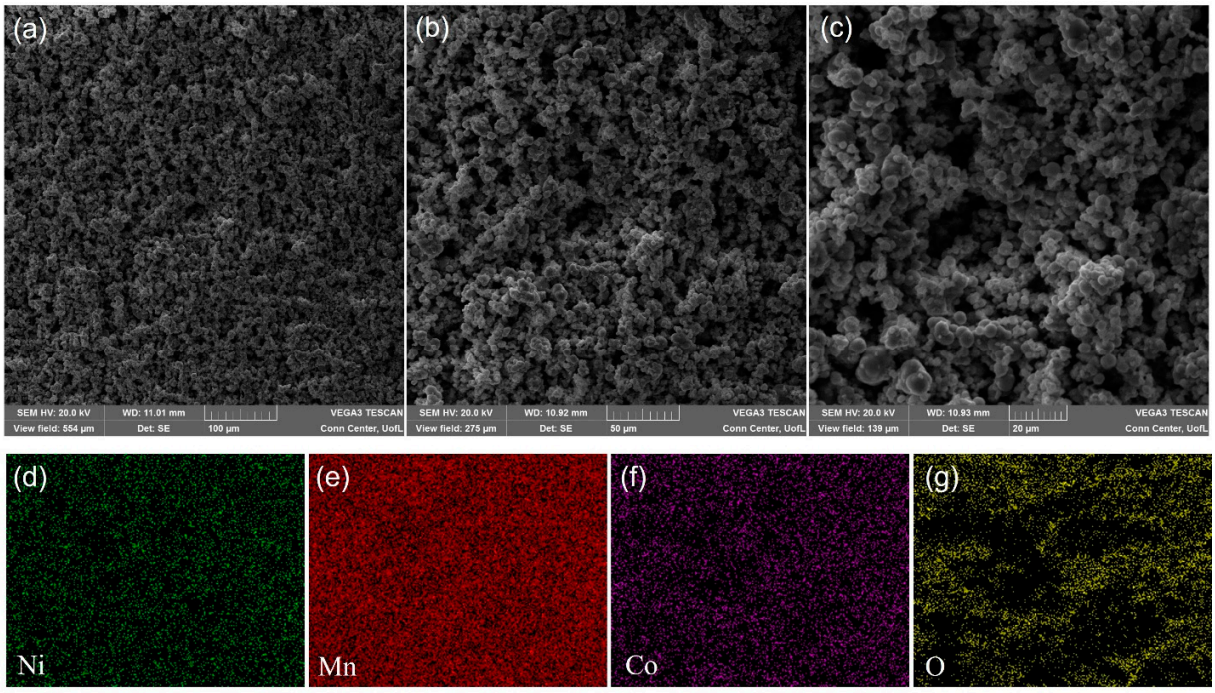

Figure S5: SEM images of sample NMC 262 at magnifications of (a) 500, (b) 1000, (c) 2000 and EDS mappings of (d) Ni, (e) Mn, (f) Co and (g) O

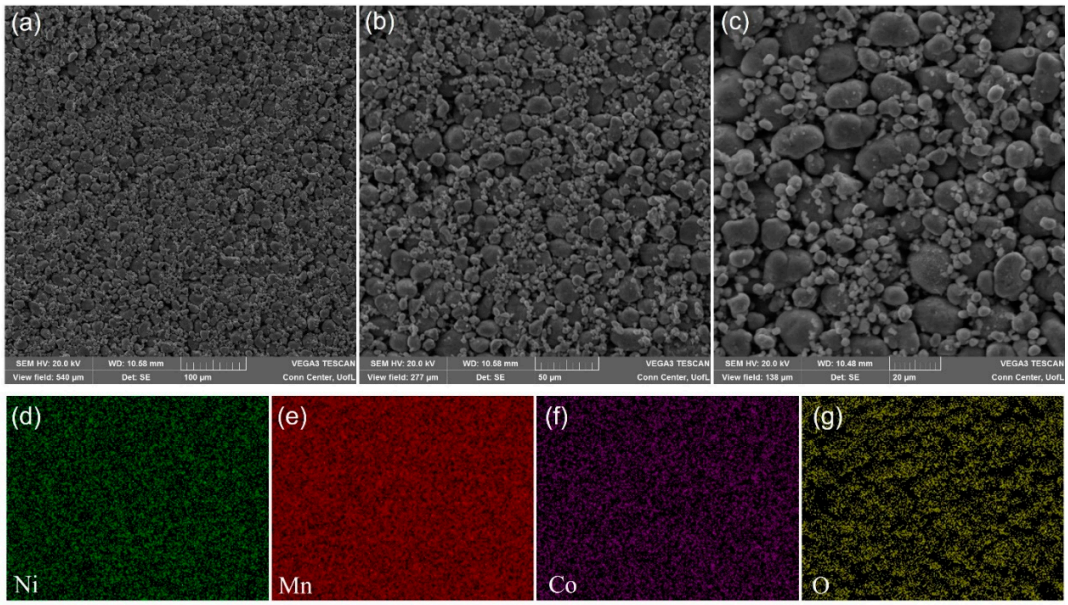

Figure S6: SEM images of sample NMC 352 at magnifications of (a) 500, (b) 1000, (c) 2000 and EDS mappings of (d) Ni, (e) Mn, (f) Co and (g) O

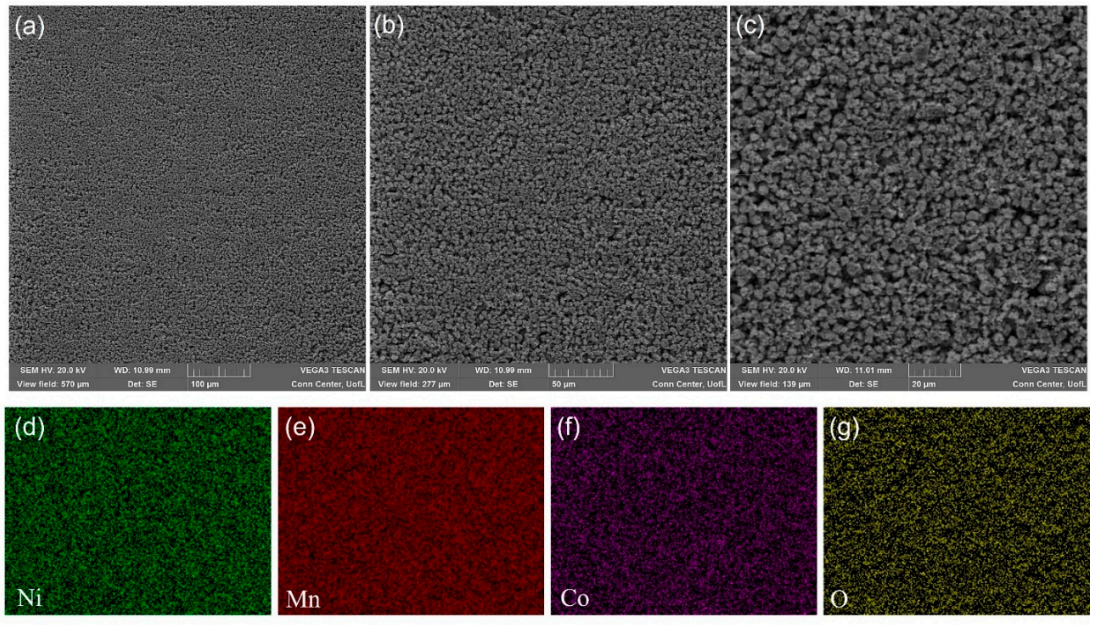

Figure S7: SEM images of sample NMC 442 at magnifications of (a) 500, (b) 1000, (c) 2000 and EDS mappings of (d) Ni, (e) Mn, (f) Co and (g) O