

Supporting Information

High Voltage $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ Cathodes for Li-ion Batteries Obtained by Sol-Gel Combustion Method - Effects of Fuel and Silver Doping

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Table S1. Standard thermodynamics data for reactants and gaseous by-products of the combustion reaction

Compound	Heat of formation, ΔH_f (kJ/mol)
LiNO _{3(s)}	-483.1
Mn(C ₂ H ₃ O ₂) ₂ ·4H ₂ O _(s)	-859.0
Ni(NO ₃) ₂ ·6H ₂ O _(s)	-415.1
C ₁₂ H ₂₂ O _{11(s)}	-2226.1
C ₆ H ₁₀ O _{8(s)}	-1543.9
C ₂ H ₅ NO _{2(s)}	-528.5
O _{2(g)}	0
CO _{2(g)}	-393.52
H ₂ O _(g)	-241.83
N _{2(g)}	0
LiNi _{0.5} Mn _{1.5} O _{4(s)}	-

All values are considered at standard temperature T= 298 K [19]

Table S2. The influence of fuel on the enthalpy of the combustion reaction ($\Delta H_{combustion}$), and the amount of gases produced during the reactions.

Sample-Fuel	Fuel-to-oxidiser molar ratio	$\Delta H_{combustion}$ (kJ/mol)	Amount of gas produced (mole)
LNMO-C	1.39	-6463.33	35.79
LNMO-G	2.78	-6046.13	34.40
LNMO-S	0.52	-6327.94	32.46

Note: The enthalpy of formation for LiNi_{0.5}Mn_{1.5}O₄ is set at zero

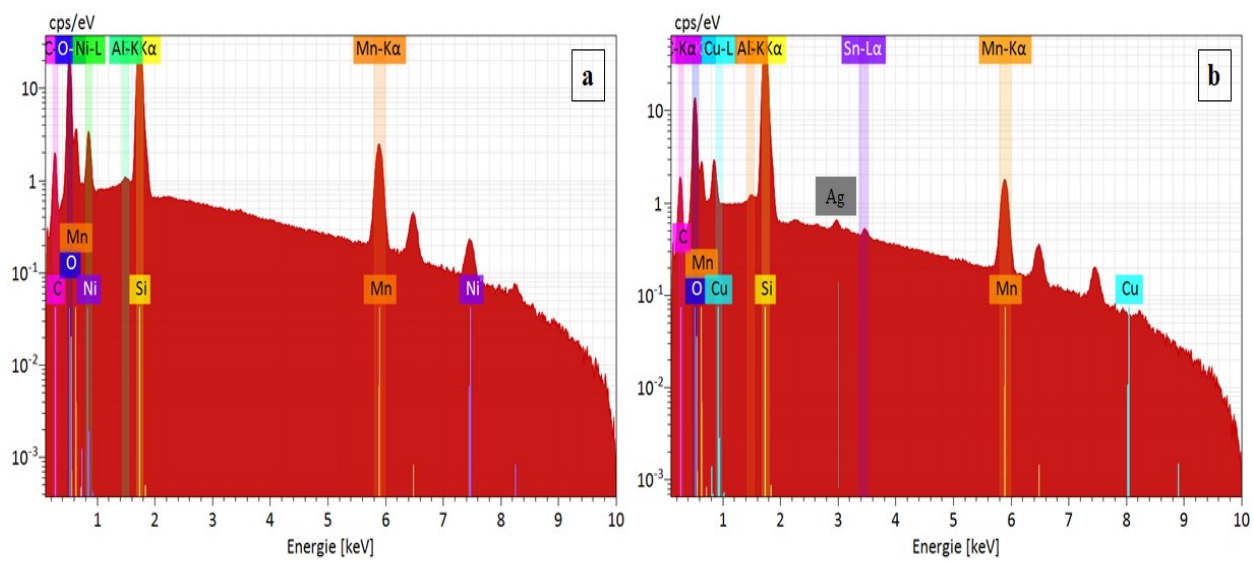


Figure S1. EDS spectra (a) LNMO-G (b) LNMAO

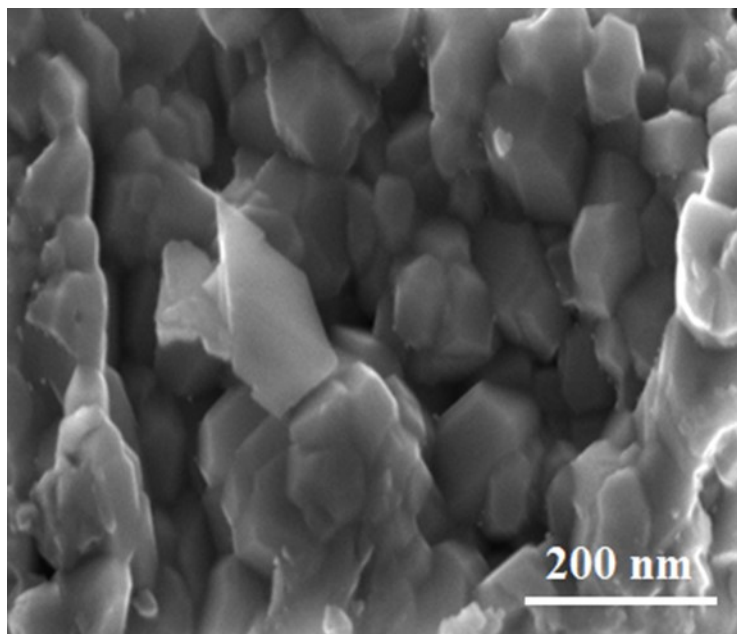


Figure S2. The SEM image of LNMAO

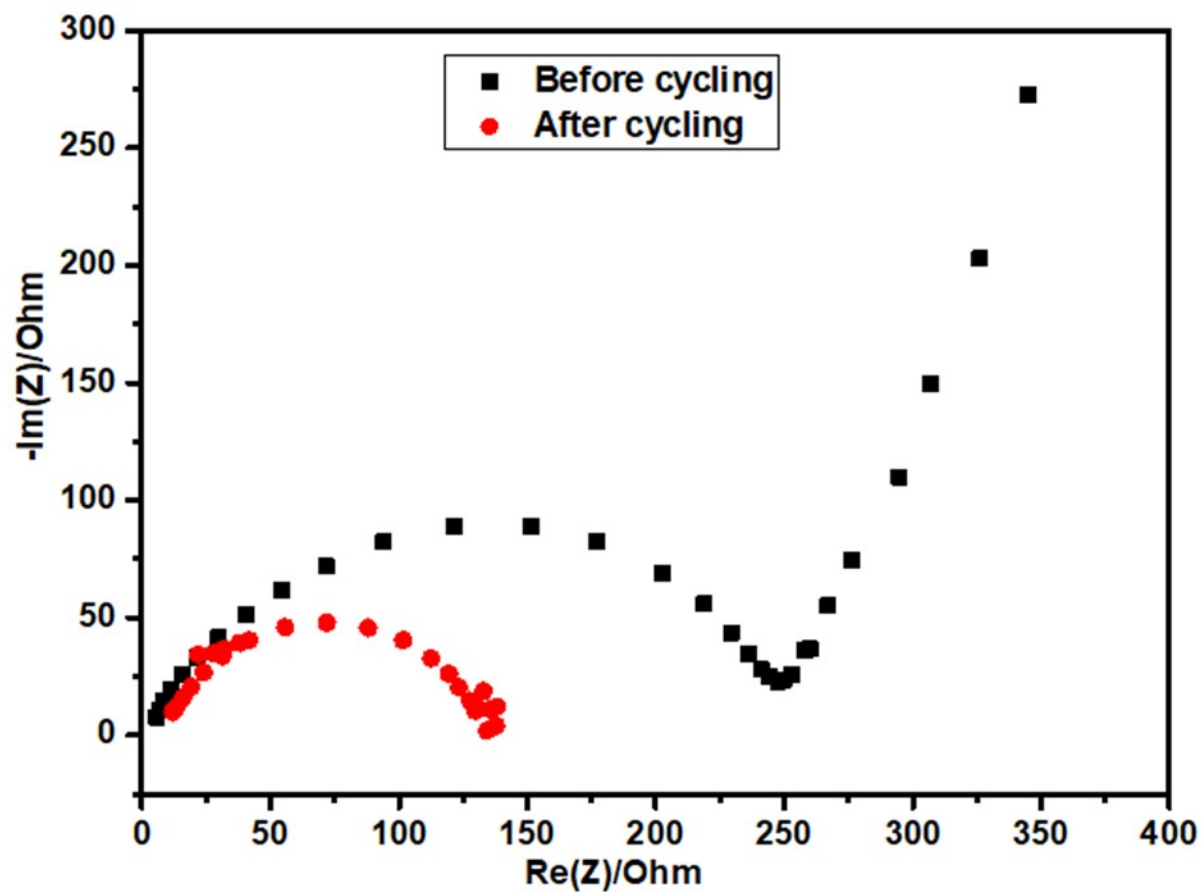


Figure S3. Nyquist plots of the LNMAO cathodes cycled (100 cycles) at 1 C using a voltage range of 3.50 – 5.30 V at 25°C.

Table S3. Elemental analysis of the synthesized LNMAO powder

Sample	Li	Transition (TM) Mn	Metal Ni	TM	Ag	Li + TM	Li/TM
Target Composition	1.00	1.47	0.50	1.97	0.03	2.97	0.51
LNMAO	1.04	1.49	0.49	1.98	0.04	3.02	0.53

Table S4. Impedance data from EIS spectra for the LNMO cathodes before and after cycling

Sample	LNMAO	
	Before cycling	After 100 cycles
Re (Ω)	4.42	9.94
Rct (Ω)	248.37	137.00

Table S5. A comparative evaluation of the electrochemical performance of LNMO cathodes synthesized using different preparation methods

Fuel/Chelating Agent	Method	Voltage Window	Initial Discharge Capacity	Capacity Retention	References
Glycine	Sol-gel combustion	3.50 - 5.30	115.83 (1C)	92.73 (200 cycles;1C)	This work
Citric acid	Sol-gel combustion	3.50 - 5.30	110.87 (1C)	81.68 (200 cycles;1C)	This work
Sucrose	Sol-gel combustion	3.50 - 5.30	28.28 (1C)	92.02 (200 cycles;1C)	This work
Citric acid	Sol-gel	3.5 - 5.0	113 (5C)	85 (500 cycles;1C)	9
	Solid state	3.5 - 5.0	88 (1C)	98 (1000 cycles;1C)	12
Oxalic acid	Solid state	3.0 - 5.0	136.9 (0.3C)	93.4 (300 cycles;0.3C)	16
Ammonium oxalate	Co-precipitation	3.5 - 5.0	141.2 (0.3C)	96.3 (200 cycles;0.3C)	17
PVP	Sol-gel	3.0 – 4.4	55 (0.3C)		18
Potassium permanganate	Molten salt	3.0 - 5.0	120 (1C)	90.1 (50 cycles;0.3C)	19

