Contents

Figure S1 – (Top) Brownian Rotations (Middle) Néel Rotations (Bottom) Hysteresis Loop of a ferromagnetic particle under an alternating current.

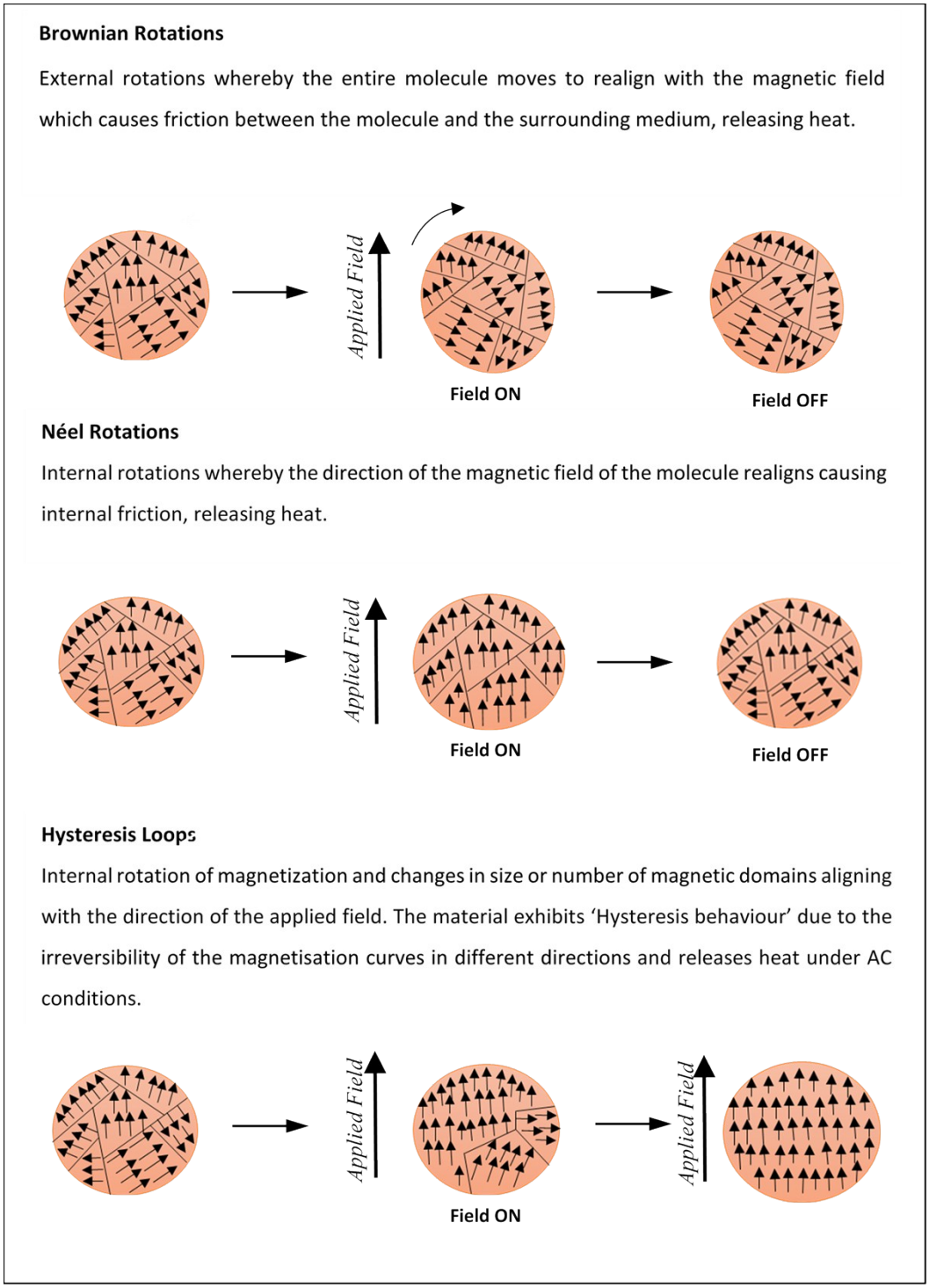


Figure S2– Ideal perovskite structures of (a) Lanthanum manganate and (b) Lanthanum strontium manganate

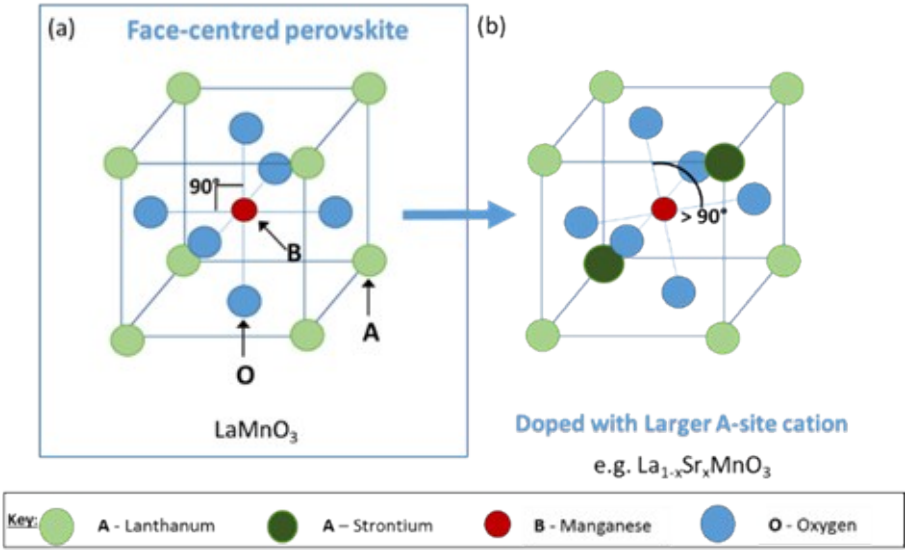


Figure S3 – Double-exchange mechanism involving the resonant transfer of two electrons where one 'spin up' electron is transferred from the intermediate oxide to the Mn^{4+} (Atom 2), and is replaced by another electron from the high-spin Mn^{3+} (Atom 1) which is also 'spin up' to obey the Pauli principle. Thus the magnetic information transferred is ferromagnetic, constantly shuttling back and forth through itinerant electrons (shown in scenarios A and B).

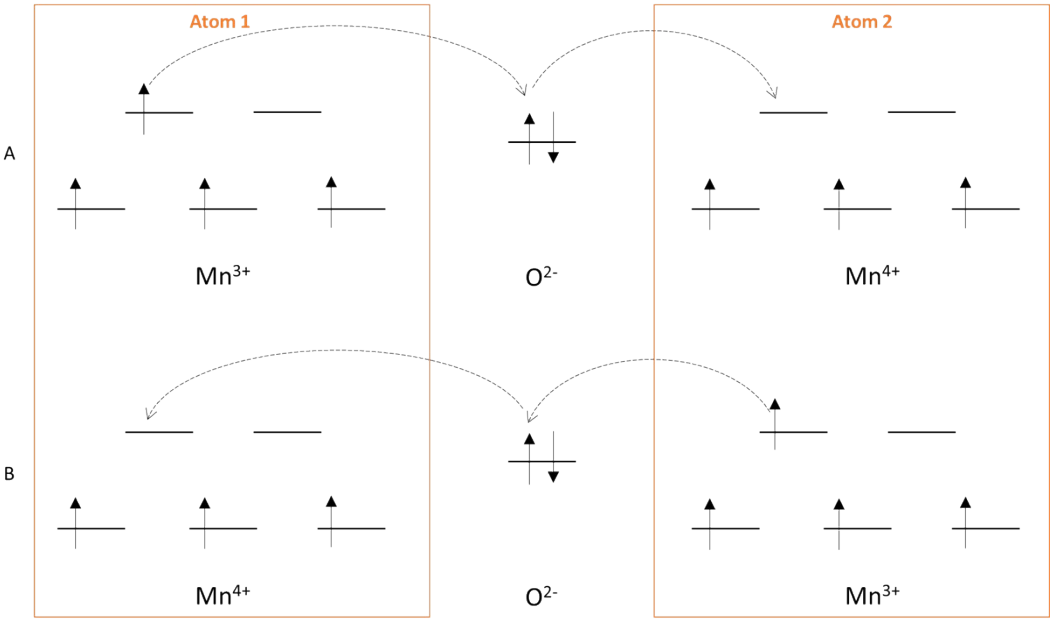


Table S1 - Key characterisations on samples presented in this work. LSMO35 - MW* has been synthesised at 100 W for 2 hours. Hence, LSMO35 - MW*, LSMO35 – 100W* and LSMO35 – 2hrs* are all the same sample.

Sample Code	Heating	Time	EDX	XRD	Induction Heating	SEM	MvT (SQUID)	MvH (SQUID)
LSMO25 - Con	Con	2 hrs	✓	✓				
LSMO35 - Con	Con	2 hrs	✓	✓	✓	✓		
LSMO40 - Con	Con	2 hrs	✓	✓	✓			
LSMO25 - MW	100 W	2 hrs	✓	✓	✓	✓	✓	
LSMO35 - RedVol	Con	2 hrs	✓		✓		✓	
LSMO35 – MW*	100 W	2 hrs	✓	✓	✓	✓	✓	
LSMO35 - 50W	50 W	2 hrs	✓		✓		✓	
LSMO35 - 100W*	100 W	2 hrs	✓	✓	✓	✓	✓	
LSMO35 - 200W	200 W	2 hrs	✓		✓		✓	
LSMO35 - 10min	100 W	10 min			✓	✓		
LSMO35 - 30min	100 W	30 min			✓	✓		
LSMO35 – 2hrs*	100 W	2 hrs	✓	✓	✓	✓	✓	
LSMO40 - MW	100 W	2 hrs	✓	✓	✓	✓	✓	

Table S2 - Lattice parameters and atomic coordinates for **(a)** Orthorhombic (Pnma) and **(b)** Rhombohedral (R-3c) which were used to as input parameters for Rietveld analysis for each material.

(a) Orthorhombic (Pnma) lattice parameters and atomic coordinates

a = 5.5743, b = 7.695 and c = 5.537

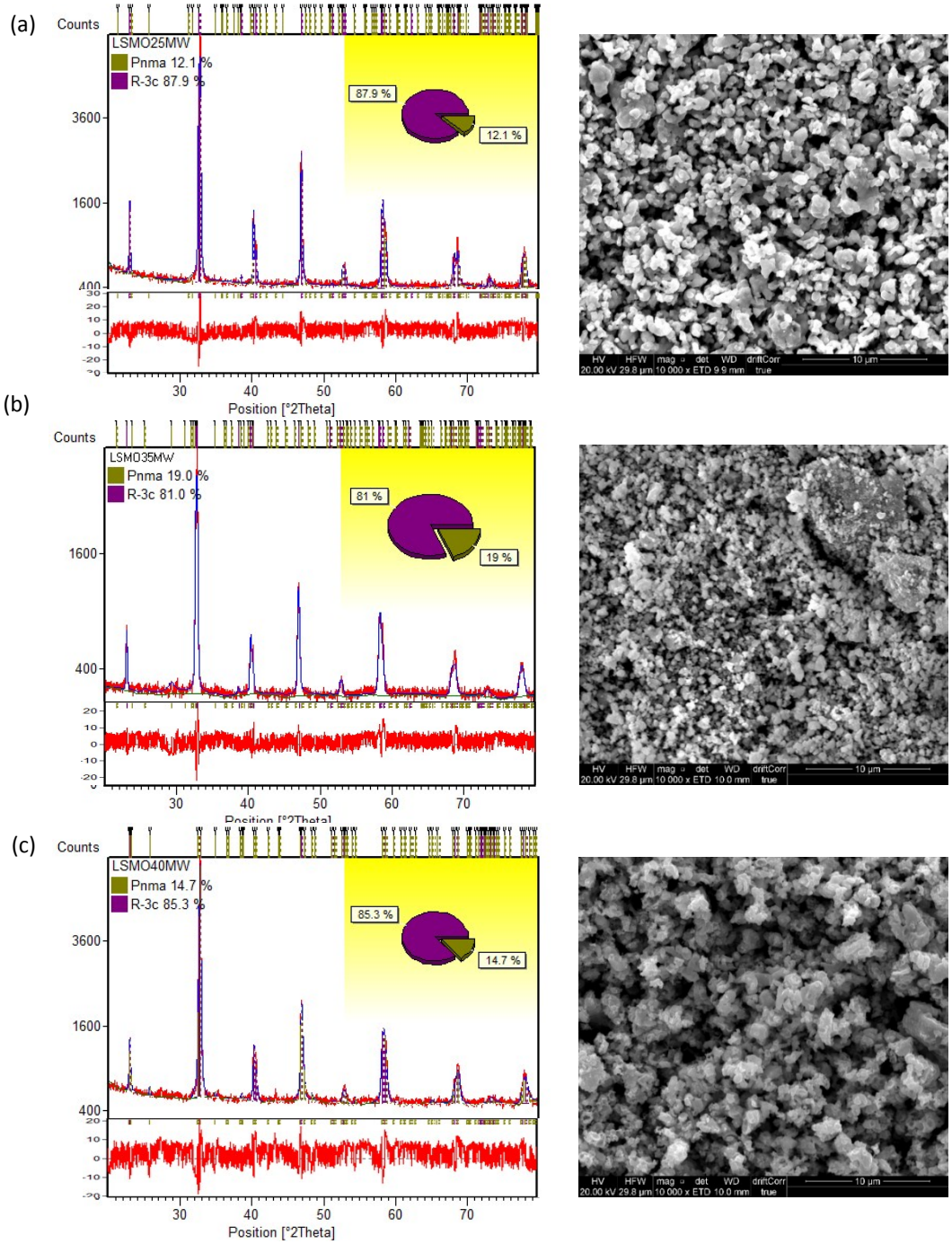
Atom	Wycoff Position	x	y	z	B_{Iso}
La	4c	0.55	0.25	0.009	0.5
Mn	4a	0	0	0	0.5
O(1)	4c	-0.011	0.25	-0.071	0.5
O(2)	8d	0.309	0.039	0.225	0.5

(b) Rhombohedral (R-3c) lattice parameters and atomic coordinates

a = b = 5.5212 and c = 13.37908

Atom	Wycoff Position	x	y	z	B_{Iso}
La	6a	0	0	0.25	0.5
Mn	6b	0	0	0	0.5
O	18e	0.5511	0	0.25	0.5

Figure S4 – Rietveld analyses of X-ray diffraction patterns and scanning electron micrographs (SEM) of a selection of LSMO materials (a) LSMO25-MW (b) LSMO35-MW and (c) LSMO40-MW to quantify the relative weight percentages of orthorhombic (Pnma) and rhombohedral (R-3c) crystalline phases. The red line below each diffraction pattern is the difference plot which gives an indication of the variation between the calculated and experimental data.



Equation S1 - The SAR is estimated using the following corrected slope method equation using Wildeboer *et.al*'s method:

$$SAR_{corrected\ slope} = \frac{C_w \frac{\Delta T_W}{\Delta t} + L\Delta T_w}{m_{MNP}}$$

where C_w = Specific Heat Capacity (J g^{-1} K^{-1}) of water, m_{MNP} = Weight fraction of the magnetically active element, $\frac{\Delta T_w}{\Delta t}$ = Change in Temperature against time, L = Thermal Losses of the system.

Figure S5 – EDX Maps - LSMO25MW

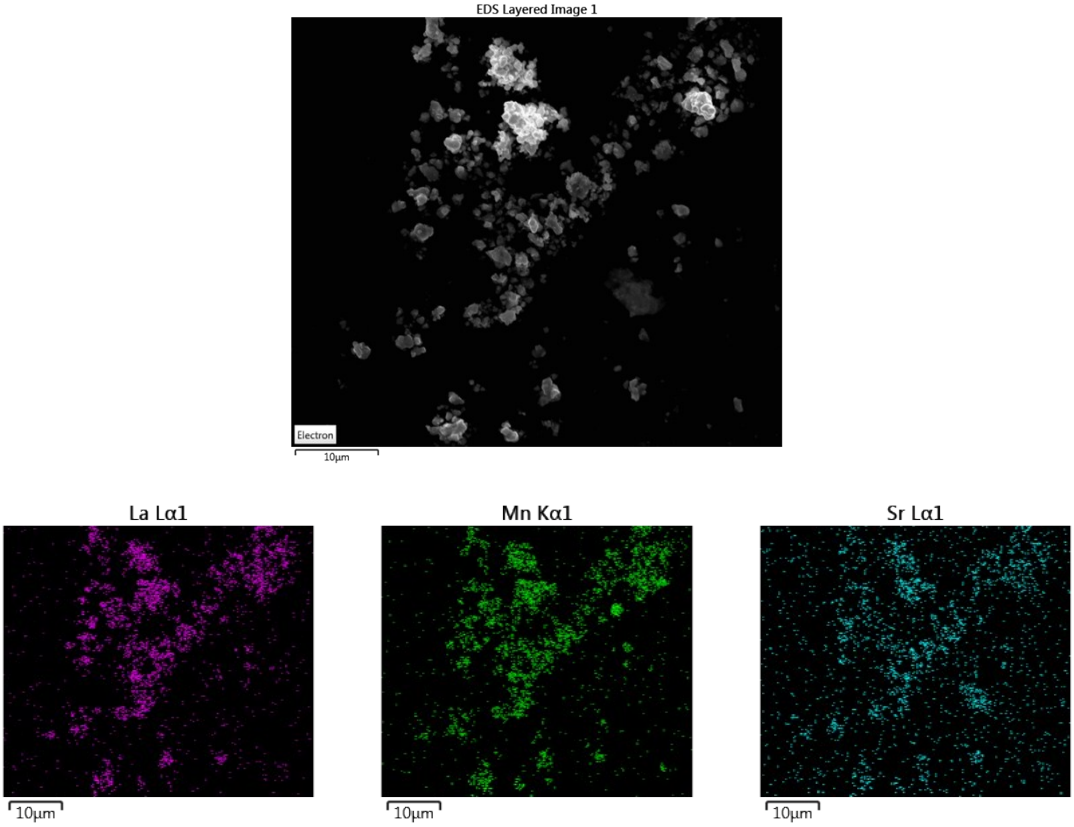
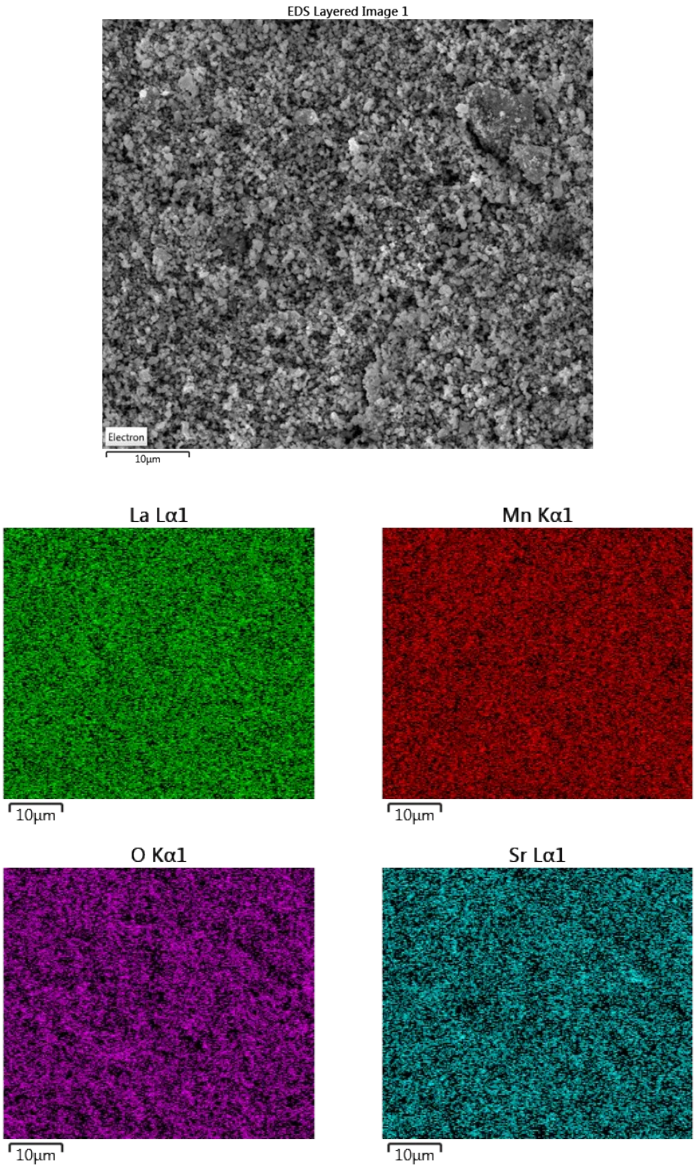


Figure S6 – EDX Maps of LSMO35MW



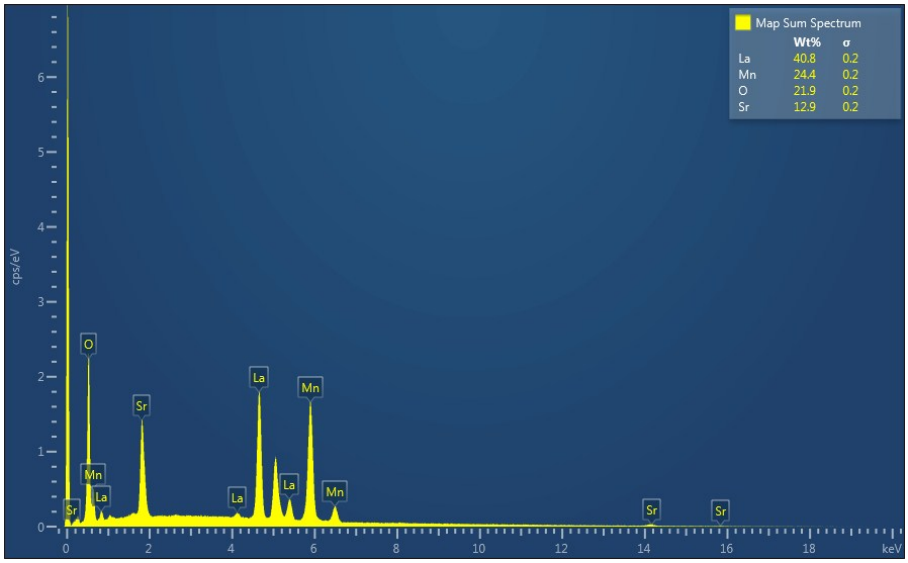


Figure S7 – EDX Maps of LSMO40MW

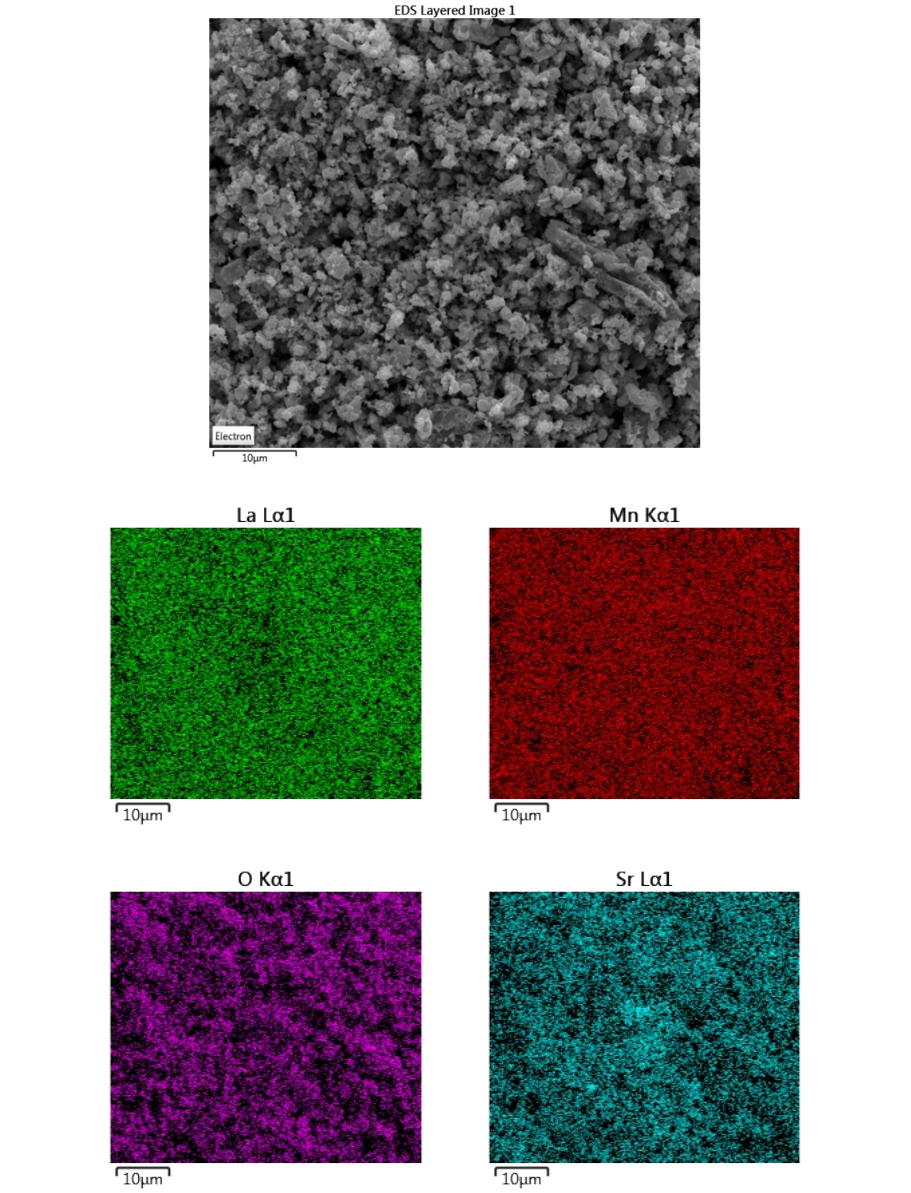


Figure S8 – EDX Maps of LSMO35RedVol

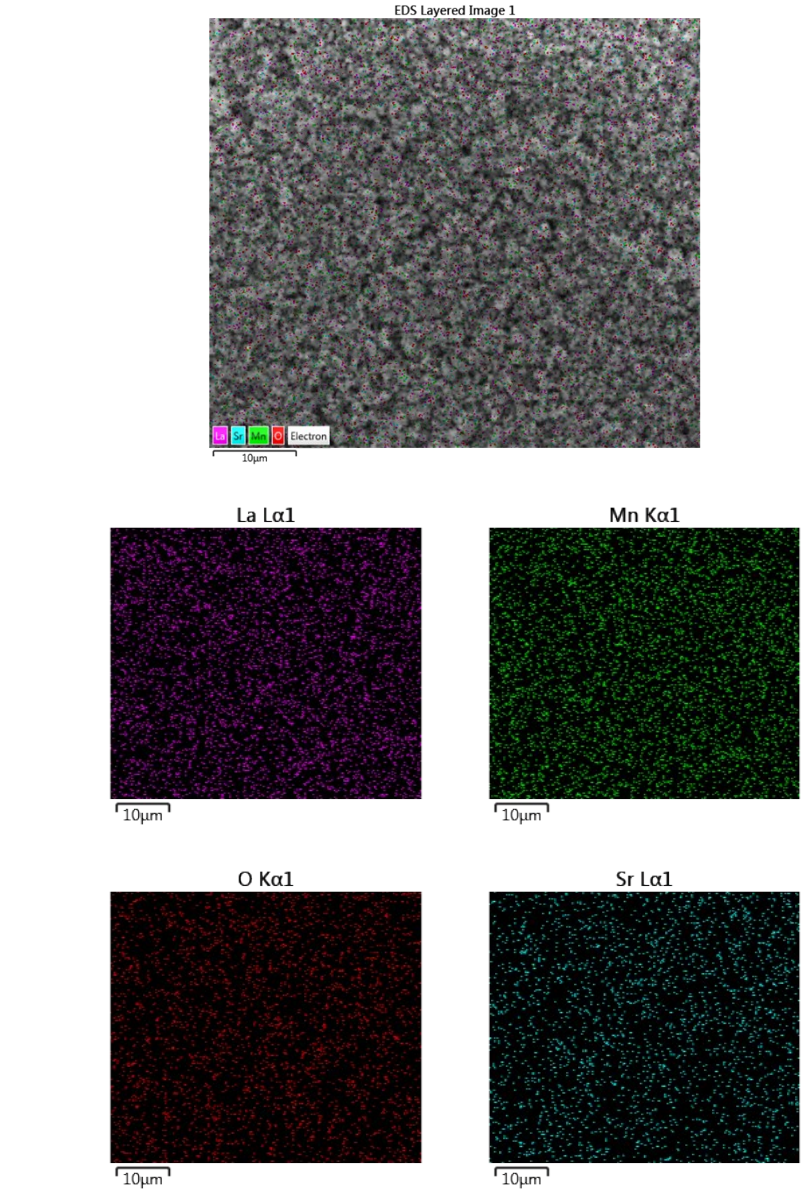
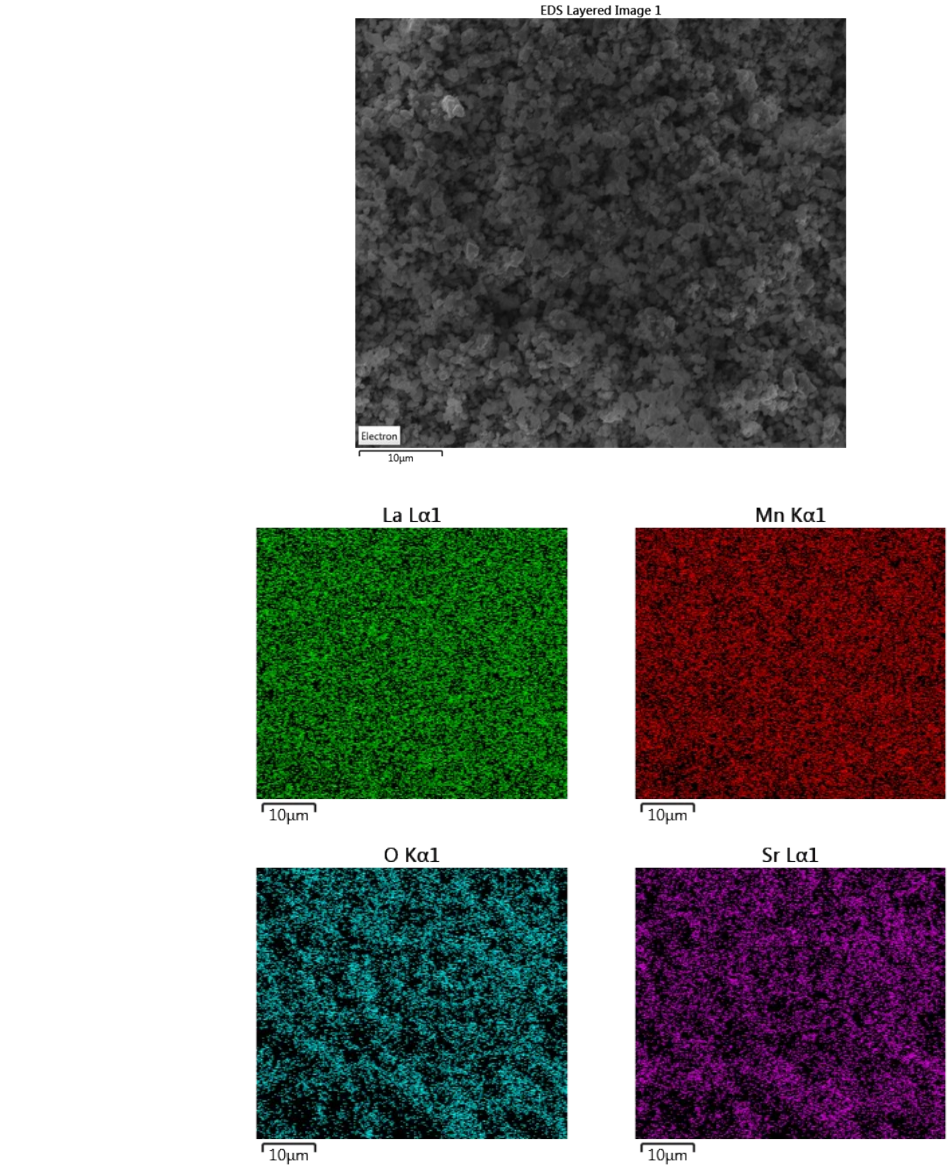


Figure S9 – EDX Maps of LSMO35MW 50W



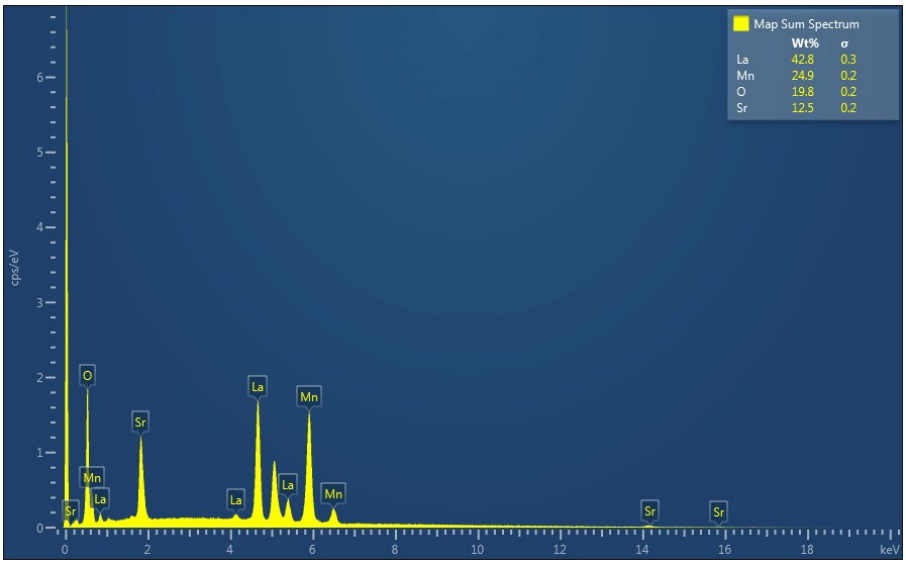


Figure S10 - The relationship between the strontium dopant level (x) and the percentage of Pnma crystal structure as determined from Rietveld analysis of powder diffraction data. Connecting lines are included as a guide to the eye. A polynomial fit was limited to the dopant range of interest where $0.25 \leq x \geq 0.4$.

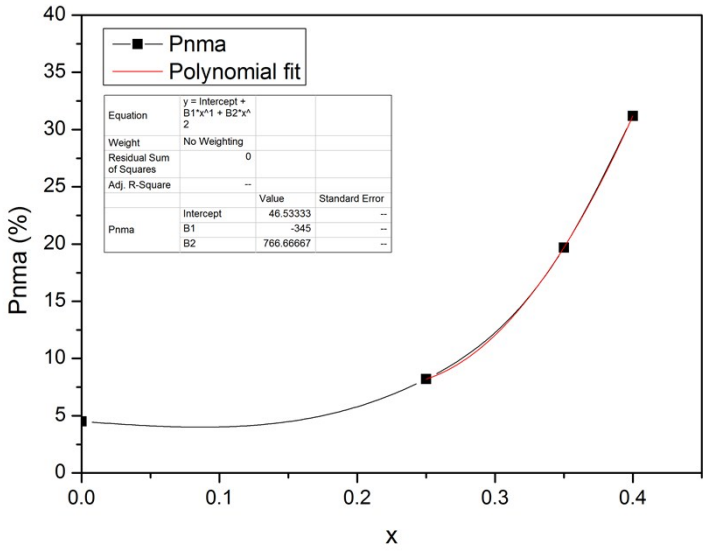
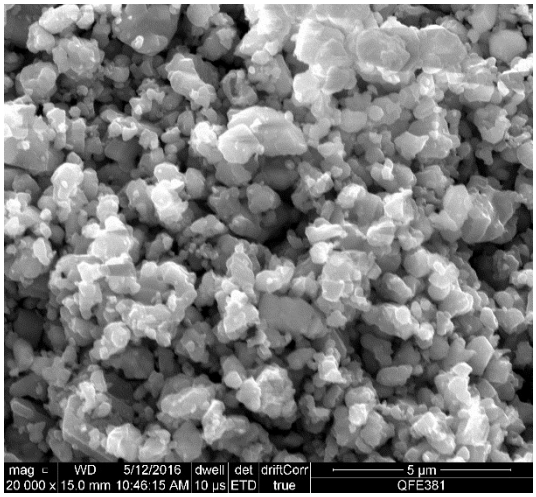
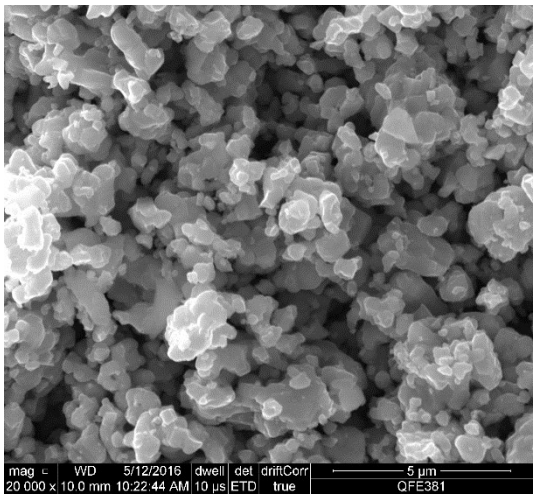


Figure S11 – SEM comparison (a) LSMO35MW-10 minutes (b) LSMO35MW – 30 minutes and (c) LSMO35MW - 2 hours taken at x20,000 magnification.

(a)



(b)



(c)

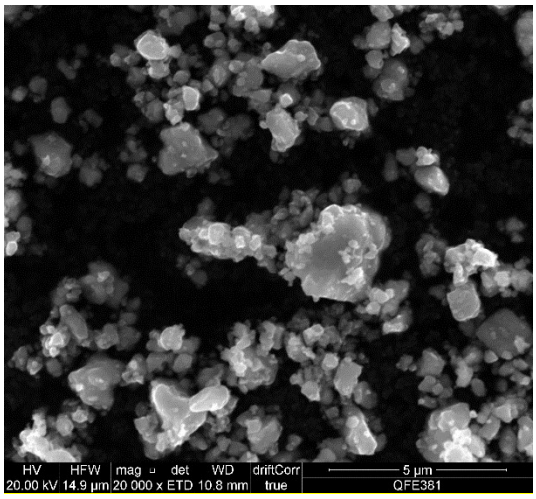
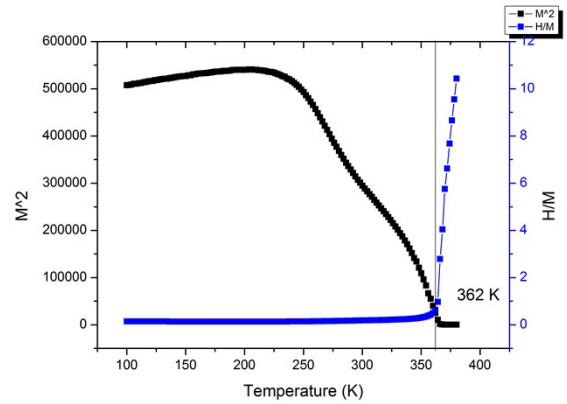
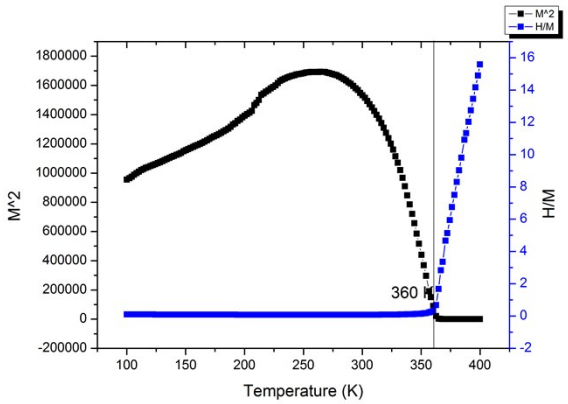


Figure S12 – Arrott plots to calculate Curie Temperatures for (a) LSMO35MW-Con, (b) LSMO35MW-50W, (c) LSMO35MW-100W, (d) LSMO35MW-200W.

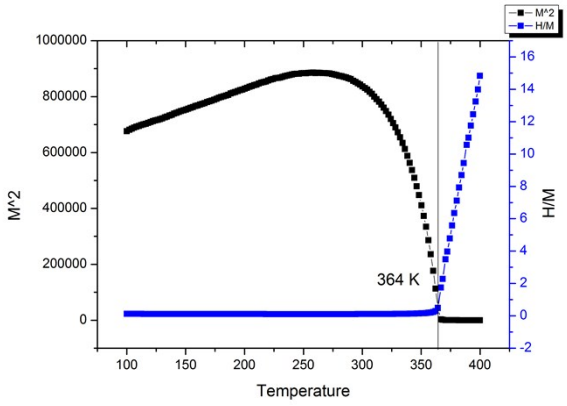
(a)



(c)



(b)



(d)