

Tuning of Curie Temperature in $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$ manganites by Annealing Conditions

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Discovery of colossal magnetoresistivity and giant magnetocaloric effect in perovskite-like lanthanum manganites made them attractive for practical applications[1]. The properties of manganites are very sensitive to compositions and sintering conditions[2,3]. We present here the careful analysis results for $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$ manganites which were processed with different annealing conditions.

The samples were prepared by the conventional solid-state reaction technique. A stoichiometric mixture of La_2O_3 , CaCO_3 , and MnO_2 precursors was calcined at 1100°C for 8 h. The calcination process was repeated several times with intermediate grinding. The final sintering was made at different temperatures and cooling rates in air as presented in Table 1.

Table 1. Variation of cell parameters, volume of unit cell, and Curie temperature of sintered samples due to different annealing conditions.

Sample ID	Annealing Temp($^\circ\text{C}$)	Cooling Rate	Cell parameters (\AA)			Volume (\AA^3)	T_C (K)
			a	b	c		
a	1400	17 $^\circ\text{C}/\text{min}$	5.4707	7.6803	5.4520	229.0	216
b	1400	5 $^\circ\text{C}/\text{min}$	5.4729	7.6810	5.4563	229.3	242
c	1400	2 $^\circ\text{C}/\text{min}$	5.4692	7.6805	5.4678	229.6	242
d	1200	2 $^\circ\text{C}/\text{min}$	5.4679	7.6784	5.4570	229.1	247
e	1200	5 $^\circ\text{C}/\text{min}$	5.4693	7.6797	5.4528	229.0	242

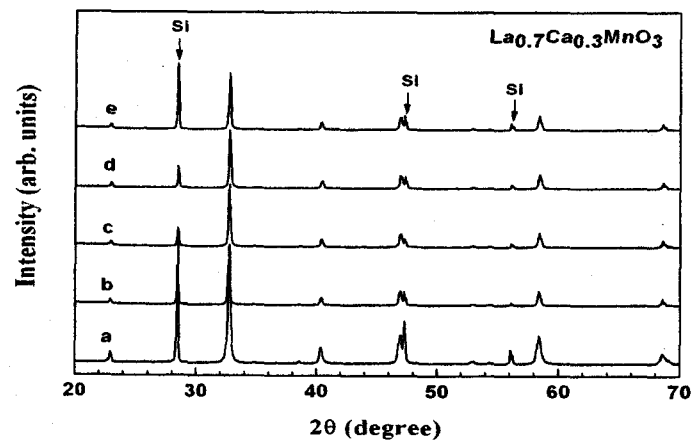


Fig.1. X-ray diffraction profiles of $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$ samples. The XRD patterns a-e corresponds to the samples in Table 1.

According to x-ray Cu K_{α} diffraction analysis the samples were single orthorhombic $Pbnm$ phase. Si powder was used as reference material to get more accurate values of cell parameters (error bars were about 0.0006 Å). It is obvious that annealing conditions affect the lattice parameters of the samples (See Fig.1). There is a tendency that higher sintering temperature and slower cooling rate increase cell volumes of the samples (See Table.1).

The temperature dependencies of magnetization for our samples are represented in Fig.2. The $M-T$ curves revealed that slow cooling rate increases Curie temperature (T_C). Compared to 1400°C, 1200°C annealing temperature caused higher T_C .

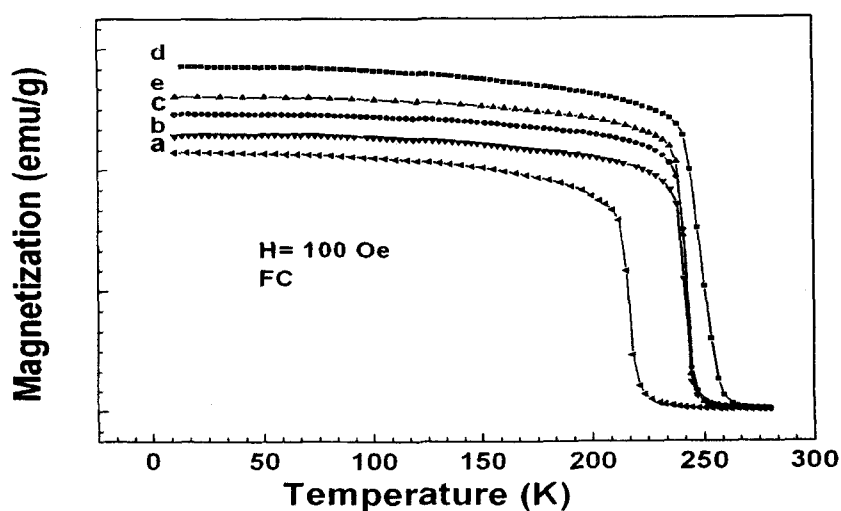


Fig. 2. Temperature dependence of magnetization of the samples in the field of 100 Oe

1. J.M.D. Coey, M.Viret, and S. von Molnar, *Advances in Physics* 48 (1999) 167.
2. D.C. Worledge et al., *J. Appl. Phys.* 80 (1996) 5158.
3. G. Venkataiah et al., *Physica B* 357 (2005) 370.