The multiphase structural evolution and electromagnetic properties driven by Co (III) ions of $La_{2-x}Sr_xCoMnO_6$ (x = 0~1.0) polycrystals

Xuesong Wang, Hongyuan Song*, Kun Dong, Ruihang Yao, Haorong Wu, Xiaolong Yang, Liangwei Chen, Bin Liu, Zhenhua Ge, Lan Yu**

Faculty of Materials Science and Engineering, Kunming University of Science and Technology, Kunming, 650093, PR China

** Corresponding Authors: songhongyuan0227@outlook.com* (*Hongyuan Song*), *yulan000@hotmail.com* (*Lan Yu*).

The standard crystal structure cif card used for XRD structural refinement is as follows:

Monoclinic crystal system of ordered phase La_2CoMnO_6 ($P2_1/n$, ICSD #98240);

Orthorhombic crystal system of disordered phase La_2CoMnO_6 (*Pbnm*, ICSD #151836);

Rhombohedra crystal system of $La_{1.6}Sr_{0.4}CoMnO_6$ (*R3c*, ICSD #151839);

Cubic crystal system of $LaSrCoMnO_6$ (*Fm-3m*, ICSD # 96530).

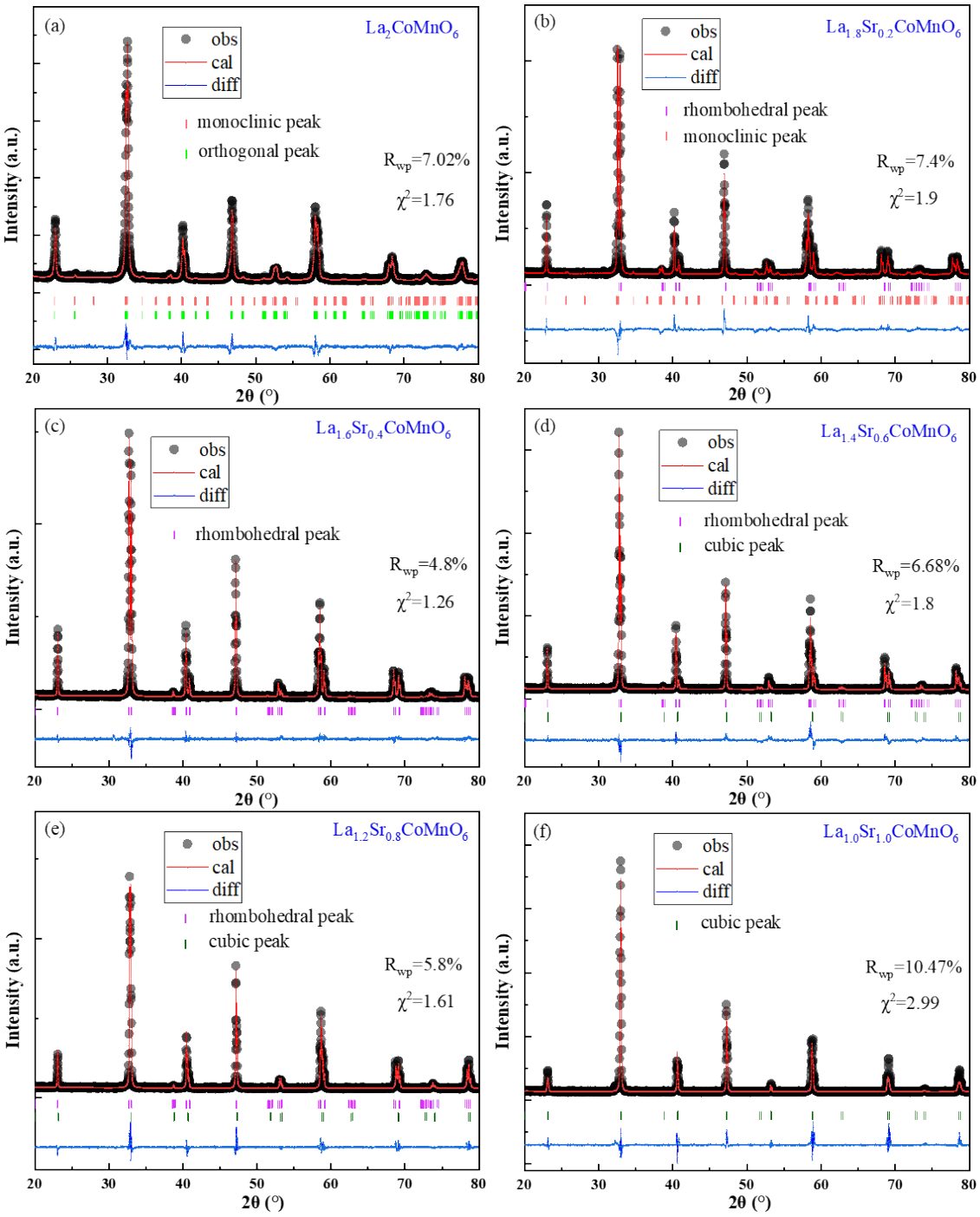

Fig. S1. XRD structural refinement profiles of $La_{2-x}Sr_xCoMnO_6$ ceramics (a) $x = 0$, (b) $x = 0.2$, (c) $x = 0.4$, (d) $x = 0.6$, (e) $x = 0.8$, (f) $x = 1.0$.

Tab. S1. Oxidation states, coordination numbers, and corresponding ionic radii of the elements r_c.

Element	Oxidation	Coordination Number	r_c/Å
La	+3	XII	1.36
Sr	+2	XII	1.44
Co	+2	VI	0.745
	+3	VI	0.61
Mn	+3	VI	0.654
	+4	VI	0.53
O	-2	VI	1.4

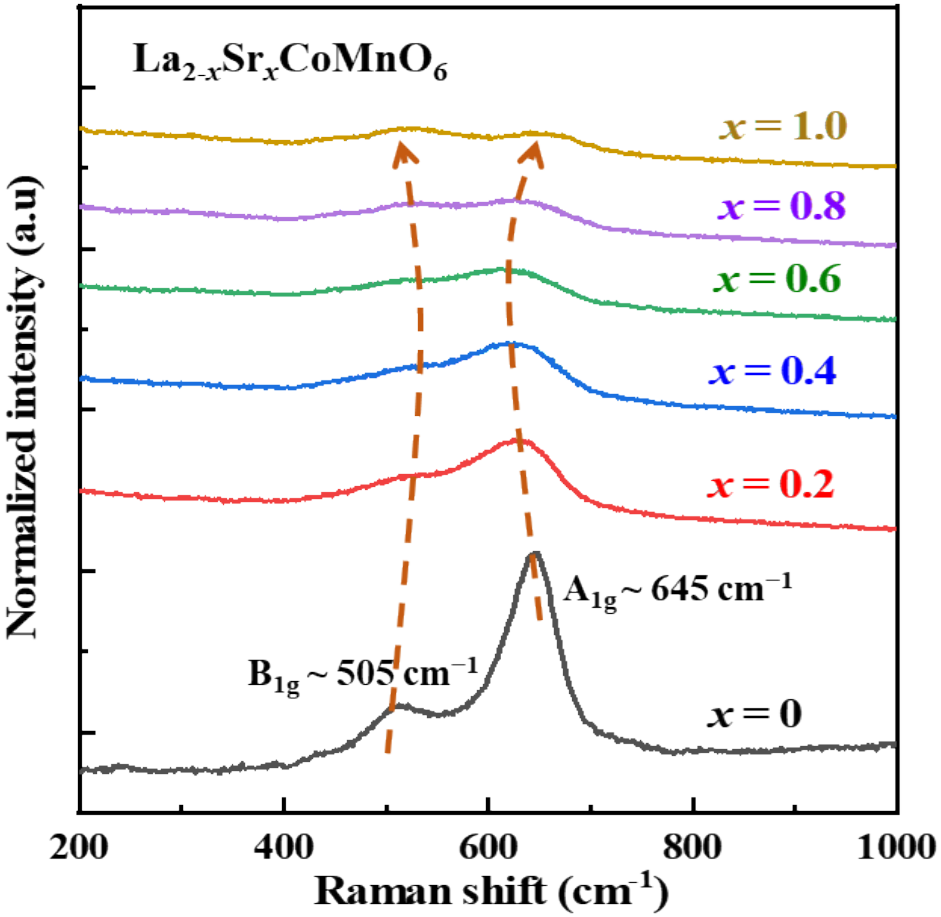

Fig. S2. Raman spectra of $La_{2-x}Sr_xCoMnO_6$ (x = 0~1.0) ceramics.

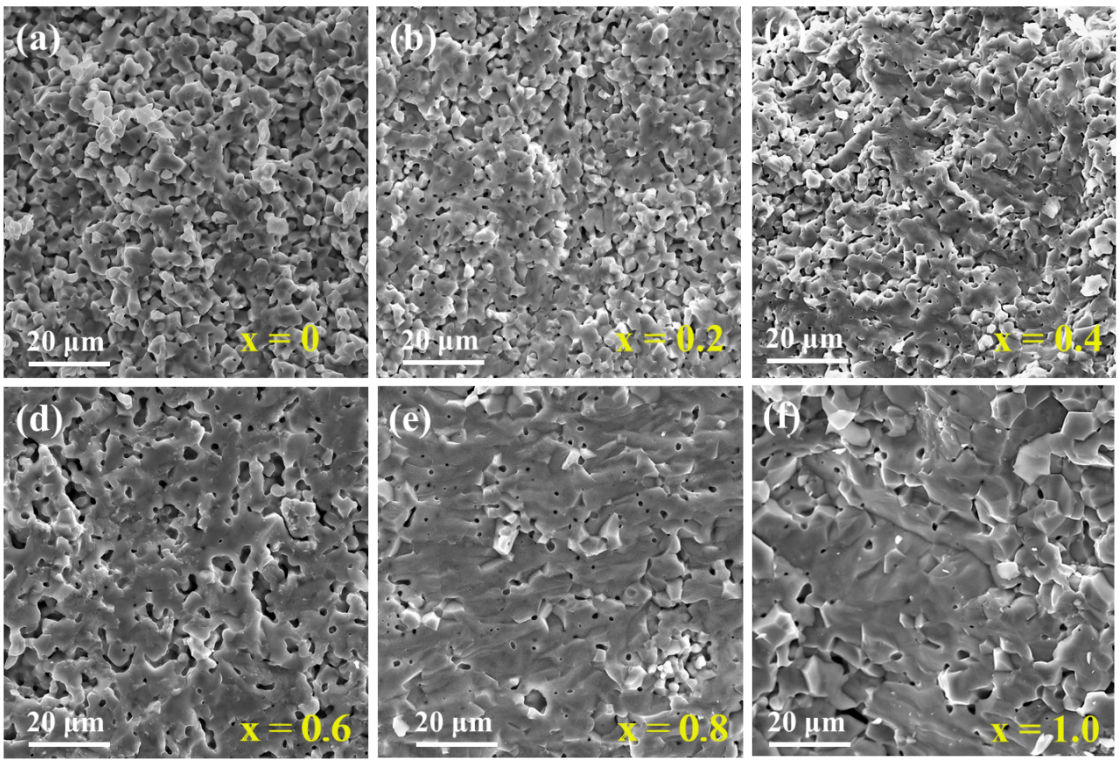

Fig. S3. SEM topography of $La_{2-x}Sr_xCoMnO_6$ ceramics

(a) $x = 0$, (b) $x = 0.2$, (c) $x = 0.4$, (d) $x = 0.6$, (e) $x = 0.8$, (f) $x = 1.0$.

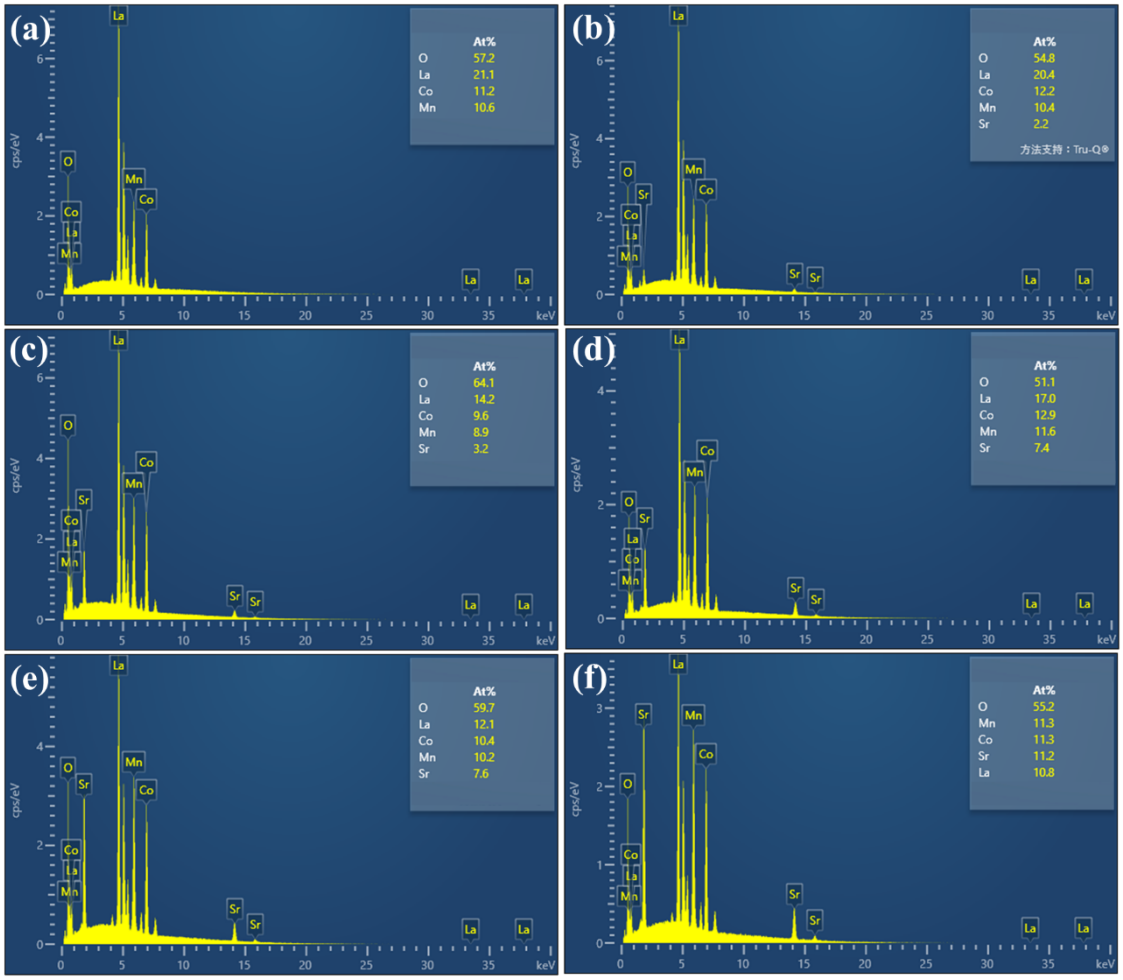

Fig. S4. Atomic ratio of element distribution in EDS atlas of $La_{2-x}Sr_xCoMnO_6$ ceramics (At%) (a) x = 0, (b) x = 0.2, (c) x = 0.4, (d) x = 0.6, (e) x = 0.8, (f) x = 1.0.

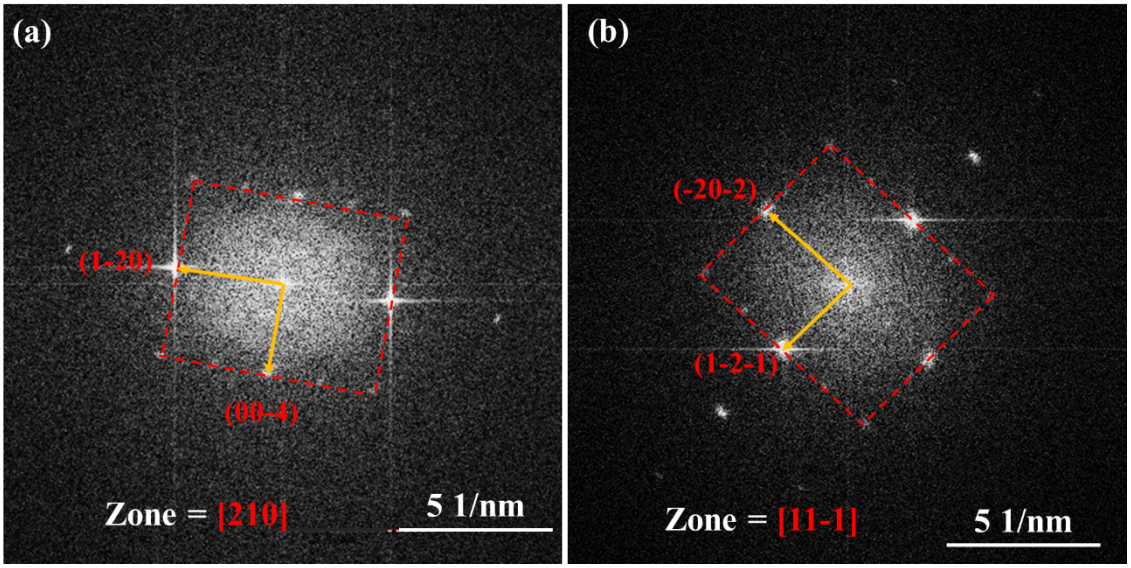

Fig. S5. (a) FFT diagram corresponding to LS0.4CMO along the crystal band axis [210]; (b) corresponding to LSCMO FFT diagram along the [11-1] band axis.

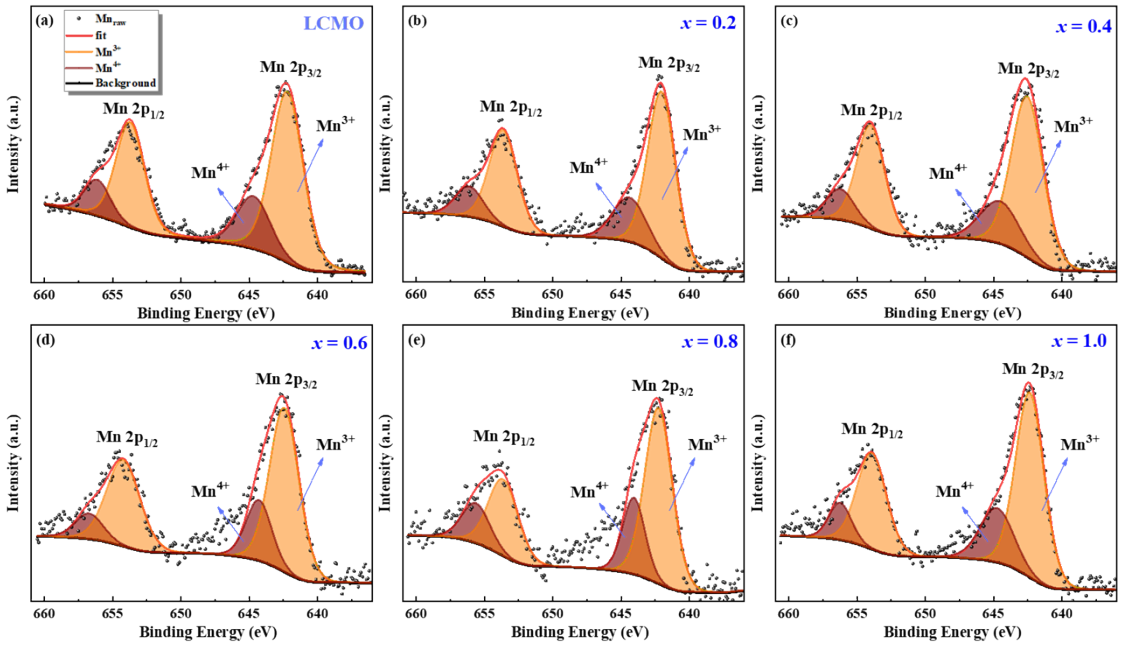

Fig. S6. Mn ion binding energy and fitting map of LS*x*CMO samples (a) $x = 0$, (b) $x = 0.2$, (c) $x = 0.4$, (d) $x = 0.6$, (e) $x = 0.8$, (f) $x = 1.0$.

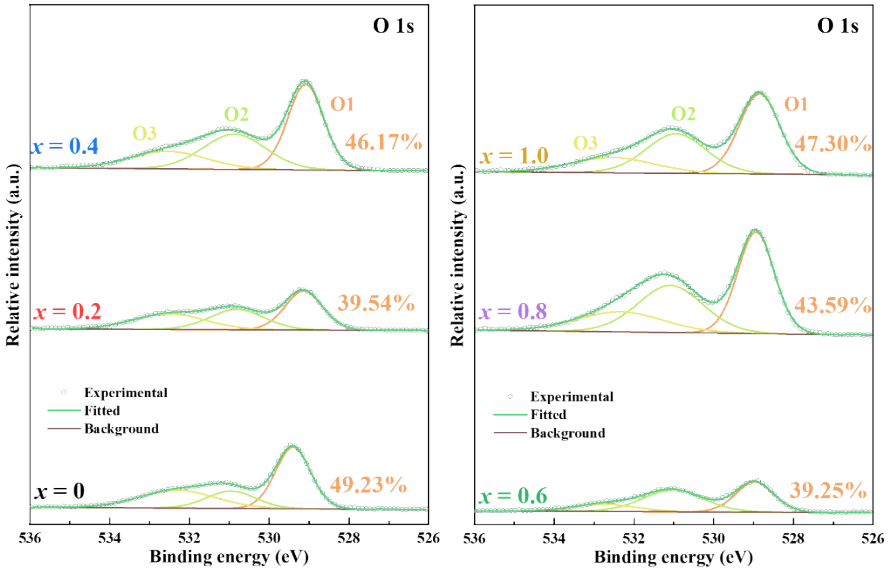

Fig. S7. Deconvoluted O-1s XPS spectra of $La_{2-x}Sr_xCoMnO_6$ ($x = 0$~1.0) ceramics.

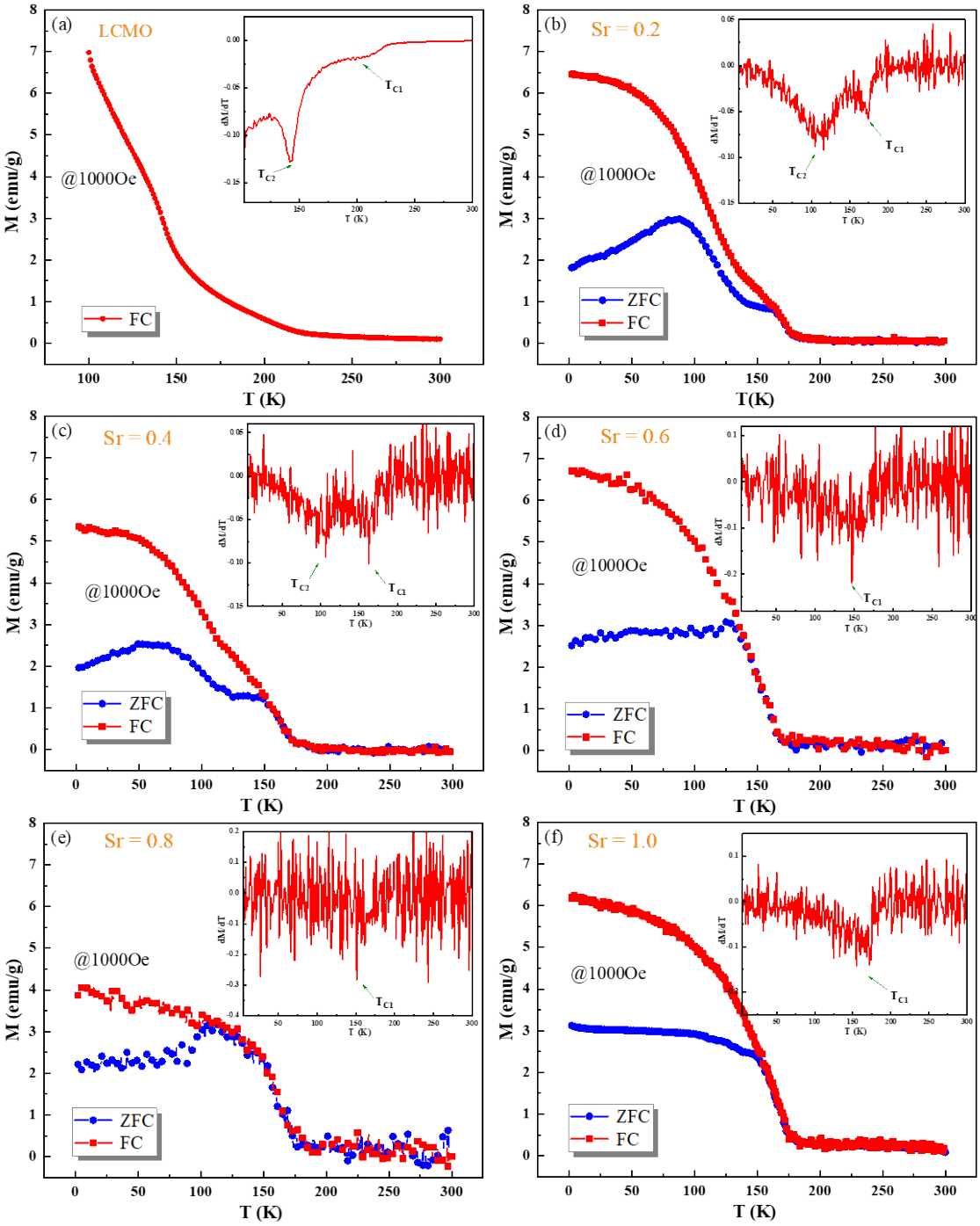

Fig. S8. *M-T* data under ZFC and FC modes for 1000 Oe field in the LS*x*CMO samples (a) $x = 0$, (b) $x = 0.2$, (c) $x = 0.4$, (d) $x = 0.6$, (e) $x = 0.8$, (f) $x = 1.0$, and the inset of their respective figures represents the first derivative of ZFC magnetization with temperature.