Supporting Information

Synergistic Effects of Intrinsic Cation Disorder and Electron-Deficient Substitution on Ion and Electron Conductivity in $La_{1-x}Sr_xCo_{0.5}Mn_{0.5}O_{3-\delta}$ (x = 0, 0.5, and 0.75)

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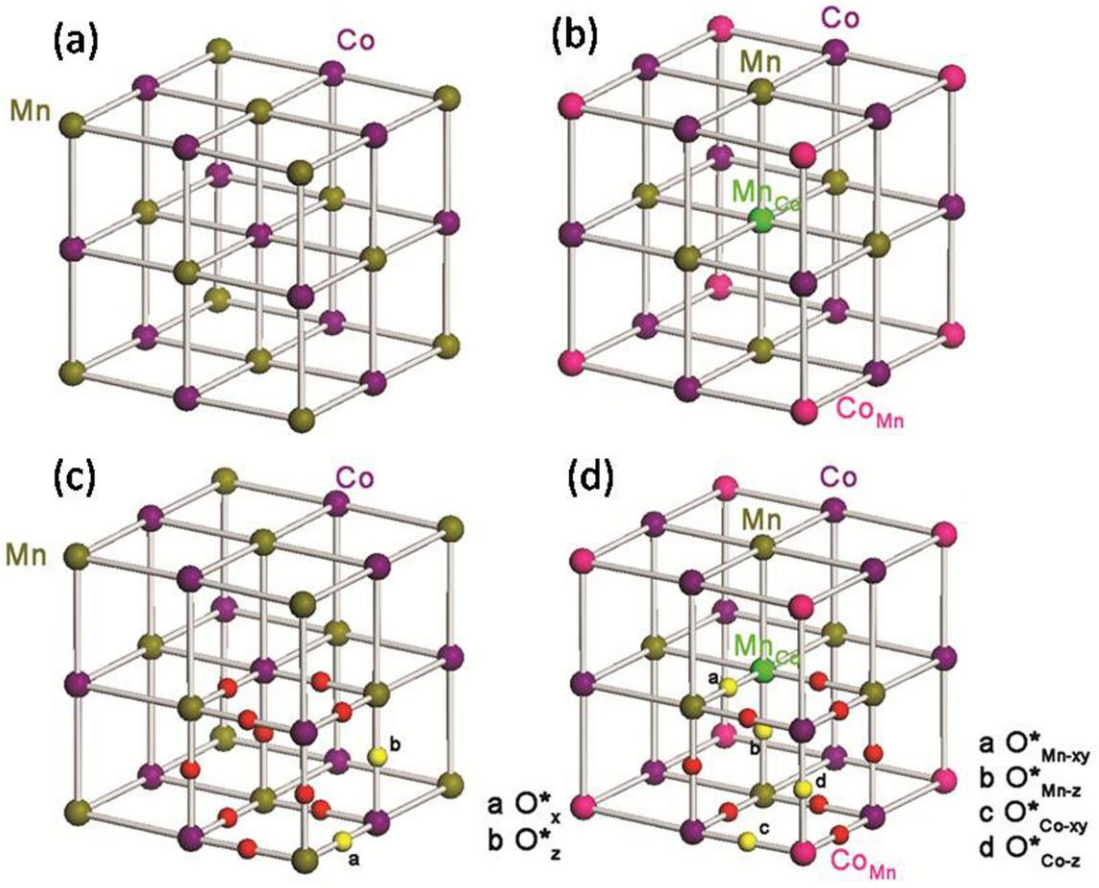

Figure S1. (a) Perfect LCMO supercell; (b) LCMO with antisite defects (AD: LCMO); (c) Oxygen vacancies considered in perfect LCMO supercell; (d) Oxygen vacancies consider in AD: LCMO. Different atoms are represented in different color as labeled in the figure.

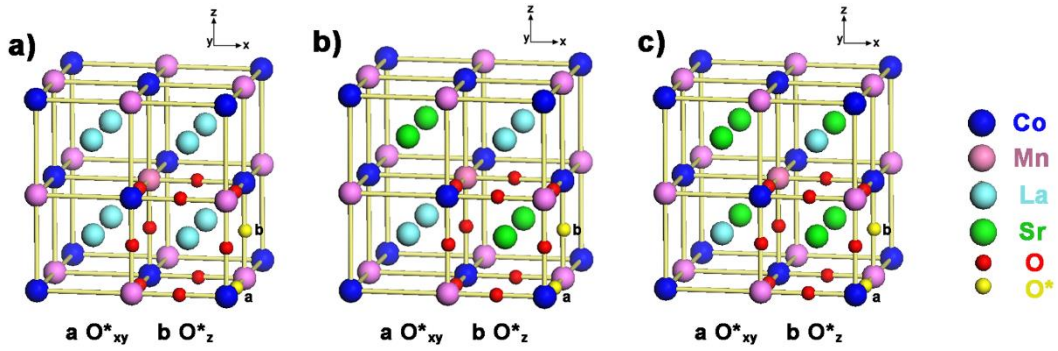

Figure S2. (a) Oxygen vacancies in LCMO (O*: LCMO); (b) oxygen vacancies in $L_{0.5}S_{0.5}$CMO (O*: $L_{0.5}S_{0.5}$CMO); (c) oxygen vacancies in $L_{0.25}S_{0.75}$CMO (O*: $L_{0.25}S_{0.75}$CMO).

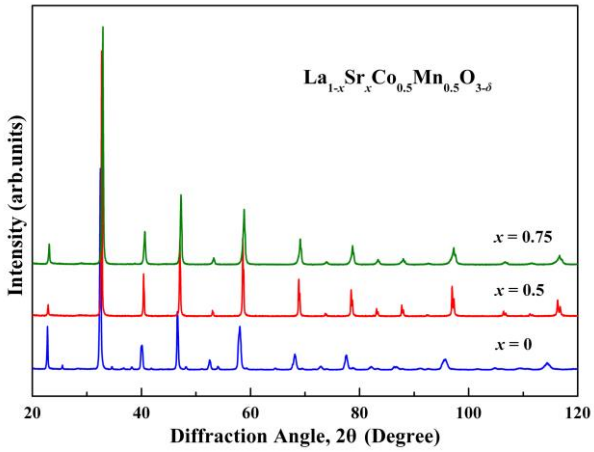

Figure S3. Powder X-ray diffraction patterns of the $La_{1-x}Sr_xCo_{0.5}Mn_{0.5}O_{3-\delta}$ (x = 0, 0.5, and 0.75) series at room temperature.

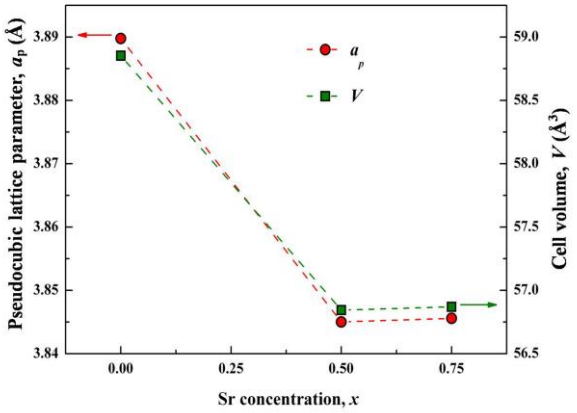

Figure S4. The pseudocubic lattice parameter and cell volume for $La_{1-x}Sr_xCo_{0.5}Mn_{0.5}O_{3-\delta}$ (x =0, 0.5, and 0.75) obtained from Rietveld Refinement of powder X-ray diffraction data.

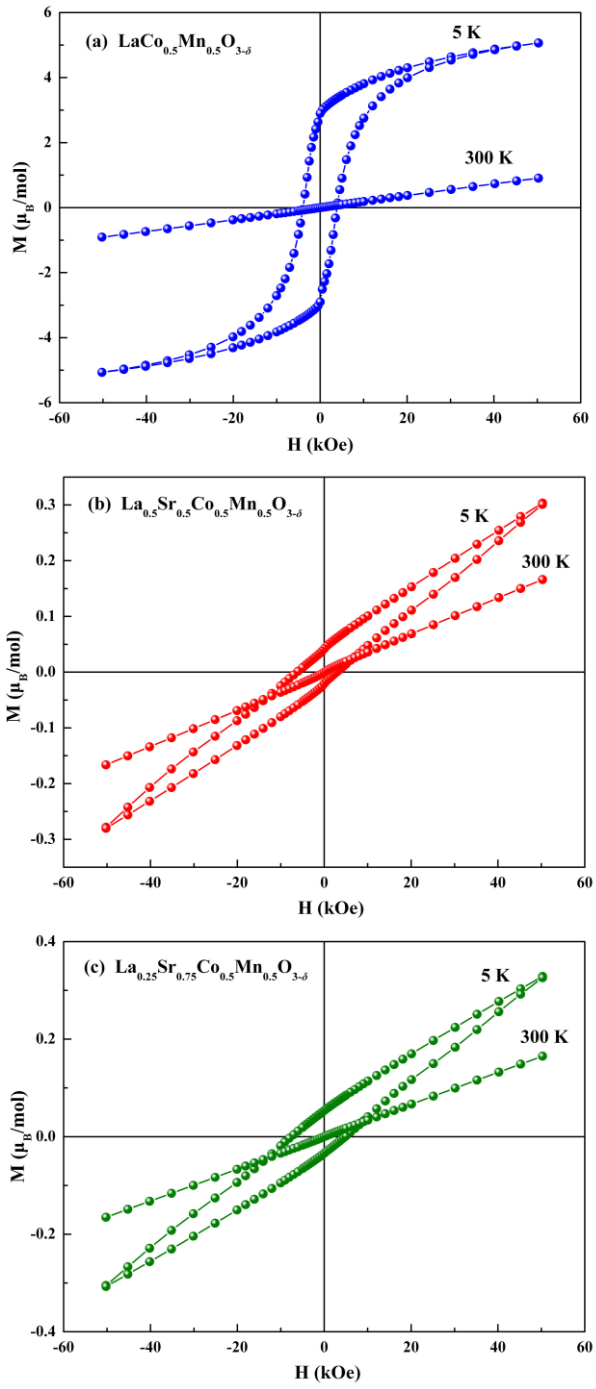

Figure S5. The M–H hysteresis loops of $La_{1-x}Sr_xCo_{0.5}Mn_{0.5}O_{3-\delta}$ (x = 0, 0.5, and 0.75) at T = 5 K and 300 K over the magnetic field range from –5 T to 5 T.

Table S1. Bond lengths and angles for $La_{1-x}Sr_xCo_{0.5}Mn_{0.5}O_{3-\delta}$ (x = 0, 0.5, and 0.75) obtained from Rietveld refinement of powder X-ray diffraction data.

Doping content	***x* = 0**	***x* = 0.5**	***x* = 0.75**
Space group	*Pnma* (No. 62)	*P4/mmm* (No. 123)	*Pnma* (No. 62)
Co(Mn)-O1 ×2 (Å)	2.024(4)	1.928(6)	1.937(13)
Co(Mn)-O2 ×2(Å)	1.911(12)	1.922(3)	1.951(29)
Co(Mn)-O2 ×2 (Å)	2.027(11)	—	1.964(28)
Co(Mn)-O3 ×2(Å)	—	1.917(6)	—
Co(Mn)-O1-Co(Mn)(deg)	147.5(7)	180	164.5(6)
Co(Mn)-O2-Co(Mn) (deg)	162.74(2)	179.674(2)	158.85(31)
Co(Mn)-O3-Co(Mn) (deg)	—	179.960(0)	—