

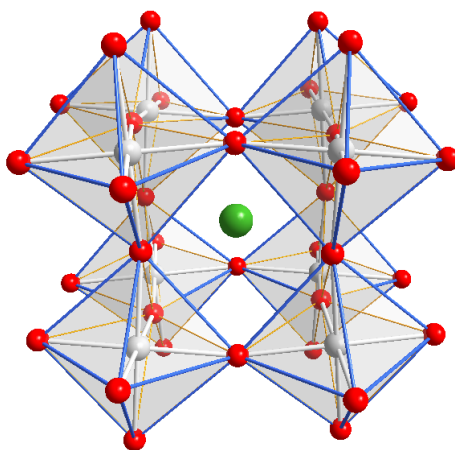
## Synthesis, Structure and Simulation of magnetic disorder of doped Copper manganite $\text{La}_{0.65}\text{Ce}_{0.05}\text{Sr}_{0.3}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$

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Bulk nanocrystalline samples of  $\text{La}_{0.65}\text{Ce}_{0.05}\text{Sr}_{0.3}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$  ( $0 < x < 0.15$ ) manganites are prepared by the sol-gel based Pechini method. The effect of the substitution for Mn with Cu upon the structural and magnetic properties has been investigated by means of X-ray diffraction (XRD), Raman spectroscopy and dc magnetization measurements. The structural parameters obtained using Rietveld refinement of XRD data showed perovskite structures with rhombohedral (R-3c) symmetry without any detectable impurity phase. Raman spectra at room temperature reveal a gradual change in phonon modes with increasing copper concentration. The analysis of the crystallographic data suggested a strong correlation between structure and magnetism, for instance a relationship between a distortion of the  $\text{MnO}_6$  octahedron and the reduction in the Curie temperature,  $T_c$ . Hence, a theoretical description of the second-order magnetic transition, as well as the magnetic entropy change of  $\text{La}_{0.65}\text{Ce}_{0.05}\text{Sr}_{0.3}\text{Mn}_{1-x}\text{Cu}_x\text{O}_3$  ( $x=0$  and  $x=0.15$ ) compounds is presented based on the Bean-Rodbell model of magneto-volume interactions. It is shown that the magnetocaloric properties obtained from initial magnetization isotherms data are in a good matching with the numerical simulations. Within the framework of this specific theoretical model, the magnitude of the spin-lattice interaction, as well as the spin value fluctuation are found to increase upon Cu-doping. These observations shall be taken in accordance with the disorder induced by  $\text{Cu}^{2+}/\text{Cu}^{3+}$  ions in the system.



**Figure 1.** Crystal structure of  $\text{La}_{0.65}\text{Ce}_{0.05}\text{Sr}_{0.3}\text{MnO}_3$  at room temperature in space group R-3c

**Keywords:** X-ray diffraction (XRD), Perovskite manganite, Bean-Rodbell model, Raman spectroscopy, magnetization