Dependence of $(La_{0.85}Sr_{0.15})_yMnO_3$ (y =0.92, 0.94, 0.96) Properties on Crystal Composition

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Introduction

The $La_{1-x}Sr_xMnO_{3+\delta}$ perovskites have ~~being~~ been studied intensively in recent years as they exhibit colossal magnetoresistance (CMR). The magnetic and electron transport properties of this material depend on the concentration of Mn^{4+} ions, that are determined by the Sr concentration and excess oxygen, δ**.** It has been shown that δ depends on cation vacancies [1]. We continued studying the influence of cation inhomogeneity on electron transport properties of $(La_{0.85}Sr_{0.15})_yMnO_3$ (y=0.92-0.97) single crystals started in our previous work [2].

Experimental

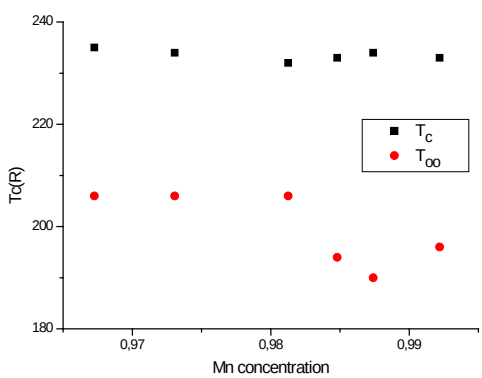
We studied the magnetoresistance and ac susceptibility of $(La_{0.85}Sr_{0.15})_yMnO_{3+d}$ single crystals with initial *y* value of 0.94, 0.96, and 0.98 in the temperature range 80-300 K and in the magnetic fields of up to 18 T at the NHMFL DC Field Facilities (SCM2). The measurements were performed at fixed magnetic field while the temperature was swept at 1K/min.

Results and Discussion

The $(La_{0.85}Sr_{0.15})_yMnO_3$ (y=0.92-0.97) single crystals were grown by the floating zone technique. Since Mn evaporated during the growth process the Mn concentration in the resulted samples was 0.967-0.992. The values of Curie temperature T_c and the temperature of orbital ordering T_{oo} were extracted from the temperature dependencies of resistivity. The T_c values are very close for all samples, while T_{oo} strongly depends on Mn deficiency: for low Mn deficiency (Mn=0.984-0.992) T_{oo} =190-196 K, for high low Mn deficiency (Mn=0.967-0.981) T_{oo} =206 K (**Figure 1a**).

Also the magnetoresistance reveals a large maximum corresponding to the metal-insulator transition and a smaller one corresponding to the transition from ferromagnetic into a canted antiferromagnetic state (see T_{max1} and T_{max2} in **Figure 1b**). For all samples the magnetic field shifts T_{max2} toward lower temperature and does not affect the value T_{max1} (Figure 1b). The results are in a good agreement with the magnetic measurements data [3].

a)



b)

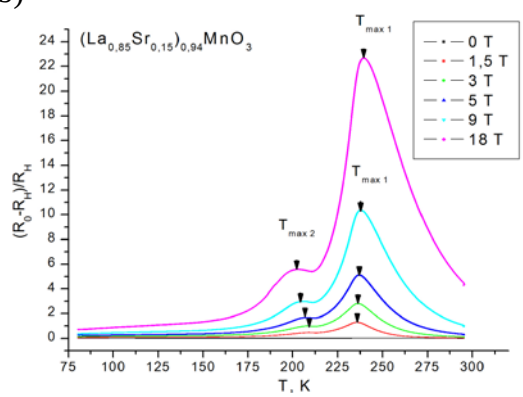


Figure 1. (a) Dependence of Curie temperature T_c and the temperature of orbital ordering T_{oo} on Mn concentration. (b) Temperature dependence of the relative magnetoresistance for sample with y=0.94 at various magnetic field**.**

Acknowledgements

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References

[1] Roosmalen, J. M., *et al.*, J. Solid State Chem., **110,** 100-105 (1994).

[2] Shulyatev, D., *et al.*, NHMFL 2011 annual report #49.
[3] Shulyatev, D., *et al.*, Solid State Phenomena **194,** 108-111 (2013).