resistivity, magnetoresistence and hysteresis simulation of $La_{2/3}Ca_{1/3}MnO_3$ thin films applying Heisenberg Model

E Restrepo-Parra*, J.C. Riaño-Rojas, J. Restrepo-Cárdenas, J. F. Jurado, C. Vargas-Hernadez
E-mail: erestrepopa@unal.edu.co

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1. Introduction

Manganite $La_{2/3}Ca_{173}MnO_3$ has been analyzed since the early days [1]. There are many experimental works that present results of resistivity, magnetoresistence and hysteresis analysis. Nevertheless, Theoretical studies that include models and simulations are need for having a better understanding of magnetic properties of this material [1]. Resistivity and magnetoresistence have been modeling employing Ising model, but It is well know that Heisengber would be a most realistic aproximation [2]. The aim of this work is to present a model and simulation of transport properties and hysteresis behavior of Manganite $La_{2/3}Ca_{173}MnO_3$, employing Monte Carlo Simulations.

2. The model

The model used in this work is[2]:

$$H = -J_{ij}\sum_{i\neq j}\mathbf{S}_i\cdot\mathbf{S}_j - K\sum_i(\mathbf{S}_i\cdot\hat{a})^2 - h\sum_i\mathbf{S}_i\cdot\hat{h}$$

Where S_i and S_j are classical Heisenberg spins vector. The first sum run over the nearest neighbors pairs of spins coupled with exchange interactions J_{ij}. Second term represents the magnetocrystalline anisotropy and the third term represents the interaction with an external field.

3. Results

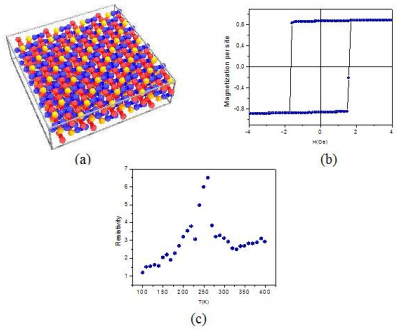

Fig.1: (a) Scheme of $La_{2/3}Ca_{173}MnO_3$ thin film with three diferent types of ions Mn^{4+}, Mn^{3+eg} and Mn^{3+eg}; (b) Hysteresis loop obtained at 100 K, (c) Resistivity for $H = 0$

Fig. 1(a) Presents an scheme of the sample employed in the simulations and Fig. 1(b) and (c) Shows the hysteresis loop obtained for a Film with $L = 12$ and thickness of 3 for T=100 K, and the resistivity for $H = 0$. The Hysteresis loop presents a ferromagnetic behaviour for this material at temperatures below of T_c and Fig. 1(c) Shows a maximum in resistivity at T_c.

4. Conclusions

Resistivity, magnetoresistence and Hysteresis loops were simulated employing Monte Carlo and Heisenberg model. The results are in agreement with those reported in the literature.

5. Submission

- AUTHORS: E Restrepo-Parra, J.C. Riaño-Rojas, , J. Restrepo-Cárdenas, J. F. Jurado, C. Vargas-Hernadez
- TITLE: resistivity, magnetoresistence and hysteresis simulation of $La_{2/3}Ca_{1/3}MnO_3$ thin films applying Heisenberg Model
- EMAIL: erestrepopa@unal.edu.co
- SESSION: Poster

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