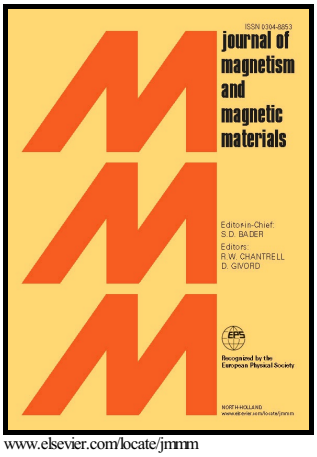

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Effective Field study of Ising model on a double perovskite Structure

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Abstract

By using the effective field theory (EFT), the mixed spin-1/2 and spin-3/2 Ising ferrimagnetic model adapted to a double perovskite structure has been studied. The EFT calculations have been carried out from Ising Hamiltonian by taking into account first and second nearest-neighbors interactions and the crystal and external magnetic fields. Both first- and second-order phase transitions have been found in phase diagrams of interest. Depending on crystal-field values, the thermodynamic behavior of total magnetization indicated the compensation phenomenon existence. The hysteresis behaviors are studied by investigating the reduced magnetic field dependence of total magnetization and a series of hysteresis loops are shown for different reduced temperatures around the critical one.

Keywords: Effective Field Theory; Ising Hamiltonian, phase diagrams; compensation phenomenon; hysteresis behaviors.

1. Introduction

The interest to study double perovskites (DPs) is mainly based on their various and unexpected physical properties which are solicited for e.g. in biomedical applications [1] or in spintronics area for the development of technologies such as highly sensitive magnetic-field sensors, tunnel junctions and non-volatile magnetic memory applications [2]. In fact, compounds having a double perovskite structure (DPS) exhibit properties such as magnetoresistance [3], half-metallicity [4], magnetodielectricity [5], a high magnetic ordering temperature [6, 7], etc. These properties are essential in the achievement of applications previously cited and in the conception of devices operating at room temperature.

Double perovskite structures (DPSs) have a general formula A_2MNO_6 where A sites are occupied by an alkaline-earth or a rare-earth ion, M and N sites are occupied by transition metal ions, and O is the