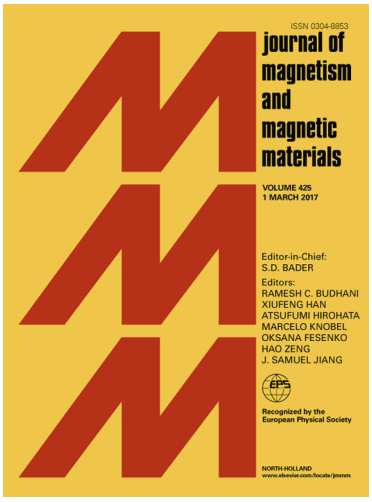

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PII: S0304-8853(18)31324-6
DOI: https://doi.org/10.1016/j.jmmm.2018.09.094
Reference: MAGMA 64376

To appear in: *Journal of Magnetism and Magnetic Materials*

Available online at www.sciencedirect.com
ScienceDirect
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Journal of Magnetism and Magnetic Materials 00 (2018) 1–10
JMMM

Magnetic Properties of the Mixed Spin 1/2 and Spin 1 Hexagonal Nanotube system: Monte Carlo simulation study

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Abstract

In order to study the magnetic properties of a mixed spin 1/2 Ising model and spin 1 Blume-Capel model in a hexagonal nanotube two layers system, we carried out a Monte Carlo simulation with the Metropolis algorithm. By means of the magnetic susceptibility curves, the phase diagram for a finite size lattice is obtained. In association with previous analytic results, an uncommon increase in the magnetization with temperature is described by the existence of an unstable state with a non-zero order parameter.

Keywords: Hexagonal Nanotube, Blume-Capel, Ising, Mixed-spin, Monte Carlo

1. Introduction

Due to the increasing use of magnetically controlled nanowires and nanotubes in novel functionalities fields, bio-technology [1, 2], recording media [3, 4, 5] and light sensor [6], these nanostructures have received much attention of experimental and theoretical researchers. One of the favorable feature for the use of nanotubes and nanowire is their higher surface effects when compared to the bulk materials.

A special kind of magnetic nanostructures with multilayers is compounded by different magnetic moments. By a theoretical point of view, this kind of structure can be represented by a lattice of mixed spins, where two of the most important technical procedures used are the effective field theory (EFT) [7, 8, 9, 10] and the Monte Carlo simulation [11, 12, 13, 14, 15, 16, 17]. These analytical and simulational procedures can be used like complementary methods to obtain a more complete and secure interpretation of the system [18].

The objective of this work is to present the magnetic behavior of a mixed spin two-layer nanotube, obtained by Monte Carlo simulation through the Metropolis algorithm, and compare it with previous analytical results [19] to better understand an uncommon increase in the magnetization with the temperature.

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