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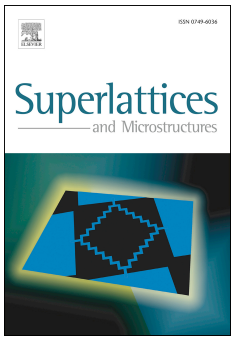

Random crystal field effects on the integer and half-integer mixed-spin system

Ali Yigit, Erhan Albayrak

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Random Crystal Field Effects on the Integer and Half-Integer Mixed-Spin System

Ali Yigit[1] **and Erhan Albayrak**[2]

[1] Çankırı Karatekin University, Department of Physics, 18100, Çankırı/TURKEY.

[2] Erciyes University, Department of Physics, 38039, Kayseri/TURKEY.

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Abstract

In this work, we have focused on the random crystal field effects on the phase diagrams of the mixed spin-1 and spin-5/2 Ising system obtained by utilizing the exact recursion relations (ERR) on the Bethe lattice (BL).The distribution function $P(D_i) = p\delta[D_i - D(1+\alpha)] + (1-p)\delta[D_i - D(1-\alpha)]$ is used to randomize the crystal field.The phase diagrams are found to exhibit second- and first-order phase transitions depending on the values of α, D and p. It is also observed that the model displays tricritical point, isolated point, critical end point and three compensation temperatures for suitable values of the system parameters.

Keywords:Mixed spin; Bethe lattice; Random Crystal Field; Tricritical Point
PACS:0520; 0550; 0570F; 0570J
PACS:05.50.+q; 05.70.Fh; 64.60.Cn; 75.10.Hk

1 Introduction

The mixed-spin Ising ferrimagnetic models have been exploited as possible models to describe certain types of molecular-based magnetic materials.They may exhibit new magnetic characteristic behaviors such as magnetic pole inversion, inverted magnetic hysteresis loop, photo-induced magnetization [1] etc. Furthermore, the mixed-spin Ising models have less translational symmetry than the models with one type of spins and thus they may exhibit a special temperature called as the compensation temperature (T_{comp}) at which the total magnetization vanishes below the possible phase transition temperatures. The existence of which may provide interesting technological applications such as the case with storage media, compact disks, optical disks, recording tapes [2] etc. It should also be noted that the molecular mixed-spin ferromagnetic compound $MnNi(NO_2)_4$ (ethylenediamine) is known as a quasi one-dimensional substance