

Accepted Manuscript

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PII: S0921-4526(17)30994-8

DOI: [10.1016/j.physb.2017.12.009](https://doi.org/10.1016/j.physb.2017.12.009)

Reference: PHYSB 310586

To appear in: *Physica B: Physics of Condensed Matter*

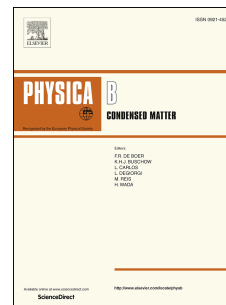
Received Date: 6 November 2017

Revised Date: 3 December 2017

Accepted Date: 4 December 2017

Please cite this article as: E. Albayrak, The phase diagrams of the mixed-spin ternary-alloy consisting of half-integer spins: Standard-random approach, *Physica B: Physics of Condensed Matter* (2018), doi: 10.1016/j.physb.2017.12.009.

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The Phase Diagrams of the Mixed-Spin Ternary-Alloy Consisting of Half-Integer Spins: Standard-Random Approach

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December 4, 2017

Abstract

The ternary-alloy in the form AB_pC_{1-p} is investigated on the Bethe lattice with the odd numbered shells containing only A atoms (spin- $\frac{1}{2}$), while the even shells randomly containing either B (spin- $\frac{3}{2}$) or C (spin- $\frac{5}{2}$) atoms with different concentrations p and $1-p$, respectively. The phase diagrams are calculated on the $(p, kT_c/J_{AB})$ and $(R = |J_{AC}|/J_{AB}, kT_c/J_{AB})$ planes for given values of R and p , respectively, with the coordination numbers $z = 3, 4, 5$ and 6 by studying the thermal variations of the order-parameters. It is found that there exist a critical value of R , i.e. $R_c \cong 0.653$, which is independent of z . In addition, the critical temperatures increase as z increases. The present work is an extension of the previous work [1] and it only differs from it by the implementation technique of randomness into the model. The obtained phase diagrams are in agreement with the site-dependent random case [1] except at low temperatures. On the other hand, there is an overall agreement with the literature.

Keywords: Molecular Magnet; Ternary Alloy; Bethe Lattice; Mixed-Spin; Randomness.

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1 Introduction

The molecular-based magnetic materials display interesting magnetic behaviors and can be fabricated by using different materials with different spins, therefore, they get a lot of attention. Many unusual properties have been exhibited by these materials, such as the photo-induced magnetization effect, magnetic pole inversion, inverted magnetic hysteresis loop occurrence of one or even two compensation points, please see [2, 3, 4, 5, 6, 7] for details. They are usually considered in the form of AB_pC_{1-p} consisting of Ising spins in which one sublattice consists of A atoms while the next sublattice consists of B or C atoms with probability p and $1-p$, respectively. The case containing the spins $S^A = 3/2$,

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