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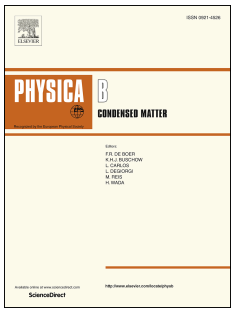


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# The Phase Diagrams of the Mixed-Spin Ternary-Alloy Consisting of Half-Integer Spins: Standard-Random Approach

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**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 $S^A = 3/2$,