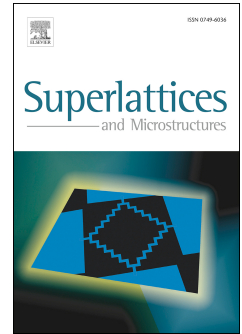


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# Low dimensional mixed-spin Ising model with next-nearest neighbor interaction

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## Abstract

In this study, the effects of next-nearest neighbor interaction on a one-dimensional mixed spin 3 - spin 3/2 system was investigated using Cellular Automaton (CA). The Ising model hamiltonian contains the antiferromagnetic nearest neighbor interaction ( $J_1$ ), the ferromagnetic next- nearest neighbor interaction ( $J_2$ ) and the external magnetic field ( $h=H/J_1$ ). Magnetization ( $M$ ) of the mixed spin system was obtained in the interval  $0 \leq R \leq 1$  of the interaction ratio ( $R=J_2/J_1$ ) using field cooling (FC) and zero-field cooling (ZFC) processes. Hysteresis curves were drawn for several  $R$  values in the interval  $-0.1 \leq h \leq 0.1$  using FC results. The functional behavior for coercive field ( $H_C$ ) was determined depending on  $R$ . Thus, the mixed spin system became a hard magnetic material and the lattice geometry also changed from one dimensional linear chain to triangular chain with increasing  $R$  value.

*Keywords:* Hysteresis, Coercive field, Ising model, cellular automaton.  
*PACS Numbers:* 05.20.-y, 75.10.Hk, 05.10.-a, 75.60.-d.

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## 1. Introduction

Developments in material science have lead to technological innovations. Cyano-bridged magnetic molecules are one of these innovations. Cyano-bridged assemblies have properties such as high relaxation barrier, change of interlayer superexchange interactions, humidity sensitivity, photoinduced metal-to-metal charge transfer and high coordination number of metal centers due to inclusion of ions with high anisotropy. Thus, the cyano-bridged assemblies gain various functionalities such as slow magnetic relaxation [1,2], cooling-rate dependent magnetism [3], humidity-induced magnetization [4], photo-induced magnetization [5,6] and high temperature magnetization [7]. One of these cyano-bridged assemblies was synthesized by Guo et al. to obtain high temperature magnetism [8]. They studied cyano-bridged Tb (III) -Cr (III) bimetallic assembly

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