

Abstract

In principle, within this research the phase transitions, for a molecular based magnet, have been studied using mean field method (MFM). The longitudinal magnetizations can be achieved by minimizing the free energy is an interesting function for locating and examination of phase transitions of the proposed system as well. The ground state step diagrams of this system have been constructed by applying the Blum-Capel (BC) configuration to a system consisting of two sublattices for a mixed spin-3/2 and spin-7/2 on a square lattice or single cubic one in the anisotropic plane. On principles of Bogoliubov inequality (BI) of the free energy, it has been investigated the spin compensation phenomena. In particular, characteristic ferrimagnetic features have been shown depending on an unequal crystal field parameters ($D_A, D_B < -1.0$) applied on the A – sites and B –sites, respectively. The magnetic anisotropies have been carefully altered such that interesting phenomena can be obtained compensation behaviors and the system's free energy. Where these characteristics found that the Blume- Capel Ising Mixed -spin model, which is known to have one compensation temperature when the anisotropy is in the range $-1.75 \leq D_B/|J| \leq -1.6$ at $D_A/|J| = -2.25$, on a square lattice $z = 4$. It is worth to note that increasing the magnetic anisotropy $D_A/|J|$ will make the total magnetization remains longer at higher temperatures, i.e., this behavior is not permanent, it will disappear at higher values of $D_A/|J|$. Besides, our system has two spin compensation temperatures in the range of negative values of anisotropy, namely, $-0.25 \leq D_A/|J| \leq -1.5$, with a fixed value of $D_B/|J| = -2.0$, of the sites occupied by B-atoms. It should be pointed out that the proposed system has two spin compensation temperatures in the ranges $-2.25 \leq D_A/|J| \leq -0.375$, that it can reach $D_B/|J|$ about to $D_B/|J| = -3.0$, for a simple cubic lattice $z = 6$. Here, one can describe the essence of this work as follows: because of an increasing interest in compensation phenomenon owing to its useful properties in technology of communication, the phase diagram of the ground-state for the mixed spin-3/2 and spin-7/2 Ising ferrimagnet with (BC) term included has been established. It is worthy note that our current results may be rich, to sustain and elucidate the characteristic features in sequence of molecular-based magnets $[Cr(CN)_4(\mu - CN)_2Gd(H_2O)_4 - (bpy)]_n \cdot 4nH_2O \cdot 1.5nbpy$. Furthermore, the contribution of free energy to the thermodynamic phase stability has been investigated. So. By using the partition function Z , free energy can be measured as function of temperature.

