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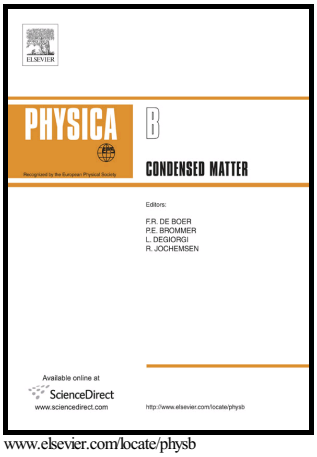

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Factors on the Magnetic Properties of the Iron Nanoparticles by Classical Heisenberg Model

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Abstract

In this paper, we used the Monte-Carlo simulation technique to investigate the magnetic properties of the samples of amorphous iron material which could be described as a spin Heisenberg system. The exchange interaction is taken into account as a function of the distance between the two spins. The results showed the existence of the magnetic phase transition behavior of the nanoparticles. The phase transition temperature obtained by our simulations and the semi-empirical calculations are well matched. The magnetization of the core/shell system strongly depends on the shell thickness when the spins on the interface of the core and the shell layer are frustrated. The transition temperature seems to be independent on the structure of the shell.

Keywords: particle size effects, core/shell model, transition temperature, iron nanoparticles, magnetism, classical Heisenberg model

1. Introduction

Iron is a ferromagnetic material with very high magnetic moment (around 220 emu/g). It is well known that the crystal structure of the bulk iron is body-centered cubic (BCC) with critical temperature from 1043 to 1881 K (corre-

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