DP08

Monte Carlo Investigation of the Grain-size Dependence of Hysteresis Properties

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Ferromagnetic in a very small reduced-structure have long been of interest due to its wide range of applications especially in the recording application [1-2]. Therefore, the topic of nano-ferromagnet has been widely studied. Nevertheless, despite of its importance technological applicability and fundamental interest, the detailed understand in such the small system is still not fully understood. For instance, in terms of magnetic stability, the magnetic coercivity was found to depend on nano-magnetic grain-sizes. When the magnetic grain is large, the coercivity increases with reducing the magnetic grain-size. However, when the grain is small enough, the coercivity stops increasing but changes to decrease [3]. Most studies believe this phenomenon is caused by the dipolar interaction. Nevertheless, the actual act of dipolar effect in such the phenomena and how its magnitude scales with the magnetic grain size and hysteresis coercivity are still not fully understood.

Consequently, this work uses Monte Carlo simulation to study the dipolar effect on two-dimensional Ising spins using the single spin flip algorithm [4] where the free boundary was set on all edges (to make a grain like). The considered systems' linear dimensions were varied to emphasize the grain-size effect. From preliminary results, at fixed dipolar interactions, the measured hysteresis loop becomes bigger with an enhancement of coercivity with increasing system sizes. However, when the system size is large enough, the hysteresis loop arrives at its maximum size. With further increasing the sizes, the hysteresis changes to reduce in shape and the coercivity decreases. This is due to that, at small system sizes, the long-ranged dipolar interaction help to stabilize a single cluster of spins so the overall magnetic interaction gets larger with increasing the system sizes. This results in larger hysteresis loop. However, if the size is still increasing, it will come to a point that the dipolar is not large enough to maintain a single cluster. Therefore, there exist multiple clusters with different spin orientation. Consequently, this reduces the magnetization and ceases the hysteresis properties. This is in agreement with those observed and predicted in experiments [3].

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DP09

Catastrophic Model for the Resistivity Stabilities of $La_{0.7-x}Y_xPb_{0.3}MnO_3$

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Variations on the resistivity of $La_{0.7-x}Y_xPb_{0.3}MnO_3$ (LYPMO) material can be identified by studying the formation of the critical points in the Temperature-Resistivity plot. The power law contributions in the lower temperature part can be describe by ($\rho=\rho_0+\rho_2T^2+\rho_{5/2}T^{5/2}$), where the term ρ_2T^2 indicates the electron-electron scattering mechanism, and the term $\rho_{5/2}T^{5/2}$ represents the resistivity cause by the electron-magnon scattering process. In the high-temperature PM insulating state, the variable range hopping conduction have been observed to obey an exponential temperature dependence $\rho(T)\infty\exp[(T'/T)^n]$ with n=1/4, and the characteristic temperature $T'=T_0$ is relative to the VHR without the Coulomb interaction among electrons. Also, T_0 value depends on localization length ξ of the electron and density of state N(EF), $T_0=16/\xi k_BN(EF)$. By taking the electron to electron interaction into consideration, variable range hopping conduction with Coulomb effects will obeys n=1/2 law, and $T'=T_1$ can be estimated with the relationship $T_1=2.8e2/(4\pi\varepsilon_0 k k_B\xi)$ based on Efros-Shklovskii model. Competitation amoung these factors leads to the formation and eliminations of the critical points on the T-R curves. In order to explain the phenomena during the Y3+ ions substitution process, catastrophic theory is introduced to model the system hamiltonian and to predict the stabilities for these critical points under different composition ratios. Resulst indicates that the cacastrophy theory can predict the transitant of the LYPMO material from the double peaks to the single peak successfuly, by taking the dopping ratios x as the only control parameter.

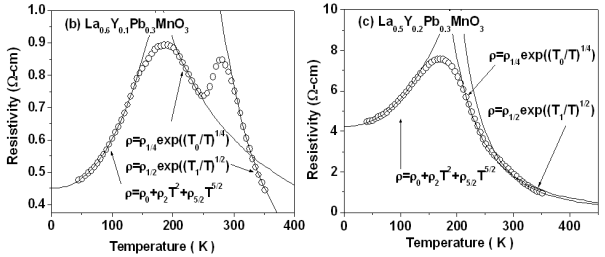

Fig.1. formation and eliminations of critical points.

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