Spin-glass Like Transition In Interacting $MnFe_2O_4$ Nanoparticles

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The temperature dependent of ac susceptibility studies are carried out on interacting 9.0 nm size $MnFe_2O_4$ particles in a wide frequency range (10-10^3 Hz) and in various external applied magnetic fields. At low external fields, the real part of ac susceptibility exhibit a maximum near room temperature. This maximum is attributed to the superparamagnetic blocking of the particles. Interestingly, the imaginary part exhibits two maximum, one near 40 K and the other near room temperature. The former is interpreted as due to a spin-glass like transition and the latter to the superparamagnetic blocking of the particles. The frequency dependence analysis of the spin glass like transition by Arrhenius and Volger-Fulcher laws is found to be unsatisfactory. The dynamic scaling analysis on frequency dependence of spin glass like transition temperature fits the model of a transition at finite temperature and yields critical exponents and parameters as: $z\nu = 6.0$, $T_c = 34.4$ K, $\tau_0 = 10^{-7}$ s and that confirms the occurrence of spin-glass like transition in 9.0 nm $MnFe_2O_4$ particles [1].

References

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