Magnetic Properties of γ-Fe_2O_3 Nanoparticles Made by Coprecipitation Method

Jong-Ryul Jeong,*[1] Seung-Jun Lee[2], Jong-Duk Kim[2], and Sung-Chul Shin[1]

[1] Department of Physics and Center for Nanospinics of Spintronic Materials, Korea Advanced Institute of Science and Technology, Daejeon 305-701, Korea
[2] Department of Chemical & Biomolecular Engineering, Korea Advanced Institute of Science and Technology, Daejeon 305-701, Korea

*Corresponding author: midpath@kaist.ac.kr, Phone: +82 42 869 8167, Fax: +82 42 869 8162

Nanoparticles of magnetic metals and oxides have attracted great interest in recent years because of their unique physical and chemical properties. [1,2] In this study, we have synthesized γ-Fe_2O_3 nanoparticles using coprecipitation technique and investigated magnetic properties of nanoparticles. Nanoscale iron oxide was prepared by a chemical coprecipitation method of ferric and ferrous ions in alkali solution. The reaction steps in our process are as follow: $FeCl_2$ (1mol) + $FeCl_3$ (2mol) $\rightarrow$ Fe_3O_4 $\rightarrow$ γ-Fe_2O_3. A molar ratio of Fe(II)/Fe(III) = 0.5 was dissolved in water with sonicator. The result solution was poured into alkali solution. Zero-Field-Cooling (ZFC) and Field-Cooling (FC) magnetization as well as magnetic hysteresis measurements were performed using a superconducting quantum interference device (SQUID) magnetometer from 2 K to 300 K. The FC/ZFC magnetization measurements showed typical superparamagnetic behavior with very narrow size distribution. For lower temperatures, a peak is observed due to the blocking of the nanoparticles at T_B = 50±2 K. Fig. 1 shows the FC and ZFC curves for the γ-Fe_2O_3 sample made by typical drop-wise technique. The magnetic hysteresis measurements performed at different temperatures are in agreement with the above results. In this paper, the dependence of the blocking temperature on the applied field and the magnetic relaxation rate with varying the magnetic field will be discussed.

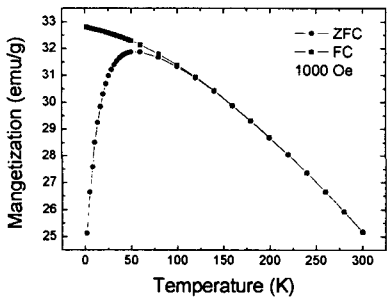

Fig. 1. ZFC and FC curves of γ-Fe_2O_3 nanoparticle.

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References

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