AP02

Fabrication and Mössbauer Characterization of $MgFe_2O_4$/ Fe_3O_4 Composite Nano-particles

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In recent years, nano-crystalline spinel ferrites have been investigated intensively due to their potential applications. It is found that magnesium ferrite, $MgFe_2O_4$, can be used as n-type semi-conducting gas-sensing materials [1]. In the mean time, H. Zhang and coworkers speculated that $MgFe_2O_4$ could be used to replace Fe_3O_4 for magnetic targeted drug delivery [2]. In addition, synthesis and study of nano-sized spinel ferrite particles is of great fundamental interest.

In the present study, $MgFe_2O_4$/ Fe_3O_4 composite nanoparticles with pure spinel structure are successfully fabricated at 90 oC by Chemical Oxidation in Aqueous Solution. Fig.1 shows the TEM image and selected area electron diffraction(SAED) pattern of the sample. Fig.2 shows a Mössbauer spectrum taken at room temperature. The composition is determined as $(MgFe_2O_4)0.33(Fe_3O_4)0.67$ by Atomic absorption spectrometry and Mössbauer spectroscopy. Magnetization hysteresis loop indicates that the saturation magnetization is much larger than that of the normal $MgFe_2O_4$ nanoparticles. The Mössbauer spectra collected at different temperatures (87 K-293 K) show that the hyperfine field is smaller that of the bulk and increase with decrease of measuring temperature. This can be understood by the collective magnetic exitation theory [3].

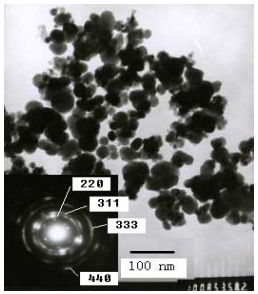

Fig. 1. TEM image and SAED pattern of $MgFe_2O_4/Fe_3O_4$ nanoparticles.

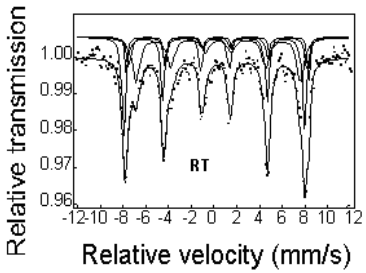

Fig. 2. Mössbauer spectrum for $MgFe_2O_4/Fe_3O_4$ nanoparticles collected at room temperature.

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AP03