Accepted Manuscript

High saturation magnetization Fe_3O_4 nanoparticles prepared by one-step reduction method in autoclave

Ping Hu, Lu Kang, Tian Chang, Fan Yang, Hua Wang, Yang Zhang, Jun Yang, Kuai-she Wang, Jinjing Du, Zhanlin Yang

PII: S0925-8388(17)33019-0

DOI: 10.1016/j.jallcom.2017.08.290

Reference: JALCOM 43047

To appear in: *Journal of Alloys and Compounds*

Received Date: 1 May 2017

Revised Date: 16 August 2017

Accepted Date: 30 August 2017

Please cite this article as: P. Hu, L. Kang, T. Chang, F. Yang, H. Wang, Y. Zhang, J. Yang, K.-s. Wang, J. Du, Z. Yang, High saturation magnetization Fe_3O_4 nanoparticles prepared by one-step reduction method in autoclave, *Journal of Alloys and Compounds* (2017), doi: 10.1016/j.jallcom.2017.08.290.

High saturation magnetization Fe_3O_4 nanoparticles prepared by one-step reduction method in autoclave

Ping Hu [a, b*], Lu Kang [a], Tian Chang [a, b], Fan Yang [a, b], Hua Wang [c], Yang Zhang [a], Jun Yang [a], Kuai-she Wang [a, b], Jinjing Du [a], Zhanlin Yang [a]

[a] School of Metallurgy Engineering, Xi'an University of Architecture and Technology, Xi'an 710055, China

[b] State Local Joint Engineering Research Center for Functional Materials Processing, Xi'an University of Architecture and Technology, Xi'an 710055, China

[c] Xi'an Electric Furnace Institute Co., Ltd., Xi'an 710061, China

Abstract: Conformal magnetite nanoparticles are successfully prepared by one-step reduction method in the autoclave with controlled reduction conditions. The x-ray diffraction pattern indicates pure phase of Fe_3O_4 nanoparticles with high crystallinity were obtained. TEM analysis shows the presence of spherical nanoparticles with homogeneous size distribution of ~20 nm. The obtained Fe_3O_4 nanoparticles have high saturation magnetization *Ms* of 75.3 emu·g^{-1}. The inverse spinel Fe_3O_4 phase displays a distinct ferrimagnetic anisotropy. The Verwey metal-insulator transition of magnetite nanoparticles usually takes place at the blocking temperature of 120 K. The one-step reduction method in the autoclave of magnetite with well-controlled phase and high saturation magnetization in this work provides a promising opportunity for the synthesis of magnetic nano-materials to be used in wastewater treatment, catalyst, lithium-ion battery, contrast imaging, and especially in bio-applications.

Keywords: One-step reduction; Magnetite; Verwey transition; Well-controlled phase; High saturation magnetization

1. Introduction

Iron is fourth-most abundant element in the earth's crust and exists in various oxidation states. Ferrous Fe(Ⅱ) and ferric Fe(Ⅲ) iron are occurred naturally and form three main oxidation, for instance FeO, Fe_3O_4, Fe_2O_3. In which, magnetite (Fe_3O_4) is

*Corresponding author. E-mail addresses: huping1985@126.com (Ping HU).