PA08

Magnetic and Photocatalytic Effect of Fe-doped Nano-rod ZnO Synthesized by the Hydrolysis of Metal Powders

Y. R. Uhm[1], B. S. Han[1], H. M. Lee[1], G. M. Kim[2], and C. K. Rhee*[1]

[1]Nuclear NanoMaterials Development Lab., Korea Atomic Energy Research Institute, Daejeon, 305-600, Korea
[2]Department of Materials Engineering, Chungnam National University, 220 Gung-Dong, Yu-Seong Gu, Daejeon, 305-764, Korea

*Corresponding author: uyrang@kaeri.re.kr, Phone: +82 42 868 4835, Fax: +82 42 868 4847

INTRODUCTION

Metal-doped ZnO is generally investigated in the form ofdiluted magnetic semiconductor (DMS) materials and photo-catalyst, because it shows much higher Curie temperature than room temperature, along with strong stability in UV light [1-2]. Especially, the Fe-doped casehas been widely examined [1]. There are several methods for synthesis of Fe-doped ZnO nanopowder [3]. In this work, we have synthesized Fe-doped ZnO nano-rods using a simple process employing the hydrolysis of metal powders, and investigated micro-structure, photocatalystic effect, and magnetic properties as a function of Fe concentration.

EXPERIMENTAL TECHNIQUE

Fe-doped ZnO nano-rods (Fe= 0, 2, 5, 8, and 10 wt. %) have been synthesized by a novel process employing hydrolysis of nano-metal powders. Firstly, high purity Zn and Fe nanopowders were prepared by pulsed wire evaporation (PWE) method and then the spherical-shaped powders with average sizeof about 80-120nm were immersed into distilled waterfor the hydrolysis reaction. Hydrolysis has been carried out at 60℃ for 24h to produce the precipitation of zinc hydroxide gel and iron doped hydroxide gel. The properties of the Fe-doped ZnO were investigated by the XRD, FT-IR, TEM, neutron powder diffraction and Mössbauer spectroscopy.

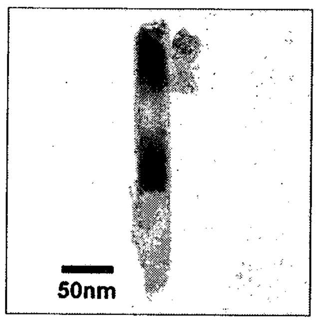

Fig. 1. TEM image for Fe-doped ZnO.

RESULTS AND DISCUSSION

Pure ZnO and Fe-doped ZnO have been simply synthesized by a novel hydrolysis method. The results of XRD, FT-IR and UV-vis spectra exhibited that the resultant precipitate materials were completely ZnO phase. The TEM result for ZnO and Fe-doped ZnO showed that the produced powders had rod-like shape. The phase transitions of iron and zinc are same, when the iron is mixed and reacted with zinc at same time. With increasing Fe content up to 5 wt.% the UV-vis spectra were shifted to the long wave length and this result indicates that the band gap was shifted by Fe-doping. The ferromagnetic phase increases with increasing Fe content.

REFERENCES

[1] G. Y. Ahm, S. I. Park, and C. S. Kim, J. Magn. Magn. Mat., **303**, 329 (2006).
[2] Z. Sojka and K. Kliertomic, J. Elect. Spec & Rel. Pheno., **60**, 155 (1992).
[3] S. He, H. Maeda, M. Uehara and M. Miyazaki, Mater. Lett.,**61**, 626 (2007).

PA09

Synthesis of Barium Titanate Nanorods Using Hydrothermal Reaction of Potassium Titanate Nanostructures

Ravindar Tadi[1], Yong-Il Kim*[2], Sung-Oong Kang[2], Kwon-Sang Ryu[2], and CheolGi Kim[1]

[1]Department of Materials Science and Engineering, Chungnam National University, 220 Gung-Dong, Yu-Seong Gu, Daejeon, 305-764, South Korea
[2]Korea Research Institute of Standards and Science, P. O. Box 102, Daejeon 305-600, South Korea

*Corresponding author: yikim@kriss.re.kr, Phone: +82 42 868 5448, Fax: +82 42 868 5639

The barium titanate ($BaTiO_3$) nanorods was synthesized by the hydrothermal reaction using barium hydroxide octahydrate ($Ba(OH)_2 \cdot 8H_2O$) and potassium titanate ($K_2O \cdot nTiO_2$, n = 4 or 6) nanostructures that was prepared by a sol-gel method. Potassium tetratitanate ($K_2Ti_4O_9$)- and potassium hexatitanate ($K_2Ti_6O_{13}$) nanorods as intermediates were prepared in the range of molar ratio of potassium methoxide (CH_3OK)to tetraethyl orthotitanate [$Ti(OC_2H_5)_4$] from 1:1 to 1:2 and the heating temperature from 800℃ to 950℃. The intermediates having layered- and tunnel-structures through the hydrothermal reaction were transformed into $BaTiO_3$ nanorods that hadtens of nanometers in a diameter, and lengths up to 2 μm, respectively. In order to get the structural information of as-synthesized $BaTiO_3$ nanorods, the structural refinement was carried out by Rietveld method using X-ray powder diffraction data at room temperature. The final weighted R-factor (R_{wp}) and goodness-of-fit ($S = R_{wp}/R_p$) were 10.33 % and 1.18, respectively. The refinement results showed that $BaTiO_3$ nanorods were composed of a mixture of tetragonal phase with the mass fraction of 98.05(3)% and cubic phase with 1.95(4) %. The lattice parameters for cubic and tetragonal phases were a (= b = c) = 4.0134(2) Å and a (= b) = 4.0270(2) Å and c = 4.0222(2) Å, respectively.

REFERENCES

[1] T. Sasaki, M. Watanabe, *J. Am. Chem. Soc.*, **120**, 4682 (1998).
[2] Y.-I. Kim, J. K. Jung and K.-S. Ryu, *Mater. Res. Bull.*, **39**, 1045 (2004).
[3] A. C. Larson and R. B. Von Dreele, *Los Alamos National Laboratory Report*, LAUR 86-748 (1994).