S02

# Structural and Magnetic Properties of $MgFe_{(1-x)}Ni_{(x)}O_4$ Synthesized Using Thermal Decomposition Procedure

Ravindar Tadi[1,2]*, Yong-Il Kim[2], Cheol Gi Kim[1] and Kwon-Sang Ryu[2]*

[1]Department of material science & engineering, Chungnam National University, Daejeon, 305-340, South Korea

[2]Korea Research Institute of Standards and Science, Daejeon, P.O. Box 102, 305-340, South Korea

Magnetic spinels are widely investigated in view of various applications for magnetic and electronic devices[1,2,3]. However they can also be used in fabrication of multiferroic composites in combination with piezoelectric phase, to generate the required magnetostriction in order to obtain a magnetoelectric coupling. Hence in this study a soft magnetic material comprising of magnesium, iron and nickel is synthesized using simple thermal decomposition process.

Magnesium nickel ferrite with various compositions of Ni (1,5,10,15) is synthesized using chemical procedure. Nitrates of Magnesium and iron, nickel acetate and oxalic acid (sigma aldrich) are mixed in $1:1_{1-x}$ :X:2 mole. Sufficient amount of absolute ethanol was used as a solvent. A homogenous mixture was obtained by dissolving the starting materials in appropriate quantities. This gel was dried to obtain a solid mixture. The solid substance was thermally decomposed at 500$^{o}$C for about 30 minutes and powdered. This powder was thermally annealed in air at temperatures ranging form 900 ~ 1100$^{o}$C for a duration of 3 hrs. Annealed samples are characterized for structural, magnetic properties at room temperature using x-ray diffraction (Rigaku) and vibrating sample magnetometer (lakeshore).

$MgFe_{(1-x)}Ni_{(x)}O_4$ samples synthesized with x= 1, 5, 10, 15 and annealed at 900~1100 $^{o}$C for 3 hrs are found to have soft magnetic behavior. Figures 1 and 2 shows magnetic properties of 10 % nickel added samples with lower coercivity and a high magnetization annealed at 1100 $^{o}$C . Addition of nickel resulted in reduction of coercivity. However samples with higher then 10 % nickel displayed an increase in coercivity. The variation of magnetic properties with respect to nickel concentration is related with the difference of bhor magnetron between Fe and Ni cations as well as site preferences of nickel cations in the spinel lattice due to increase in annealing temperature 1.

## References

1. K. Seshan, A. L. Shashimohan, D. K. Chakrabarty *, A. B. Biswas Phy.Sol. Stat. Sol. **68**, **97** (2006)

2. Min Gu, Bin Yue , Renlie Bao, Heyong He Materials Research Bulletin **44** ,**1422** (2009)

3. Z.L. Wang, Adv. Mater. **15**, **432** (2003)

* Corresponding author Tel.:+82 42 868 5164, Fax.:+82 42 868 8635

E-mail: ryuks@kriss.re.kr,

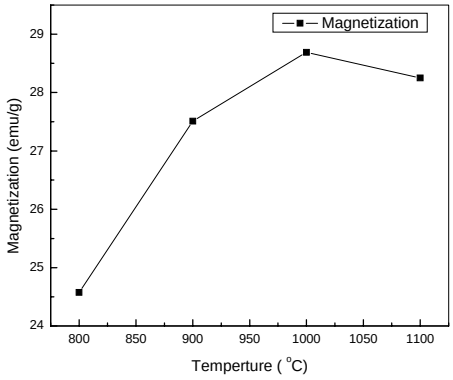


Fig. 1: Magnetization values of $MgFe_{1-x}NixO_4$ annealed at 800 ~1100 $^oC$.

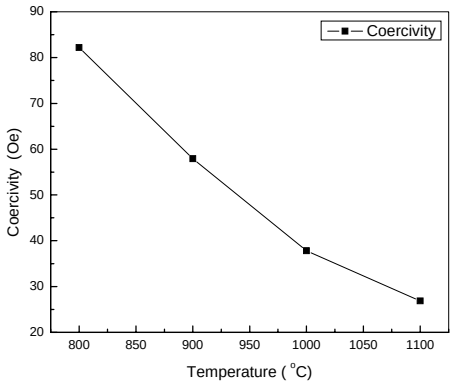


Fig. 2: coercivity values of $MgFe_{1-x}NixO_4$ annealed at 800 ~1100 $^oC$.