

課題番号 : F-14-NU-0064  
 利用形態 : 機器利用  
 Program Title (English) : Fabrication and Characterization of  $\text{CoFe}_2\text{O}_4$  and  $\text{Fe}_3\text{O}_4$  Magnetic Nanostructures; Fabrication of GMR thin films  
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### 1. 概要 (Summary)

Magnetic nanoparticles (MNPs) have become great subject of research interest because of their unique physical and magnetic properties as compared to their bulk counterpart. One of the examples of widely studied MNPs is ferrite and iron oxides and which has higher magnetic anisotropic due to the enhancement of superparamagnetism in this system. The magnetic properties of MNPs have been also investigated in order to study the potency as an active material on Surface Plasmon Resonance (SPR)-based biosensor application and as absorbents for purification of water waste. On the other hand, giant magnetoresistance (GMR) thin films with structure of  $\text{CoFeB}/\text{Cu}/\text{CoFe}/\text{MnIr}$  have been also fabricated. The films had been used for analyzing magneto-resistance effect of MNPs by adding the MNPs coloid into the surface of thin films.

### 2. 実験(Experimental)

#### • Facility used

RF magnetron sputtering, Vibrating sample magnetometer (VSM), Atomic force microscopy (AFM)

#### • Experiment

$\text{Fe}_3\text{O}_4$  and  $\text{CoFe}_2\text{O}_4$  magnetic nanoparticles have been synthesized and then encapsulated with Polyvinyl alcohol (PVA) with a ratio using coprecipitation method.  $\text{CoFeB}/\text{Cu}/\text{CoFe}/\text{MnIr}$  thin films have been fabricated by RF magnetron sputtering. Properties of ferrite-based and magnetite ( $\text{Fe}_3\text{O}_4$ ) nanoparticles have been analyzed by vibrating sample magnetometer (VSM) and atomic force microscopy (AFM) and magnetic force microscopy (MFM).

### 3. 結果と考察 (Results and Discussion)

Figure 1 show the bird view of AFM image of PVA-coated  $\text{Fe}_3\text{O}_4$  with various PVA concentrations: 25%, 65%, and 80%. RMS of the samples decrease for increasing PVA concentration, 11 nm, 2 nm, and

1.5 nm for PVA concentration of 25%, 65%, and 80%, respectively.

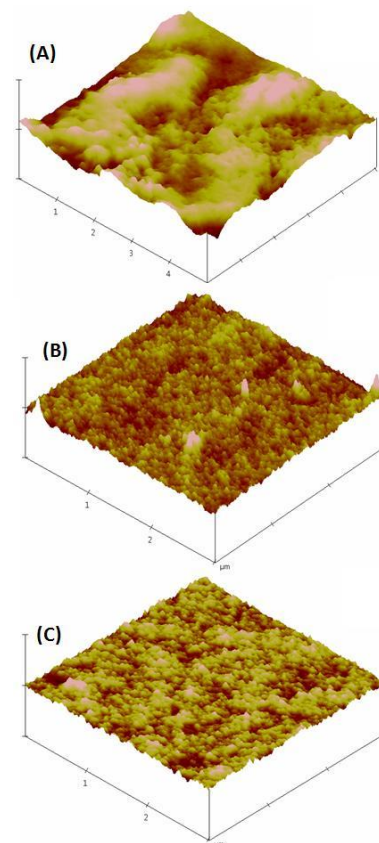


Figure 1 Bird view of AFM image of PVA-coated  $\text{Fe}_3\text{O}_4$  with various PVA concentrations: (A) 25%, (AB) 65%, and (C) 80%.

### 4. その他・特記事項 (Others)

None

### 5. 論文・学会発表 (Publication/Presentation)

- (1) Edi Suharyadi, Seveny Nuzully, Takeshi Kato, Satoshi Iwata, and Kamsul Abraha, International Conference on Magnetism, Barcelona Spain, 5 – 10 July 2015 (to be presented)
- (2) E. Suharyadi, E.A. Setiadi, A. Riyanto, T. Kato, S. Iwata and K. Abraha, Journal of Material Science, Vol.15, (2014) p. 123 (Indonesian journal).

### 6. 関連特許 (Patent)

None