

課題番号 : F-15-NU-0048
利用形態 : 機器利用
Program Title (English) : Fabrication and Characterization of Metal Oxides Magnetic Nanostructures
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1. 概要 (Summary)

Magnetic nanoparticles have been intensively studied due to the fact that they can be used in a wide range of application such as clinical diagnosis, mineral separation, magnetic storage devices, absorption of microwave radiation, magneto-optic materials, and microwave filters. Among magnetic nanoparticles, magnetite (Fe_3O_4) is a metallic mineral with the most powerful magnetism among transition metals such as nickel (Ni), cobalt (Co), and zinc (Zn). In order to fulfil application requirements of Fe_3O_4 , surface modification is needed. Surface modification by coating is one way to protect Fe_3O_4 from oxidation and reduce interparticle magnetic forces so improve the dispersibility. In this research Fe_3O_4 nanoparticles will be coated by using polyvinyl alcohol (PVA). It is therefore necessary to study the magnetic properties, crystal structure, and surface roughness of Fe_3O_4 /PVA ribbon.

2. 実験 (Experimental)

【利用した主な装置】

Atomic force microscope

【実験方法】

Fe_3O_4 magnetic nanoparticles have been synthesized and then encapsulated with PVA. Properties of ferrite-based and magnetite (Fe_3O_4) nanoparticles have been analyzed by vibrating sample magnetometer (VSM), transmission electron microscope (TEM), atomic force microscope (AFM) and magnetic force microscope (MFM).

3. 結果と考察 (Results and Discussion)

Fig. 1 shows MFM image of PVA-coated Fe_3O_4 with various PVA concentrations 25% and 65%. The coercivity increases with increasing PVA concentration, which is due to the increase of particle size. The results of this study confirm that nanoparticles in the region single domain. This might be due to increase of crystalline anisotropy energy that leads to greater shift so that inhibit the domain wall.

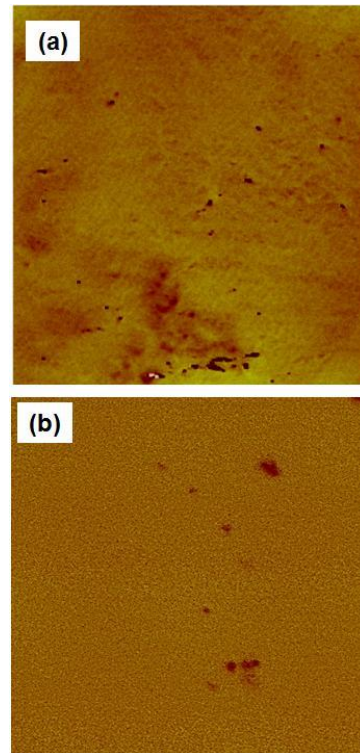


Fig.1 MFM images of PVA-coated Fe_3O_4 with various PVA concentrations: (a) 25% and (b) 65% (image size: $5\mu\text{m} \times 5\mu\text{m}$).

4. その他・特記事項 (Others)

・参考文献

Harlina Ardiyanti, Edi Suharyadi, Takeshi Kato and Satoshi Iwata, *American Institute of Physics (AIP) Conference Proceedings*, November 2015 (accepted for publication)

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 (ICM)*, Barcelona Spain, 5 – 10 July 2015.
2. E. Suharyadi, S. Nuzully, T. Kato, S. Iwata, and K. Abraha, *Journal of Nanotechnology*, September 2015 (submitted).

6. 関連特許 (Patent)

None