※課題番号 : F-12-NU-0001

※支援課題名（日本語） : $CoFe_2O_4$, Fe_3O_4 磁性ナノ粒子および GMR 膜の作成と評価

※Program Title（in English） : Fabrication and Characterization of $CoFe_2O_4$ and Fe_3O_4 Magnetic Nanoparticles; Fabrication of GMR thin film

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※概要（Summary ）:

Magnetic nanoparticles (MNPs) of cobalt ferrite ($CoFe_2O_4$) and magnetite (Fe_3O_4) with various particle sizes have been successfully synthesized by co-precipitation method. 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. $CoFe_2O_4$ nanoparticles were synthesized from $CoCl_2.6H_2O$ and $FeCl_3.6H_2O$ by co-precipitation method by varying the synthesis temperature, concentration of co-precipitant (NaOH), and duration of centrifugation. The average particle size could be varied in the range 4-10 nm. However Fe_3O_4 with different size of 12 nm to 15 nm have been synthesized chemically by $FeSO_4.7H_2O$ and $FeCl_3.6H_2O$ with ratio 1:2. On the other hand, giant magnetoresistance (GMR) thin films with structure of CoFeB/Cu/CoFe/MnIr have been also fabricated. The films had been used for analyzing magneto-resistance effect of MNPs by adding the MNPs colloid into the surface of thin films.

※実験（Experimental）:

Magnetic properties of cobalt ferrite ($CoFe_2O_4$) and magnetite (Fe_3O_4) have been analyzed by vibrating sample magnetometer (VSM) and magnetic force microscopy (MFM). CoFeB/Cu/CoFe/MnIr thin films have been fabricated by 8 source magnetron sputtering system.

※結果と考察（Results and Discussion）:

TEM images were taken to study morphology and diffraction pattern of MNPs. The diffraction pattern shows rings pattern which related to Miller index of MNPs structure. The discontinuous pattern represents a good crystallinity in sample of magnetite. The shape of MNPs is close to spherical geometry. The results give information that it has a great potency for active materials in SPR-based biosensor application. The results showed that the grain size increases with increase in the synthesis temperature and decreases with increase of concentration of co-precipitant. The coersivity decreased with the decrease of grain size which indicated transformation from ferromagnetic to superparamagnetic properties. The higher saturated magnetization is due to the degree of the better crystallinity of the sample. The utilization of MNPs as active materials not only depends on the magnetic properties and dispersibility of magnetite nanoparticles in biology fluid but also depends on being active of magnetite binds biomolecules. Therefore, nanoparticles which have been obtained by process synthesis were modified by polymer. Actually, surface modification of MNPs can improve dispersibility of sample effectively.

※その他・特記事項（Others）:

共同研究者等（Coauthor）:

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論文・学会発表
（Publication/Presentation）:

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関連特許（Patent）: