[III~3] [초청]

APPLICATION OF MAGNETO-OPTICAL AND OPTICAL SPECTROSCOPIES TO THE INTERFACE ANALYSES IN METAL MULTILAYERS

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INTRODUCTION

Compositionally modulated multilayered films (MLF) in which ferromagnetic and nonmagnetic layers are stacked alternately have become a current interest, since they have the potential for new phenomena and applications, for example, magneto-optical (MO) storage media or magnetic field sensors. In this artificial structures perpendicular magnetic anisotropy or giant magnetoresistance is caused by interlayer interactions. In the other words, the interface regions play an important role in forming the properties of MLF. That is why the investigation of the interface regions in MLF is a subject of deep scientific interest.

The authenticity of our knowledge about real atomic and magnetic structures of MLF may be verified by the comparison between the experimental and computer- simulated MO and optical data, based on different models for the structures of MLF.

In this work we aim at answering two groups of questions: is there any interface region with mixed components between pure-metal sublayers in a real

MLF, and is there any dependence of the magnetic properties on the thickness of the ferromagnetic sublayers in the MLF?

EXPERIMETAL DETAILS

A series of Co/Zr, Co/Ti and Fe/Zr MLF with bilayer period of 2 - 10 nm and different sublayer thickness ratios were prepared by a face-to-face sputtering onto glass substrates at room temperature (RT). The experimental optical conductivity (OC) and equatorial Kerr effect (EKE) spectra were measured at RT in a spectral range of 250 - 1200 nm (5 - 1 eV). The theoretical simulations for the EKE and OC spectra were also carried out by solving exactly a multireflection problem with a matrix method, assuming either "sharp" interfaces resulting in rectangular profiles of the components or "mixed" interfaces of variable thicknesses between pure-metal sublayers. Optical and MO parameters of pure metals as well as alloy-like interface were employed in these simulations.

RESULTS AND DISCUSSION

Such an approach revealed the formation of ultrathin (0.3 - 1.2 nm) alloy-like "mixed" interface regions between the sublayers in all the investigated MLF. These data agreed nicely with the results of magnetic measurements. On the other hand, a severe discrepancy between modelled and experimental EKE spectra was observed for the MLF with very thin (about 2 nm or less) ferromagnetic sublayers when the bulk MO parameters were employed for the ferromagnetic entities. This is analyzed to be connected with a crystalline-to-amorphous structural transformation in the ferromagnetic sublayers.