Magnetic Interfaces and Nanostructures
Room: Hall B - Session MI-TuP

Magnetic Interfaces and Nanostructures Poster Session

MI-TuP1 Synthesis and Characterization of $Zn_{1-x}Co_xO$/ZnO Hollow Nanosphere Structures, ***D.R. Liu**, W.-H. Cho, C.J. Weng,* ITRC, NARL, Taiwan, Republic of China

Diluted magnetic semiconductors (DMS) have recently attracted considerable attention due to their potential applications for spintronic devices, such as spin-valve transistors, nonvolatile memory, and magneto-optical switches. ZnCoO is one of the most promising diluted magnetic semiconductors materials due to its high temperature ferromagnetism. In this study, ZnO layer was conformally deposited on the surface of polystyrene (PS) nanoshpere with different diameter (100nm~800nm) by atomic layer deposition (ALD). After removal of PS nanosphere by heating, ZnO hollow nanospheres were formed. Then the $Zn_{1-x}Co_xO$ (x=0~0.1) coatings were grown on ZnO hollow nanospheres by pulsed laser deposition(PLD). According to the results of high-resolution x-ray diffraction, the $Zn_{1-x}Co_xO$/ZnO hollow nanospheres are polycrystalline with a preferential growth direction of (002). The surface and cross-section morphologies of the hollow nanospheres were analyzed using a field-emission scanning electron microscope (FE-SEM). The magnetic properties of the nanospheres were measured by a vibrating sample magnetometer(VSM) and x-ray magnetic circular dichroism (XMCD) spectroscopy. The results show the magnetic properties of $Zn_{1-x}Co_xO$/ZnO hollow nanospheres strongly depend on the Co composition fraction and the size of nanospheres.

MI-TuP2 Exchange Bias Tuning with Temperature and Pt Ratios in Pt_xCo_{1-x}/CoO Bilayer, *M. Erkovan, M. Ozturk, E. Demirci, N. Akdogan, O. Erdemir*, ***O. Ozturk***, Gebze Institute of Technology, Turkey

In this study, we report EB effect observed in Pt_xCo_{1-x} (x changes from 10 to 90 by 10 step)/ CoO bilayer thin films. PtCo alloys have very large magnetocrystalline anisotropy so they will be very good candidate for next generation data storage media. Besides EB effect is used in the read head sensors, so PtCo may find usage area in both the read head sensor and data storage media. Our goal was to determine how EB depends on Pt concentration in ferromagnetic PtCo layer and temperature.

All films were prepared at UHV conditions by magnetron sputtering deposition technique. The chemical ratios of PtCo layers and CoO layers for all composite films were characterized by Photoelectron Spectroscopy (XPS) technique. Quantum Design PPMS 9T vibrating sample magnetometer (VSM) was used to investigate EB properties of the films. Since the Néel temperature is about 290 K for antiferromagnetic CoO layer, Pt_xCo_{1-x} /CoO films were heated up to 320K before cooling down to the measurement temperature to observe Exchange bias effect. An in-plane magnetic field of 2 kOe was applied while cooling the samples to the measurement temperatures.

Temperature-dependent magnetization measurements show that strength and onset temperature of exchange bias are enhanced by increasing Pt concentration. We observed also two different results from magnetization measurement. One of them is that the blocking temperature (T_B) of both samples is lower than the expected bulk value. The other one is that decreasing Pt concentration within the FM PtCo layer reduces T_B to lower values. In order to determine the effect of Pt concentration on magnetic anisotropies, the samples have been investigated by using ferromagnetic resonance (FMR) technique at room temperature (RT). FMR experiments show uniaxial in-plane magnetic anisotropy at room temperature. This behavior becomes stronger when the Pt concentration is increased. According to these results, the manipulation of common interface between ferromagnetic and antiferromagnetic layers gives the possibility to tune the exchange bias with Pt concentration and temperature.

MI-TuP4 Internal Magnetic Friction of Gold-Nickel Alloy Substrates on a Quartz Crystal Microbalance, ***K.M. Stevens**, L. Pan, J. Krim,* North Carolina State University

The study of magnetic friction provides an opportunity to access bulk properties of the material and internal dissipation pathways. This gives benefits beyond that of surface studies, which assume a uniform substrate response and typically access phononic, conduction and charging pathways. This technique has been used successfully to study superconductivity-dependent friction [1,2] and nonhomogeneous magnetic microstructures[3-5].

We study gold-nickel alloys, as these provide an interesting spectrum of bulk magnetic properties. Samples with 5-20% nickel alloyed with gold were deposited as a homogenous solid-solution or as a two-phase FCC solid through the modification of annealing procedures. The solid solution is known to be paramagnetic for concentrations below 35% Ni [6], while the two phase solid maintains domains of ferromagnetism within bulk gold. These materials have been deposited onto a quartz crystal microbalance to allow properties to be monitored continuously by measuring the frequency and amplitude of the oscillator [7].

The two-phase Ni/Au material has demonstrated unique properties. Prior work has shown this to be an exceptional candidate for MEMS electrodes [8]. This work explores the impact of the bulk inhomogeneity. We have observed a “flexing” effect due to the application of an external magnetic field on two-phase alloy samples, which is measured as a discrete decrease of oscillator amplitude synchronized with the applied field; the effect is not seen on the solid solution samples of the same nickel-gold composition. The results are consistent with the formation of internal shear waves around the domains of nickel within bulk gold. An internal degree of freedom at the grain boundaries may decrease friction even in the absence of an external magnetic field.

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