BP08

Evaluation of LDPC and SCCC on the PMR Channel Model

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LDPC (Low-density parity-check) code and Turbo code show good performance in many communication systems. Recently they are applied in storage systems for improving the bit error rate (BER) performance [1]. Serial concatenated convolutional code (SCCC) using recursive systematic convolutional (RSC) code has simpler scheme than iterative coding schemes like LDPC or Turbo codes [2]. We know that the LDPC code has better BER performance than RSC code but LDPC code has very higher hardware complexity than RSC code. We investigate the performance of these systems after four channel iterations. In Fig.1, we notice that the SCCC has better performance than the LDPC system until 27dB (< 10^{-6} BER). On the other hand (> 10^{-6} BER), the LDPC code has better performance than the SCCC. We see the error floor of SCCC after 10^{-6} BER. The SCCC and LDPC perform 3.5dB better than the NPML at 10^{-6} BER. In LDPC, the maximum number of inner iterations and channel iterations are 10 and 4, respectively. In SCCC, the number of channel iterations is 4, too. The normalized user bit density (UBD) is 1.7. The code rate is 0.944(4096/4336). We use the PR target of PR(12321). The percentage of the jitter noise is 80% and AWGN is 20%.

We can expect that the performance is improved if we increase the number of iterations in both systems. Therefore we simulate the performance when inner iterations of LDPC decoder and channel iterations are increased.

We conclude that the SCCC is better coding scheme than LDPC because the RSC encoder/decoder is simple. Also the error floor may not cause any problem since the system has to use the outer code (In general, RS code is used for the outer code.) for error free system.

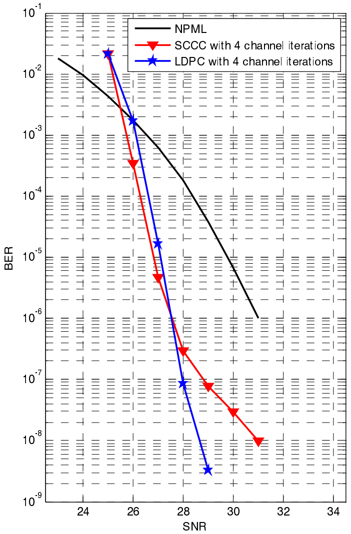

Fig. 1. Result of the comparison LDPC and SCCC.

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BP09

Structural and Magnetic Properties of Electrodeposited Co-W Films

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Perpendicular magnetic recording (PMR) has been developed as a high density recording technique[1]. Co-W alloy films attracted great research interests due to their favorable magnetic properties for PMR, as well as a good wear resistance which is a major problem in magnetic recording media. These alloys also possess a high Curie point and perform endurance to hostile environments or extreme vacuum condition which is the feature of space environment[2,3]. Although preparation of electrodeposited Co-W were well studied[1~3], the imformation of correlation of structrual and magnetic properties for magnetic anisotropic films is still lack. In this study, the effects of composition, thickness and annealing on the morphology and magnetic properties of electrodeposited Co-W films for perpendicular magnetic recording were studied.

Co-W alloy films with different thickness were deposited on pre-polished Cu substrates by electro-chemical method at different current densities from a novel bath containing some organic additives. The solution temperature was kept constant at 50°C. The bath was well-stirred by nitrogen gas flow during deposition. After deposition the samples were annealed in a vacuum condition better than 1×10^{-6} Torr at different temperatures. The morphology and composition of the films were examined with a scanning electron microscopy (SEM) and energy-dispersive X-ray analyzer (EDS), respectively. The crystalline structure was investigated by X-ray diffraction (XRD) with CuKα radiation. The magnetic properties were studied by a vibrating sample magnetometer (VSM).

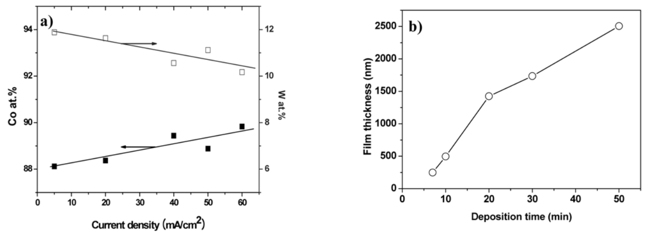

Fig. 1. a) Composition of electrodeposited Co-W films as a function of current density (deposition time: 20 min); b) Film thickness as a function of deposition time (deposition current density: 5 mA/cm^2).

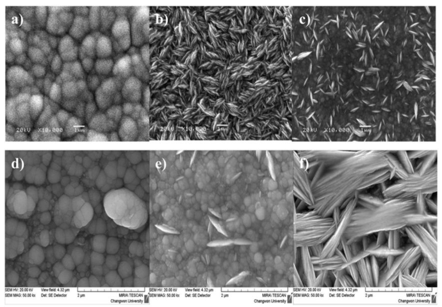

Fig. 2. SEM image of Co-W films electrodeposited at a) 110 mA/cm^2, b) 60 mA/cm^2 and c) 5 mA/cm2; FESEM image of Co-W films electrodeposited at 5 mA/cm2 for d) 5 min, e) 20 min and f) 50min.

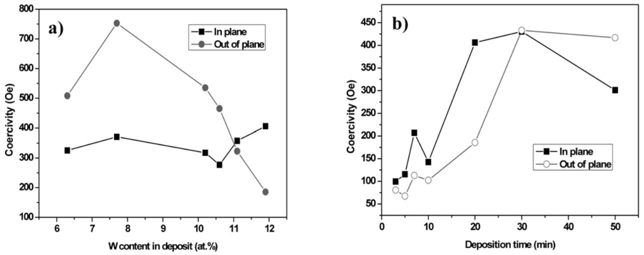

Fig. 3. M-H curves for Co-W films as a function of a) composition and b) deposition time.

It was found that morphology and magnetic properties of the samples were affected by composition and thickness of the sample, as well as post-annealing treatment. Hard magnetic films were obtained for both as-deposited and post-annealed films deposited from a solution by controlling proper deposition parameters. Effort of preparation of electrodeposited Co-W thin films with perpendicular magnetic anisotropy is underway.

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BP10

Magnetization Reversal of Co/Pd Multilayers on Si Substrates and AAO Membranes

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Recently, researchers paid attention to the magnetization reversal of magnetic nanostructures because of the developments of spintronic devices and ultra-high density recording. In this study, $[Co(0.3nm)/Pd(1nm)]_{15}$ multilayers are deposited on Si(100) substrates and anodic-alumina-oxide membranes (AAO) with an average hole diameter of around 200nm in an UHV e-beam system. The out-of-plane coercivity of Co/Pd multilayers grown on Si substrates is of around 3000 Oe which is measured by the PMOKE. The magnetization reversal of Co/Pd multilayers is directly imaged by the MFM with a variable perpendicular field up to 4000 Oe. The domain nucleation and the wall motion of Co/Pd multilayers grown on Si are observed as shown in Fig. 1(a). Instead of domain-wall motion, the magnetization reversal in Co/Pd multilayers grown on AAO displays a domain rotation. Small domains are observed in MFM images as shown in Fig. 1(b). In the VSM investigation, we make a plot of coercivity vs. out-of-plane angle for both samples. They suggest a wall motion and a domain rotation for Co/Pd multilayers grown on Si and AAO templates, respectively.

In the perpendicular magnetoresistance (PMR) measurements, a large resistivity is observed in the AAO case due to a relatively small cross-sectional channel for electrons to pass. The PMR displays a negative MR behavior for both films as shown in Fig. 2. The position of maximum peak is located at 2400 Oe and 1100 Oe for the co/Pd multilayers grown on Si and AAO templates. They indicate that the magnetization reversal take place under a low field and the strength of perpendicular anisotropy is relatively low in the AAO case.

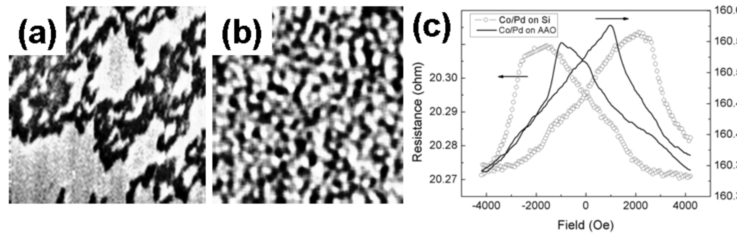

Fig. 1. The MFM images of Co/Pd multilayers on (a) Si substrates and (b) AAO membranes. The perpendicular MR curves of Co/Pd multilayers are shown in Fig. (c).