R-8

스퍼터링한 MgO(111) 하지막을 이용한 $L1_0$ FePt(111) 극박막의 결정배향성 조절

정 재윤*, 김 정기, 배 승영+, 신경호+

한양대학교 물리학과
한국과학기술연구원 박막기술연구센터+

Controlling the crystallographic orientation in ultra thin $L1_0$ FePt(111) films on sputtered MgO(111) underlayer

Jae-Yoon Jeong*, Jung-Gi Kim, Seung-Young Bae+ and Kyung-Ho Shin+

Department of Physics, Hanyang University, Seoul 133-791, Korea
Thin Film Technology Research Center, KIST, Seoul 136-791, Korea+

1. Introduction

Feasibility of chemically ordered, (111) textured FePt longitudinal media for ultra high recording density has been suggested especially in the region of ultra thin films with high coercivity (3,000Oe) and very low Mrt ($\leq$ 0.3 memu/cm^2, less than 10nm film thickness) as the potential candidate to be substituted for Co based alloy media. However, rapid decrease of crystallographic texture due to decrease of thickness, in the absence of the proper template layer, results in very low coercivity squareness(S*$\leq$ 0.3), which may be detrimental to recording application because of large switching field distribution.[1] To improve this problem it is certain that we have to introduce the proper template layer for epitaxial growth. However these FePt thin films must pass through annealing process in order to be transformed into ordering phase. Accordingly, the underlayer should have the characteristics of (1) minimal interdiffusion with FePt layer (2) good lattice match with FePt lattice (a = 3.8525 Å and c = 3.7133 Å) and (3) excellent prefered orientation to provide (111) texture growth of overlying FePt. MgO with rock salt structure (a = 4.213 Å) meets such condition, as single cyrstalline MgO(110) or sputterred MgO(100) accommodate the expitaxial growth of FePt or CoPt at moderate substrate temperature in the previous investigation.[2),3)] We present the enhanced (111) texture and the consequent high S* of ultra thin FePt using reactively sputtered MgO(111) underlayer.

2. Experiment

MgO thin films were fabricated on Corning 7059 glass and SiO_2(200nm)/Si(100) substrates by DC reactive sputtering using a magnesium metal target. FePt thin films were subsquently sputtered on a MgO underlayer using DC magnetron sputtering at 300 °C, and then annealed in-situ at 500 °C. Texture development was dependent on oxygen partial pressure in O_2/Ar gas mixture, working pressure and substrate temperature. A strong

crystallographic texture of MgO(111) was successfully developed by optimization of the sputtering conditions.

3. Result & Discussion

An introduction of MgO(111) underlayer significantly enhanced the crystallographic texture of FePt(111) when FePt films were as thin as 10nm or less. For example, full width at half maximum(FWHM) of FePt(111) reflection measured from XRD rocking curve was as small as 7^{o} when FePt films were deposited on a MgO(111) underlayer. No sizeable FePt(111) texuture was observed in FePt films without a MgO underlayer. Consequently, the S* increased from 0.3 in the films without a MgO underlayer to 0.75. FePt(111) textured films showed the coercivity of 3200 Oe at $M_rt = 0.3$ memu/cm^2.

1) Seung-Young Bae, Kyung-Ho, Jae-Yoon Jeong and Jung-Gi Kim, *J. Appl. Phys.* 87, 6953 (2000)
2) R. F. C. Farrow, D. Weller, R. F. Marks, M. F. Toney, David J. Smith and M. R. McCartney, *J. Appl. Phys.* 84, 934 (1998)
3) Sangki Jeong, Yu-Nu Hsu, Michael E. McHenrry and David E. Laughlin, *J. Appl. Phys.* 87, 6950 (2000)