ER01

Annealing Effects on the Structural and Magnetic Properties of Ion-beam Deposited Pt/Fe and Pt/Co Multilayers

J.-Y. Guo[1], K.-W. Lin[1]*, S.-R. Lin[1], C.-Y. Liu[1], H. Ouyang[2], J. van Lierop[3], and T. Suzuki[4]

[1]Department of Materials Science and Engineering, National Chung Hsing University, Taichung 402, Taiwan

[2]Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu, Taiwan

[3]Department of Physics and Astronomy, University of Manitoba, Winnipeg, R3T2N2, Canada

[4]Information Storage Materials Laboratory, Toyota Technological Institute, Nagoya 468-8511, Japan

*Corresponding author: e-mail address: kwlin@dragon.nchu.edu.tw

The structural and magnetic properties of Pt/Fe and Pt/Co multilayers were investigated. X-ray diffraction results have shown that as-deposited Pt/Fe and Pt/Co multilayers consist of f.c.c. Pt (a = 3.91 Å), b.c.c. Fe (a = 2.91 Å), and h.c.p. Co (a = 2.46 Å, c = 4.10 Å) phases. Intermixing at the interface during deposition also created disordered Fe-Pt and Co-Pt phases. The grain sizes of these polycrystalline Pt/Fe and Pt/Co multilayers ranged from 5 nm to 15 nm, as revealed by transmission electron microscopy. The coercivity of the as-deposited multilayers is small (Hc < 100 Oe), which we believe is mainly from the soft Fe or Co phase. For Pt/Fe multilayers, annealing the films (400°C for 6 min) did not alter the structure. However, the grain sizes of an annealed [Pt (20 Å)/Fe (15 Å)]10 sample (550°C) increased, now ranging from 20 nm to 60 nm. This film system also exhibited the highest coercivity, Hc~ 9200 Oe (corresponding to an order parameter S~ 0.82), and was attributed to the formation of ordered f.c.t. FePt (a = 3.84 Å, c = 3.72 Å) phases. An [Pt (10 Å)/Fe (23 Å)]10 sample exhibited a small coercivity, Hc~ 160 Oe, when annealed, and this Hc is from the formation of soft f.c.c. Fe3Pt phases. Increasing the annealing period or temperature helped improve the order parameter (S ~ 0.87) while keeping the high coercivity (Hc~ 8200 Oe). Similar results have been found in annealed Pt/Co multilayers, however, the results indicate that the ordering temperature of formation of a CoPt phase is higher than that a FePt phase.

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ER02

Magnetization Reversal Processes and Domain Patterns of $L1_0$ FePt/glass Film with Perpendicular Anisotropy

J. L. Tsai*, G. B. Lin, M. Y. Chen, and C. L. Ou

Department of Materials Science and Engineering, National Chung Hsing University, Taichung, Taiwan, R.O.C

*Corresponding author: e-mail: tsaijl@dragon.nchu.edu.tw

$L1_0$ ordered (001) FePt has been proposed to be a promising candidate as an ultrahigh-density perpendicular recording media due to its high magnetocrystalline anisotropy (Ku). Fundamentally, magnetization reversal process is important for high Ku material and rare discussed recently.

The work successfully fabricated highly textured $L1_0$ FePt thin film nonepitaxially. The nearly perfect (001) texture was obtained by depositing FePt thin film on glass substrate at room temperature and subsequently annealing by rapid thermal annealing (RTA) for 300-600s. Laminating growths of like atomic-scale Fe/Pt multilayer have been discussed and promised to obtain perfect (001) oriented $L1_0$ phase and reduced ordering temperature due to limited diffusion length. However, the sputtered FePt single layer film was rare reported recently due to high ordering temperature or extended annealing time but re-explored in this study. The film properties prepared by FePt alloy target by sputtering was rare discussed recently and re-explored in this study. To optimize the $L1_0$ FePt ordering process, different atmospheres were introduced during RTA annealing and we found the Argon mixed with 5%H_2 gas reduced the ordering temperature and enhanced the (001) orientation more significantly. The coercivity mechanism from the angular dependent on coercivity and modeling fitting changes from in-between domain walls pinning and magnetization rotation (nucleation) in FePt film under Ar+H2 annealing to reversed domain nucleation dominated under vacuum annealing. Multi- and single-domain pattern analysis includes mapping AFM and MFM images and proven in line-profile curves. This work observes stripe and maze-like domains in perpendicular anisotropic film at different applied field.