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Role of MgO Buffer Layer in SiO_2 Doped L10 FePt Anisotropic Film

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The $L1_0$ FePt phase is widely consideredas the material for perpendicular recording media to reach areal densities of 1Tbits/in^2 and beyond as compared to the limit of 500Gbits/in^2 by Co-based alloys [1]. Reported literature to obtain the $L1_0$ phase was to deposit FePt directly on MgO (001) single crystal substrate by heteroepitaxial growth and to post-deposition anneal at temperatures above 500°C for a period of time. However, the magnetic properties such as coercivity (H_c) and squareness (S) were below that would be expected as the strain energy arising from the lattice mismatch between FePt (001) ∥ (100) and MgO (001) ∥ (100) was considered sufficient to aid produce a well ordered $L1_0$ phase. Butfor ultra-high areal density applications, in addition to the well ordered structure, magnetically isolated grains are equally important. In this report, MgO buffer layer was sputter deposited on MgO (001) single crystal substrates as it was expected that the interface between the FePt layer and sputtered MgO layer would be different from that of the single crystal substrates and hence would affect the crystallography, magnetic properties and the segregation of SiO_2 which was the dopant used for magnetic isolation.

MgO (001) single crystal substrate/MgO (0, 2 nm)/FePt + x vol% SiO_2 (10 nm), where x = 0, 10, 15, 20, films were fabricated by a custom built dc/rf magnetron 4-targets sputter deposition system. The MgO buffer layer was fabricated by rf sputtering at 10 mTorr Ar working pressure and the deposition temperature at 80°C. The FePt magnetic layer was deposited at 400°C.

hen SiO_2 doped FePt was deposited on MgO (001) single crystal substrate, the superlattice FePt (001) texture was dominant even up to 20 vol% dopant content. With the 2 nm MgO buffer layer, FePt (001) texture deteriorated significantly with increasing SiO_2 content and almost dimished when doped with 20 vol% SiO_2.Magnetic measurements showed that good perpendicular anisotropy was maintained with the in-plane M-H loop resembling typical hard axis loop when SiO_2 doped FePt was deposited on MgO substrates. For the samples deposited on MgO buffer layer, Hc showed a significant decreasing trend from about 13.8 kOe to 1 kOe.

Interestingly, the loop slope parameter, a, did not exhibit a decreasing trend with increasing SiO_2 content for the doped FePt deposited on MgO substrates while this trend was identified for the samples deposited on MgO buffer layer, suggesting that the MgO buffer had significant effect on the segregation of SiO_2 to obtain exchange decoupling effect. The effect of the interface from the MgO buffer layer on the texture formation and dopant segregation will be discussed in the full paper.

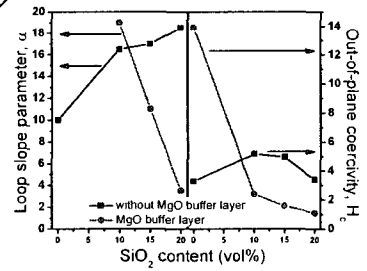

Fig. 1. Trend of Hc and a, against SiO_2 content

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TA04

Enhancement of Hard Magnetic Properties of $Pr_{60}Fe_{30}Al_{10-x}Ti_x$ Alloys

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This work presents results of study on structure and magnetic properties of $Pr_{60}Fe_{30}Al_{10-x}Ti_x$(x = 0, 2, 4, 6, 8) alloys prepared by arc-melting and suction casting with water cooling. The cross section of the samples is partly crystallized. With increasing Ti content, the crystallization volume fraction increases, the coercivity is improved up to 3.78 kOe for sample with x = 8, Curie temperature changes from 358 K for sample with x = 0 to 420 K for sample with x = 8, whereas, the magnetization at 13.5 kOe slightly reduces. Zero-field-cooled and field-cooled curves measured in low field reveal a separation from each other indicating the existence of cluster-glass state.