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Fabrication and magnetic properties of Ta/FePt films

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Several L_1^0 structure alloys such as FePt and CoPt films are candidates for ultrahigh density magnetic recording media because of the high magnetic anisotrotpy of L_1^0 phase. L_1^0 FePt films has attracted much attention due to its high K_u value ($6.6 \sim 10 \times 10^7$ erg/cm^3). This high magnetic anisotropy energy allows for thermally stable grain size down to around 2nm. thus, the FePt ordered alloy may lead to the realization of a magnetic medium capable of recording densities beyond 1 Tb/in^2.[1,2] However, a high temperature treatment is necessary to transform phase from disordered fcc structure to the L_1^0 structure. Recently, several attempts have been made to reduce the transition temperature, Such as the insertion of under layersor multilayer and in-situ annealing. Most of these investigations need single crystaland a complicated preparing process.[2]

In this letter, we propose a reducing the ordering temperature of the L_1^0 FePt-ordered alloy. L_1^0phase FePt thin films were fabricated on thermally oxidized Si wafer using a dc magnetron sputtering system with Ta under layerat room temperature. The base pressure was better than 3×10^{-7} Torr. After deposition, the samples were annealed in vacuum. The annealing temperature was varied from 100~500 ℃ and the annealing time was fixed 1 hour. Structure of the thin films were observed at room temperature using x-ray diffractometer (XRD), atomic force microscopy (AFM) and field effect scanning electron microscopy (FE-SEM). Magnetic properties of the films were measured with vibrating sample magnetometer (VSM) and magneto optic kerr effect (MOKE). It has been found that the thin films enhanced in plane magnetic anisotropy compared with non under layer thin films. However, upon thermal annealing in vacuum,thin films undergo a smooth transition of magnetic anisotropy from in-plane to perpendicular direction. The anisotropy field and coercivity can be controlling the annealing temperature.

References

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