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Buffer Layer Effect on Magnetic Properties of (001)-oriented $L1_0$ FePt Films

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Highly anisotropic FePt is a leading candidate material for ultra high density magnetic recording media of ~ 1Tbits/in^2. A lot of investigations have been made to process FePt films by various thin film preparation techniques. However, avoiding a high temperature annealing process to form high anisotropic $L1_0$ FePt and reducing the grain size of FePt are actual challenges for the researchers to make this film suitable for reliable high-density data storage using conventional write heads.

We investigated the buffer layer effect on magnetic and structural properties of FePt films with a thickness less than 10 nm prepared by using co-evaporation technique of UHV-MBE system. Without high temperature heat treatment, at substrate temperature (T_s) lower than 350℃, the FePt films was deposited beyond the different thickness of Pt layer grown on an epitaxial MgO buffered-Si (100) substrate. We observed the (001)-oriented epitaxial $L1_0$ FePt films grown on the thinner (001)-oriented fcc Pt films, while a poorly crystallized FePt film was formed on the (111)-textured Pt film. In this work, for the FePt film with perpendicular magnetic anisotropy (PMA) we have focused on optimizing growth conditions, such as buffer layer, deposition rate, and T_s. The structural analysis was systematically carried out by x-ray diffractometer, atomic force microscope and transmission electron microscope. The magnetic properties were measure by vibrating sample magnetometer. Also, we will discuss the spin reorientation transition (SRT) as a possible explanation for the origin of PMA. Our results could be useful to develop high density recording media technology for mass production.

This research was supported by a grant from the Fundamental R&D Program for Core Technology of Material funded by the Ministry of Commerce, Republic of Korea

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