Fabrication of $L1_0$ (MnCo)Al thin film with high perpendicular magnetic anisotropy on Pt seed layer

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Spin-orbit torque (SOT) induced magnetization switching in heavy metal (HM) / ferromagnetic metal (FM) heterostructures has been devoted lots of research attention as it shows promise for future ultrafast and power conservation magnetic memories [1]. For FM layer, magnetic thin films with high perpendicular magnetic anisotropy (PMA) are needed, which promote research of Mn-based alloys, such as $L1_0$-MnAl with high PMA [2]. Crystal, roughness and magnetic properties of $L1_0$-MnAl thin film with high PMA deposited on CrRu buffer layer have been studied systematically [3,4]. However, fabrication of $L1_0$-MnAl films on HM layer, such as Pt, has not been investigated. In this work, we report the crystal and magnetic properties of $L1_0$-(MnCo)Al thin films (light-doped Co into MnAl) deposited on Pt seed layer.

All the samples were prepared by magnetron sputtering system. The stacking structures were MgO(001) sub. / $Cr_{90}Ru_{10}$ (20) / Pt (0~10) / $Mn_{0.97}Co_{0.03}Al$ (10) / Ta (5) (thickness in nm). Small amount of Co was doped into MnAl to improve surface roughness of the films. The substrate temperature was 250°C. The crystal structure was measured by X-ray diffraction (XRD). The magnetic properties of the films were measured by superconducting quantum interference device (SQUID) magnetometer.

Fig. 1 shows the XRD patterns of the prepared films with various Pt thicknesses. The MnAl (001) peak is a signature of crystallization in the tetragonal $L1_0$ phase, and all the films exhibiting this peak showed clear PMA properties. With the increasing of Pt thickness, the (001) peak position shifted towards smaller angle, corresponding to a stretch of the lattice along the *c* direction approaching to bulk value, indicating that the films had improved crystallization on thick Pt seed layer. The magnetic properties of the films will be given in the conference.

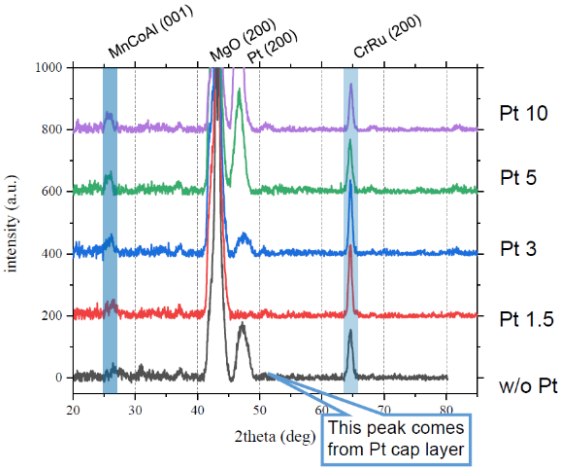

Fig. 1 XRD pattern of (MnCo)Al films grown on various thick Pt seed layers.

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