DC-sputtering法によるβ-Mn型構造CoZnMn薄膜の作製と磁化特性

Structural and magnetic properties of β-Mn-type CoZnMn alloy thin films fabricated by DC-sputtering

アルバック未来研1, 物材機構2 ○石川 諒1, 奥承俊1, 森田 正1, 葛西 伸哉2, 高橋 有紀子2

ULVAC Future Technology Research Lab.1, NIMS2

Ryo Ishikawa1, Seungjun Oh1, Tadashi Morita1, Shinya Kasai2 and Yukiko Takahashi2

E-mail: ryou_ishikawa@ulvac.com

β-Mn-type CoZnMn alloys have been known as single-component ferromagnetic material hosting skyrmions above room temperature. However, the observation of skyrmion phase in CoZnMn is limited to bulk samples [1,2]. In order to utilize skyrmions in electronic devices, well-established fabrication method of thin films of CoZnMn is essential. In this work we fabricated thin films of CoZnMn and evaluated their structural and magnetic properties.

Thin films of CoZnMn were deposited on silicon substrates with oxide film using DC-magnetron sputtering technique. Sintered target composed of Co, Zn and Mn metals was used as source material. In order to crystalize the films, we performed post-deposition thermal annealing in vacuum. Structural properties of the films were checked using 2θ-θ scan of XRD. The magnetization of films were measured using VSM. The composition ratio of films checked by EDX were about 9 : 9 : 2 = Co : Zn : Mn.

Figure 1 shows the result of XRD 2θ-θ scan of annealed film (a) and calculated diffraction pattern for β-Mn-type CoZnMn powder (b). As seen in Figure 1, annealed film exhibits polycrystalline of β-Mn-type structure. Figure 2 and 3 shows M-H curves of CoZnMn films measured with applied magnetic field in-plane and out of plane respectively. Both annealed and as-deposited films has in-plane magnetization easy axis. However, only annealed film exhibits out of plane hysteretic component (Figure 4). One possible explanation of this magnetic behavior is superimpose of two magnetic phases including the β-Mn phase and amorphous phase. The detail will be discussed at the presentation.

References