第77回応用物理学会秋季学術講演会 講演予稿集 (2016 朱鷺メッセ (新潟県新潟市))

Fabrication of perpendicular magnetized spin-filter junctions using ferromagnetic insulator $CoFe_2O_4$

Hokkaido Univ, °Hiroki Kajita, Takashi Yanase, Toshihiro Shimada, Taro Nagahama

E-mail: tjuvolley0@eis.hokudai.ac.jp

【Introduction】The generation of highly spin-polarized electron currents is one of the dominant focuses in the field of spintronics. A spin-filter junction with a ferromagnetic insulator is potential candidate for practical spin-polarized current sources. Many investigations have been carried out on the development of in-plane magnetized spin-filter junctions using ferromagnetic insulator $CoFe_2O_4$ [1]. On the other hand, several studies have reported that the $CoFe_2O_4$ films have the perpendicular magnetic anisotropy induced by lattice strain on MgO(100) substrate[2]. In this work, we fabricated the perpendicular magnetized spin-filter junctions using $CoFe_2O_4$ and investigated the magnetotransport properties.

【Experiment】The perpendicular magnetized spin-filter junctions were prepared by reactive MBE method. Sample structures were MgO(100) /Cr(20 nm) /Pt(10 nm) / $CoFe_2O_4$ (3-7 nm) /MgO(2 nm) / FePt(10 nm)/Au(30 nm). $CoFe_2O_4$ thin films were deposited at 300°C in the oxygen radical atmosphere of 4×10^{-4} Pa and annealed at 450°C. FePt films were prepared from individual Fe and Pt sources at 500°C. The epitaxial growth and surface structures were observed by RHEED and AFM. The magnetic properties were measured by MOKE at RT. The films were patterned into 10 x 10 μm^2 devices with photolithography, Ar ion milling and sputtering.

【Results】Fig.1 shows MOKE loops of $CoFe_2O_4$ layers for various thickness. The magnetic field was applied perpendicular to the film plane. The films showed clear perpendicular magnetic anisotropy. The RHEED of $CoFe_2O_4$ was clear streak pattern and the Root Mean Square(RMS) was estimated as 0.29 nm from AFM measurements. Fig.2 shows a MR curve of the perpendicular magnetized spin-filter junctions at 10 K with a bias of 0.3 V. The MR curve of -1.1% was observed.

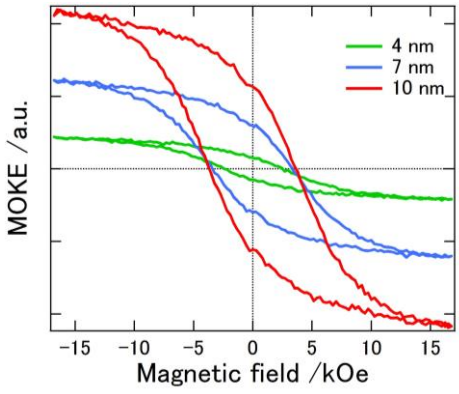

Fig.1. MOKE loops of $CoFe_2O_4$ layers for various thickness at R.T.

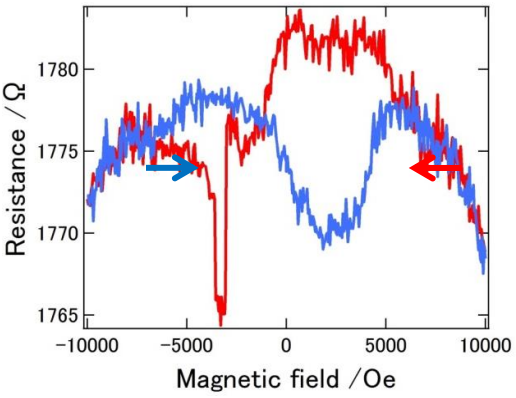

Fig.2. MR curve of the perpendicular magnetized spin-filter junctions at 10 K.

[1] Y. K. Takahashi *et al.*, Appl. Phys. Lett. **96**, 072512(2010).

[2]H. Yanagihara *et al.*, J Appl. Phys., **109**, 07C122(2011).