

Structural and Magnetic Properties of BiFeO₃/Magnetic Bilayer

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1. Introduction

Spontaneous polarization changes interfacial magnetic state; therefore, the tunneling conductance also can be modulated by the spontaneous polarization. Control of spontaneous polarization by magnetic field through magneto-electric (ME) coupling at the interface becomes interest as the new type of multiferroics. [1] By replacing the ferroelectric by multiferroics, it is not investigated yet multiferroic properties can be modulated. In this study, BiFeO₃ having antiferromagnetic spin configuration was combined with metal magnetic material, and systematically investigate the structural and magnetic properties of bilayer films.

2. Experimental Procedure

(1 at.% La-doped) SrTiO₃ (001) sub. /BiFeO₃ (t_{BFO})/Co₅₀Fe₅₀ or Co (t_{m})/Ru(3) (in nm) samples were prepared by r.f. magnetron sputtering. The thickness of BiFeO₃ and magnetic layer (CoFe, and Co), and sputtering condition such as substrate temperature (T_s), input-power was changed. Film structure was observed by XRD, TEM and AFM. The magnetic properties were measured by VSM and XMCD.

3. Experimental Results

The BiFeO₃ epitaxial with atomically flat films were deposited at 550°C with Ar + O₂ mixture gas, [2] and then the CoFe and Co layer was deposited by various T_s . XRD analyses indicates that CoFe layer epitaxially grown on the BiFeO₃ with b.c.c. structure at 200°C while the Co was epitaxially grown with h.c.p. structure on BiFeO₃ at 300°C. However, in both cases, the surface became rough by heating due to island growth. Figure 1 shows the cross-sectional TEM image at the interface BiFeO₃ (50) / CoFe (4)/Ru (3). The CoFe was deposited at room temperature. The interface seems flat and CoFe layer was formed as polycrystalline structure. XMCD measurement indicates the hysteresis loops by L_3 edge of Fe has clear hysteresis loops for both BiFeO₃ and CoFe layer. It seems the Fe in BiFeO₃ has influenced by magnetization reversal of CoFe layer.

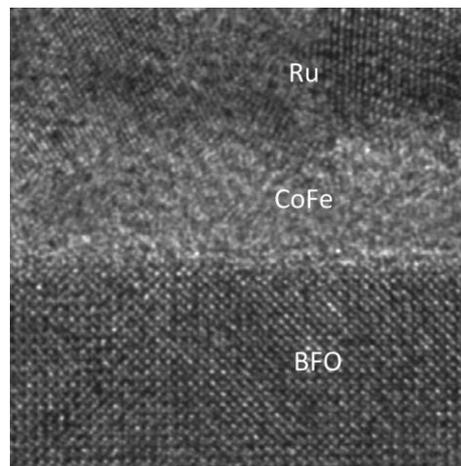


Fig. 1 Cross-sectional TEM image. CoFe layer was deposited at room temperature.

[1] V. Garcia *et al.*, Science, **327**, 1106 (2010). [2] S. Sato, *et al.* 75th JSAP Autumn Meeting (17p-PA4-2)

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