UD01

Anomalous magnetoimpedance in Co-Fe-Al-O thin films

Le Anh Tuan[1], Nguyen Duy Ha[2], Chong-Oh Kim[1],
Seong-Cho Yu[3], Heebok Lee[4], and Manh-Huong Phan*[5]

[1] Research Center for Advanced Magnetic Materials, Chungnam National University, Daejeon 305-765, Korea The
[2] Kamerlingh Onnes Laboratory, Leiden University, P.O. Box 9504, 2300 RA Leiden, The Netherlands
[3] Department of Physics, Chungbuk National University, Cheongju 361-763, Korea
[4] Department of Physics Education, Kongju National University, Kongju 314-701, Korea
[5] Advanced Composites Centre for Innovation and Science, University of Bristol, Queen's Building, Bristol BS8 1TR, England

*Corresponding author: M.H.Phan@bristol.ac.uk, Phone: +441173317917, Fax: +441179272771

Ferromagnetic thin films have proved useful for giant magnetoimpedance (GMI) sensor technology [1]. Due to the complex nature of the problem, however, some anomalous high-frequency GMI features observed in the films cannot be explained within the framework of the existing theoretical models [2]. This thus warrants further studies.

In this work, the high-frequency GMI effect has been studied in $Co_{47.5}Fe_{21.9}Al_{17.2}O_{15.2}$ thin films, which were fabricated by the RF magnetron reactive sputtering technique, using Si (100) substrate under a field of 120 Oe that was applied parallel to the substrate plane. The input power and the mixed Ar + O2 (3%) pressure were 300 W and 2 mTorr, respectively. It has been shown that in the investigated frequency range of 100~500 MHz, GMI profiles show a double-peak characteristic, reflecting an evident existence of the transverse magnetic anisotropy in the film. This is in agreement with the magnetization data. It is very interesting that an anomalous transformation in GMI profile from "positive" to "negative"has been observed. Note that the "positive" GMI effect means an increase in the film impedance when a saturating magnetic field (~300 Oe) is applied, whereas the "negative" GMI effect does a decrease in the film impedance with respect to applied magnetic field. It has been found that the GMI effect is "positive" in the frequency ranges f = 100~143 MHz, 184~265 MHz, and 400~500 MHz, whereas it is "negative" in the frequency ranges f = 143~184 MHz and 265~400 MHz. This is likely associated with the complex phase transformation of the permeability. In the frequency range where the "negative" GMI effect is observed, the change of the GMI magnitude with frequency is opposite to that of the anisotropy field. It is found that the GMI ratio decreases with decreasing film-thickness, which is attributed to the increase of the resistivity and to the decrease of the magnetic softness of the film.

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UD02

Comparison on the magnetic properties and Auger depth profile of Co/Ge(111) filmswith oxygen exposure and CoO layer

C.W. Lai[1]*, H.W. Chang[2], J.S. Tsay[3], and Y.D.Yao[2]

[1] Department of Physics, National Chung Cheng University, 168, University Road, Min-Hsiung, Chiayi 621, Taiwan, ROC
[2] Institute of Physics, Academia Sinica, Nankang, Taipei 11529, Taiwan, ROC
[3] Department of Physics, National Taiwan Normal University, Taipei 116, Taiwan

*Corresponding author: corponic@yahoo.com.tw, Phone: +886 86912888 #6876, Fax: +886 86912379

The influences of interfaces and metal oxide layers on the magnetic properties of nanometer-scale materials are very important in material science and have received intensive attention, since these systems are promising candidates as the next-generation magnetic storage and read-out devices [1]. In our previous studies, magnetic properties of ultrathin Co grown on the Ge(111) surface have been systemically investigated [2]. For further application, effect of oxide top layer on the magnetic properties of the Co/Ge(111) is more important. In this presentation, we use two methods to obtain oxide (1) exposing oxygen on 15 ML Co/Ge(111) and (2) evaporating Co in an oxygen atmosphere at a constant pressure of 1×10^{-7} torrand study effect of layer fabricated by different method on the magnetic properties and depth profile of ultrathin Co/Ge(111) films. By comparing the Auger depth profiles of the ultra-thin films deposited by these two methods, we found the layered composition of these two ultra-thin films consisted of 100% oxygen on the topmost layer, 90% oxygen on the second layer and 80% oxygen on the third layer. The difference on the fourth layer's oxygen composition is 60% and 0% of these two methods respectively. The major difference is the sputtering rate ML/min for each compositional layer [3]. The sputtering rate at the topmost few layers of the second method deposited ultra-thin film is only quarter relative the first one. This implied the cobalt oxide existed in the second method deposited ultra-thin film. Therefore, either CoO layer or oxygen absorption enhances coercivity of ultrathin Co/Ge(111) films respectively due to exchange anisotropy and stress anisotropy.

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