

OSCILLATORY MAGNETIC ANISOTROPY IN Fe/Cr/Fe TRILAYERS

Dept. of Physics and CNSM, KAIST Ki-Yeon Kim*, Dong-Hyun Kim, and Sung-Chul Shin

Dept. of Physics, Inha University Chun-Yeol You

Fe/Cr/Fe 삼층구조에서의 진동하는 자기이방성

한국과학기술원 김기연, 김동현, 신성철

인하대학교 물리학과 유천열

1. INTRODUCTION

Fe/Cr/Fe trilayers have attracted much interest from both theoretical and experimental aspects due to many novel magnetic properties such as antiferromagnetic coupling, giant magnetoresistance, oscillatory bilinear and biquadratic coupling [1]. In this work, we report that there is an oscillation of magnetic anisotropy with increasing intervening Cr layer thickness in Fe/Cr/Fe trilayers.

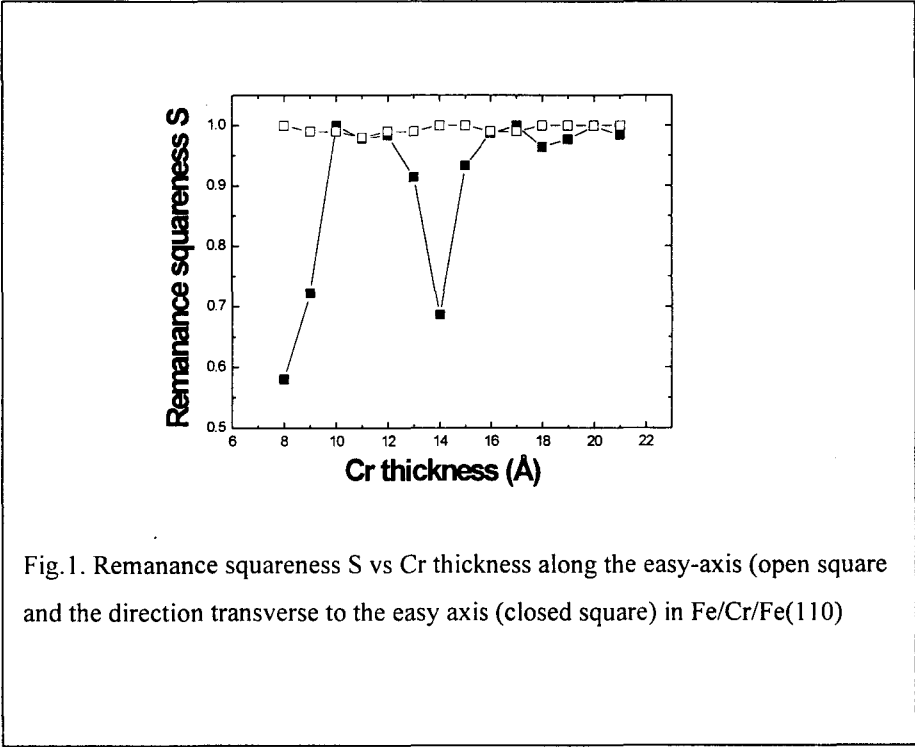
2. EXPERIMENT

We prepared 150-Å Fe/ t_{Cr} -Å Cr/50-Å Fe on a Si(100) substrate by dc magnetron sputtering with varying the Cr thickness t_{Cr} from 8 to 21 Å at room temperature. *In situ* magnetic field of about 500 Oe was applied along a certain orientation in the film plane during deposition to induce the easy axis along this orientation. Structural and magnetic properties were characterized by XRD, AFM, VSM, torque magnetometer, and magneto-optical Kerr microscope.

3. RESULTS AND DISCUSSION

XRD measurement shows that polycrystalline Fe/Cr/Fe trilayers grow with a (110) texture on a Si(100) substrate at room temperature. Hysteresis loops measured by VSM and Kerr microscope along the direction parallel to the easy axis exhibit square shapes for all samples whereas, interestingly enough, hysteresis loops along the direction transverse to the easy axis exhibit oscillatory behavior between square and slant loops with varying t_{Cr} [Fig.1]. The oscillation period is found to be approximately 5~6 Å. To clarify this phenomenon, we measured the magnetic anisotropy using torque magnetometer, where we witnessed a clear oscillating behavior of magnetic anisotropy along the direction transverse to the easy axis. Domain configuration and evolution using time-resolved magneto-optical Kerr microscope reveals that domain-wall type corresponds to the results obtained via VSM and torque magnetometer measurement. The oscillation period of about 5~6 Å is similar to well-known

short period oscillation (2ML) of Fe/Cr/Fe system proposed by the models considering critical spanning vectors of Fermi surface of Cr interlayer. However, the measurement of surface morphology by AFM reveals that the rms roughness slightly increased from 2.5 to 5.0 Å with increasing t_{Cr} . Thus, it is not appropriate to directly compare our experimental result with theoretical prediction, since the magnetic anisotropy is generally determined by electronic states of the entire Brillouin zone, whereas the exchange coupling is governed only by the electronic states at the Fermi surface [2].



4. ACKNOWLEDGEMENT

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5. REFERENCES

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- [2] W. Weber *et al.*, Phys. Rev. Lett, **76**, 3234 (1996).