DA05

Tunneling Anisotropic Mangetoresistance in a Magnetic Tunnel Junction with a Single Ferromagnet CoPt

B. G. Park[1]*, J. Wunderlich[1], S. J. Joo[2], K. Y. Jung[2], K. H. Shin[2], A. B. Shick[3], and T. Jungwirth[3,4]
[1]Hitachi Cambridge Laboratory, Cambridge CB3 0HE, United Kingdom
[2]Nano Device Research Center, Korea Institute of Science and Technology, Seoul 136-792, Korea
[3]Institute of Physics ASCR, Praha, Czech Republic
[4]School of Physics and Astronomy, University of Nottingham, Nottingham NG7 2RD, United Kingdom
*Corresponding author: B.G. Park, e-mail: bp286@cam.ac.uk

A magnetic tunnel junction consisting of two ferromagnetic (FM) layers separated by a tunnel barrier exhibits a large tunnel magnetoresistance (TMR), depending on the relative magnetization direction of the two FM layers. Recently, a similar magnetoresistnace effect (so-called tunneling anisotropic magnetoresistance, TAMR) is observed in tunnel junctions with *only one FM layer* where the TMR is not present. Studies in ferromagnetic semiconductor devices showed that TAMR response can in principle be huge and richer than TMR, with the magnitude and sign dependent on the magnetic field orientation and electric fields. Theoretical work predicted [1] that the TAMR effect is generic in FMs with spin-orbit (SO)-coupling, including the transition metal systems. In this work we present a study of the TAMR effect in a tunnel junction with a single FM electrode of Co/Pt multilayer [2]. While in stacks with the FM electrode terminated by a Co film the TAMR shows around 0.15% (fig 1, right panel), for FM electrodes terminated by two monolayers of Pt we observe two order of magnitude enhancement of the TAMR (fig 1, left panel) and a stronger dependence on field, temperature and bias. The large enhancement of the TAMR signal is attributed to the induced moment and strong SO-coupling in the two-monolayer Pt film inserted between Co and the tunnel barrier. The discussion of the results is based on relativistic *ab initio* calculation of magnetization orientation dependent densities of states of Co and Co/Pt model systems

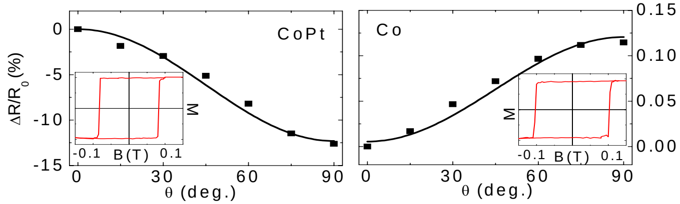

Fig. 1. TAMR [$(R_\theta - R_0)/R_0$] at -5 mV bias and 4 K (θ=0 perp. to plane, θ=90 in-plane). Insets: SQUID magnetization measurements in out of plane magnetic fields.

REFERENCES
[1] A. B. Shick, F. Maca, J. Masek, and T. Jungwirth, Phys. Rev. B 73, 024418 (2006).
[2] B. G. Park et al., Phys. Rev. Lett. 100, 087204 (2008).

DA06

Spin Transport via Tunneling in CoFe/Al_2O_3/Bi/CoFe Junctions

Kyoung-il Lee[1], Kiyoung Lee[2], Joonyeon Chang[1], Kyung-Ho Shin[1], Mark Johnson[3], and Wooyoung Lee[2]*
[1]Center for Spintronics Research, Korea Institute of Science and Technology, Seoul 136-791, Korea
[2]Department of Material Science and Engineering, Yonsei University, Seoul 120-749, Korea
[3]Naval Research Laboratory, Washington DC 20375, USA
*Corresponding author: Wooyoung Lee, e-mail: wooyoung@yonsei.ac.kr

It has been well known that the spin-dependent tunneling effect leads to tunneling magnetoresistance (TMR) in magnetic tunnel junctions (MTJs) is very sensitive to the interface between I and FM, as well as to the electronic band structure of electrodes. The MTJ with a non-magnetic layer (NM) inserted between I and FM is one of the structures to investigate the interface sensitivity. In the past decade, the effect of NM inserted layer on TMR in MTJs has been investigated theoretically [1,2] and experimentally [3-5]. It has been found that the TMR diminished significantly at the NM layer thickness within a few tens of Å and the estimated spin decay length reached only few Å. However, there has not been reported the TMR and spin decay in a semimetal inserted MTJs. We report the spin-dependent transport properties in a semi-metallic Bi-inserted MTJs. Clear spin-dependent tunneling effects in the Bi-inserted MTJs were observed at room temperature. The relatively slow decay of TMR observed experimentally as a function of the Bi layer thickness. The spin decay length of injected spin- polarized electrons in the inserted Bi layer is quantitatively estimated. Also, a spin decaying in the Bi-inserted layer is investigated by taking into account the directions and the magnitude of an applied electric field. Our results demonstrate the extension of successful spin tunnel injection and detection of spin-polarized electrons to a novel material system, semimetallic bismuth.

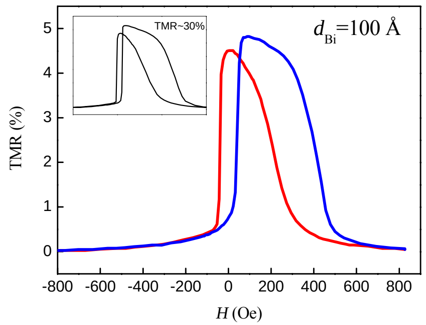

Fig. 1. Representative TMR curve measured at room temperature.

REFERENCES
[1] V. Vedyaev *et al*., Europhys. Lett. 39, 219 (1997).
[2] J. Mathon and A. Umerski, Phys. Rev. B 60, 1117 (1999).
[3] R. Jansen and J. S. Moodera, J. Appl. Phys. 83, 6682 (1998).
[4] P. LeClair *et al*., Phys. Rev. Lett. 86, 1066 (2001).
[5] S. Yuasa *et al*., Science 297, 234 (2002).