BB08

Epitaxial Relationship of Fe/MgO on InxGa1-xAs Substrates

Kyung Ho Kim[1], Hyung-jun Kim[1]*, Il Jae Shin[1,2], Jun-Hyun Han[3], and Suk Hee Han[1]
[1]Center for Spintronics Research, Korea Institute of Science and Technology, Seoul, Korea
[2]NFMD labortory, Department of Physics, Hanyang University, Seoul, Korea
[3]Advanced Functional Materials Research Center, Korea Institute of Science and Technology, Seoul, Korea
*Corresponding author: Hyung-jun Kim, e-mail: mbeqd@kist.re.kr

Thin MgO is a promising material for a tunnel barrier due to the extremely high tunneling magnetoresistance, which enhances electrical injection of spin-current from ferromagnetic metal into semiconductor[1,2]. It is expected that the epitaxial quality of MgO layer significantly determines the tunneling behavoir of spin polarized electrons. In this study, epitaxial relationship of Fe/MgO/semiconductors has been systematically examined when Fe/MgO is grown on three different substrates of GaAs, InAs, and In0.53Ga0.47As, respectively. Those three substrates are the representative semiconductors used for spintronic device applications and provide different lattice mismatch with MgO overlayers. All the sequential layers of Fe, MgO, and semiconductor buffer layers were in-situ grown on (2 × 4) reconstructed substrate surfaces using by a cluster molecular beam epitaxy (MBE) without vacuum break. High-resolution transmission electron microscopy (HRTEM) and X-ray pole figure analysis were used to reveal crystallographic epitaxial realationship at the interfaces. Figure 1 is the cross-section TEM image of Fe/MgO/GaAs. The pole figure analysis of the corresponding structure reveals the epitaxial relationship of Fe(001)[100]//MgO(001)[110]//GaAs(001)[100] which exhibits less lattice mismatch. This epitaxial relationship is dominant in the cases of Fe/MgO/InAs and Fe/MgO/$In_{0.53}Ga_{0.47}As$.

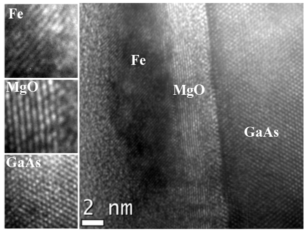

Fig. 1. Cross-sectional HRTEM image of /Fe/MgO grown on GaAs substrate.

This work is supported by KIST Institutional Program.

REFERENCES
[1] A. Fert *et al*., Phys. Rev. B. 64, 184420 (2001).
[2] W. H. Butler *et al*., Phys. Rev. B. 63, 054416 (2001).

BC01

Magnetic Field Effects in Electrochemistry

J. M. D. Coey*
School of Physics and CRANN,
Trinity College, Dublin 2, Ireland

Magnetic fields influence processes occurring in electrochemical cells in often unexpected ways, which are reviewed in this presentation. Many of the effects can be traced to the Lorentz force, which introduces magnetohydrodynamic flow on a whole-cell scale or microscale. Among the consequences are enhanced (or occasionally diminished) electrodeposition rates, change of rest potential, enhanceent or inhibition of corrosion and modification of electrodeposit texture and morphology. Another set of phenomena are related to the magnetic field gradient force acting on paramagnetic species in the electrolyte. Specially nanostructured electrodes have been designed to maximize this effect, and significant modifications are achieved for reactions involving oxygen. However, there is no force associated with a uniform field acting on an electolyte containg magnetic ions, and this mechanism must be discounted in magnetoelectrochemistry.

Hydrogen evolution during electrolysis of water is also susceptible to a magnetic field, although the origin of the effect, whether mechanical or kinetic, is controversial.