



BILKENT UNIVERSITY

unam - INSTITUTE of MATERIALS SCIENCE & NANOTECHNOLOGY

FACULTY OF SCIENCE

MATERIALS SCIENCE and NANOTECHNOLOGY GRADUATE PROGRAM SEMINAR

“Spin Electronics and MgO tunnel barrier as a nearly perfect spin filter”

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Spin Electronics

Conventional Electronics has ignored the spin of the electron. It was only after the introduction of giant magnetoresistive read heads in hard disks in 1998, that the spin electronics became a mainstream technology, which lowered the cost of data storage dramatically. In this talk, I will give an overview of this relatively new technology and highlight its future directions and promises. Specifically, I will talk about the spin dependent quantum tunneling in magnetic tunnel junctions.

MgO tunnel barrier as a nearly perfect spin filter

The spin dependent tunnelling through a crystalline MgO barrier has intrigued researchers worldwide due to its potential for rich physics and device applications. Following theoretical predictions in 2001, room temperature tunnelling magnetoresistance (TMR) ratios above 200% were observed in magnetic tunnel junctions (MTJs) with highly oriented MgO (001) tunnel barriers. The growth of such barriers requires sophisticated growth methods, such as radio frequency sputtering and/or MBE. We show that high quality MgO tunnel barriers can be grown on CoFeB electrodes by electron beam evaporation by carefully adjusting the flux of sublimed MgO dimers. MTJs fabricated using this technique show TMR ratios in excess of 240% at room temperature. Our results show that e-beam evaporation can be used to grow MgO tunnel barriers as a simple alternative to rf-sputtering without any compromise in the TMR. In addition, the barrier height of e-beam evaporated MgO is higher than that of rf-sputtered and MBE grown barriers, making it more advantageous for spin transfer torque applications, where critical currents are high.

Date : January 7, 2010 (Thursday)

Time : 15:40

Place : Faculty of Science Building, A Block, Seminar Room (SA 240)

Tea and cookies will be served after the seminar