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Electronic structure of sputter deposited MgO(100) tunnel barriers in magnetic tunnel junction structures exhibiting giant tunneling magnetoresistance SEE-HUN YANG, IBM Almaden Research Center, MAHESH SAMANT, IBM Almaden Reseach Center, STUART PARKIN, IBM Almaden Research Center, IBM ALMADEN RESEARCH CENTER TEAM — Giant tunneling magnetoresistance (TMR) in magnetic tunnel junctions formed with crystalline MgO tunnel barriers [1] have potential applications in a wide variety of spintronic devices. However, the relationship of the TMR to the detailed chemical and electronic structure of the MgO barrier and its interfaces with the ferromagnetic electrodes is not yet fully understood. We have carried out valence band photoemission spectroscopy and x-ray absorption spectroscopy to characterize the chemical state and electronic structure of sputter deposited, highly oriented, MgO (001) barriers and its interfaces with ferromagnetic electrodes. A large band gap of $\sim$7.5 eV is found even for ultrathin MgO layers. This is consistent with barrier heights found from fitting current versus voltage curves providing that very small effective electron masses are used. We discuss the role of thin Mg interface layers that we have used to reduce oxidation of the underlying ferromagnetic layer during the MgO layer formation [1]. [1] S. S. P. Parkin, C. Kaiser, A. Panchula, P. M. Rice, B. Hughes, M. Samant, S.-H. Yang, Nature Materials 3, 862 (2004).

See-Hun Yang
IBM Almaden Research Center

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