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Chemical and electronic studies of CoFeB / MgO / CoFeB magnetic tunnel junctions J. READ, J. CHA, Cornell University, P. HUANG, Carleton College, W. EGELHOFF, NIST, D. MULLER, R. BUHRMAN, Cornell University — MgO based magnetic tunnel junctions (MTJs), particularly the CoFeB/MgO/CoFeB system, exhibit large tunneling magnetoresistance (TMR) which makes them viable for MRAM [1] and sensor applications. Careful engineering of the MgO tunnel barriers, CoFeB electrodes, and their interfaces is essential for optimizing device performance [2,3], which motivates investigation of the chemical and electronic properties of high quality MTJs. We correlate scanning tunneling (STS), x-ray photoelectron (XPS) [4], and electron energy loss (EELS) [5] spectroscopies with current-in-plane tunneling (CIPT) measurements to gain insight on the electronic structure and chemistry of MgO MTJ structures. The measurements reveal that quite high TMR (>200%) can be obtained when there is substantial boron in the tunnel barrier, showing that proper doping of the MgO layer plays a significant role in the performance of such MTJs. We will discuss the impact of materials properties upon transport measurements and provide suggestions for greater control over MTJ device characteristics. [1] Parkin, Nat. Mater. 3, 862 (2004). [2] Nagamine, APL 89, 162507 (2006). [3] Lee, APL 90, 212507 (2007). [4] Read, APL 90, 132503 (2007). [5] Cha, APL 91, 062516 (2007).

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