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Characterization of Magnetic Tunnel Junctions by IETS and STS
HYUNSOO YANG, CHRISTIAN KAISER, Stanford University, SEE-HUN YANG, STUART PARKIN, IBM — Inelastic electron tunneling spectroscopy (IETS) and superconducting tunneling spectroscopy (STS) have been employed to investigate spin-dependent tunneling in magnetic tunnel junctions (MTJs). MTJs were studied in which the ferromagnetic electrodes were formed from the 3d transition metals, Fe, Co and Ni and their alloys, and the tunnel barriers were formed from various nitrides and oxides including MgO. MTJs with MgO barriers exhibit more than 220% tunneling magnetoresistance (TMR) at room temperature[1]. IETS was used to measure the contributions of defects and impurities, as well as phonons and magnons, to the tunneling current. These processes give rise to conductance peaks at characteristic voltages according to their excitation energies. STS was used to measure the spin polarization of the tunneling current as well as to explore the role of spin-flip scattering in the tunneling process. The goal of this research is a more complete understanding of the mechanisms which gives rise to the bias voltage dependence of the TMR as well as indirect tunneling through states in the barrier.
[1] S. S. P. Parkin, C. Kaiser, A. Panchula, P. Rice, B. Hughes, M. Samant, and S.-H. Yang, *Nature Materials*, vol. Published online: 31 October 2004, 2004.

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