Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Probing spin-dependent tunneling and transmission below the Fermi level with a p-type magnetic tunnel transistor. B.G. PARK, T. BANERJEE, B.C. MIN, J.C. LODDER, R. JANSEN, MESA+ Institute for Nanotechnology, University of Twente, The Netherlands — A magnetic tunnel transistor (MTT) can be used to probe spin-polarized tunneling involving states away from the Fermi level, as well as spin-dependent transmission of non-equilibrium carriers in a ferromagnet. Here we have used a p-type MTT, in which the magnetocurrent (MC) is determined by the tunnel spin polarization of the states below the Fermi level, and the spin-dependent scattering of hot holes in the magnetic base. For p-type MTT's with the structure p-Si/Au/Co/Al_2O_3/NiFe and large Co base thickness (8nm) and/or large emitter bias, the MC has the usual positive sign. Thus, the transmission of holes in the majority spin band of Co is larger than that of minority spin holes. Surprisingly, for smaller Co thickness and bias near the collection threshold (0.3 eV), the MC reverses sign and becomes negative. This unusual result shows that the Co interfaces preferentially transmit carriers of minority spin. With help of specifically designed MTT's and ab-initio calculations we discuss possible contributions of spin-dependent transmission across Au/Co interfaces in the base, and of a negative tunneling spin-polarization of the Co/Al_2O_3 interface for states below the Fermi level.

Ronald Jansen
University of Twente

Date submitted: 30 Nov 2005 Electronic form version 1.4