MAR07-2006-000632

Abstract for an Invited Paper
for the MAR07 Meeting of
the American Physical Society

Highly Efficient Room Temperature Spin Injection Using Spin Filtering in MgO

XIN JIANG, IBM Almaden Research Center, San Jose, CA 95120

Efficient electrical spin injection into GaAs/AlGaAs quantum well structures was demonstrated using CoFe/MgO tunnel spin injectors at room temperature. The spin polarization of the injected electron current was inferred from the circular polarization of electroluminescence from the quantum well. Polarization values as high as 57% at 100 K and 47% at 290 K were obtained in a perpendicular magnetic field of 5 Tesla. The interface between the tunnel spin injector and the GaAs interface remained stable even after thermal annealing at 400 ^{o}C. The temperature dependence of the electron-hole recombination time and the electron spin relaxation time in the quantum well was measured using time-resolved optical techniques. By taking into account of these properties of the quantum well, the intrinsic spin injection efficiency can be deduced. We conclude that the efficiency of spin injection from a CoFe/MgO spin injector is nearly independent of temperature and, moreover, is highly efficient with an efficiency of $\sim$ 70% for the temperature range studied (10 K to room temperature). Tunnel spin injectors are thus highly promising components of future semiconductor spintronic devices.

Collaborators: Roger Wang[1,3], Gian Salis[2], Robert Shelby[1], Roger Macfarlane[1], Seth Bank[3], Glenn Solomon[3], James Harris[3], Stuart S. P. Parkin[1]

[1] *IBM Almaden Research Center, San Jose, CA 95120*

[2] *IBM Zurich Research Laboratory, Säumerstrasse 4, 8803 Rüschlikon, Switzerland*

[3] *Solid States and Photonics Laboratory, Stanford University, Stanford, CA 94305*