Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Comparison of Organic and Inorganic Semiconductors for Spin Injection and Transport[1] J.D. ALBRECHT, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH, P.P. RUDEN, University of Minnesota, Minneapolis, MN, D.L. SMITH, Los Alamos National Laboratory, Los Alamos, NM —
We present a theoretical description of spin injection, extraction, and transport in structures with a ferromagnetic metal injector, a thin semiconductor layer in which diffusive transport occurs, and a ferromagnetic metal collector. Transport layers composed of conjugated polymers, small molecule organic molecular crystals, and inorganic semiconductors are compared. Spin injection implies driving the semiconductor out of local (spin) equilibrium and requires a spin-selective injection process. Tunneling through a Schottky barrier or a thin interfacial insulator layer may provide that selectivity. Since carrier mobilities (and other relevant parameters) for the three systems differ over orders of magnitude, the conditions for achieving spin injection also differ. We present results for spin injection and transport, and we derive design criteria for spin injectors accounting for the varied fabrication and process issues relevant to the device technologies.

[1]Supported in part by NSF, LANL LDRD, and AFOSR.

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Date submitted: 30 Nov 2004 Electronic form version 1.4