MAR07-2006-000678

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

Electrically-Induced Polarization and the Spin Hall Effect in Semiconductors at Room Temperature[1]

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The capability to generate and manipulate spin polarization through the spin-orbit interaction inspires growing interest in all-electrical techniques to exploit electron spins for applications in semiconductor spintronics. Experiments show spin polarization can be electrically generated by current- induced spin polarization from internal magnetic fields in the bulk of a conducting channel, or accumulation of spin polarization near sample edges due to transverse spin currents generated by the spin Hall. These spin currents can drive spin accumulation over micron length scales in semiconductor arms transverse to a conducting channel [3]. More recently, we investigate electrical generation of spin polarization in n-ZnSe epilayers using Kerr rotation spectroscopy[4]. The internal magnetic field is studied and found to only be measurable in strained layers, likely due to the weak spin-orbit interaction in ZnSe. Despite this, unstrained n-ZnSe layers exhibit both in-plane bulk current-induced spin polarization and an out-of-plane spin accumulation of opposite sign on opposite edges of a conducting channel indicative of the spin Hall effect. The spin Hall conductivity is estimated according to a spin accumulation model and is found to be consistent with the extrinsic spin- dependent scattering mechanism. Both the current-induced spin polarization and the spin Hall effect are robust to room temperature in ZnSe. These results suggest the potential for practical utilization of electrically generated spin polarization in room temperature semiconductor devices.

[1]Work supported by the NSF, ONR, and the Hertz Foundation.

[2]Work performed in collaboration with S. Ghosh, G. Xiang, M. Zhu, N. Samarth, and D. D. Awschalom.

[3]V. Sih, W. H. Lau, R. C. Myers, V. R. Horowitz, A. C. Gossard and D. D. Awschalom, *Phys. Rev. Lett.* **97**, 096605 (2006).

[4]N. P. Stern, S. Ghosh, G. Xiang, M. Zhu, N. Samarth, and D. D. Awschalom, *Phys. Rev. Lett.* **97**, 126603 (2006)