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Electrical detection of spin accumulation at 500K at FM/SiO2/Si(001) contacts via the Hanle effect[1] CONNIE H. LI, OLAF M. J. VAN 'T ERVE, EUGENE A. IMHOFF, BERRY T. JONKER, Naval Research Lab

— We demonstrate the electrical detection of spin accumulation in Si (doped n-type 3E18 and 3E19/cm3) via injection from a ferromagnetic contact through a SiO2 tunnel barrier formed by plasma oxidation. The injection of spin-polarized carriers produces a net spin accumulation described by the splitting of the spin-dependent electrochemical potential, and is detected as a voltage. The decrease of this voltage with increasing out-of-plane magnetic field due to spin dephasing, i.e., Hanle precession of the electron spin, is observed at temperatures up to 500K. Lorentzian fits to the Hanle curves yield a spin lifetime of 100 and 320ps for the high and lower doped Si. The direct correlation between spin lifetime and carrier concentration in the Si, and that the magnitude of the Hanle signal agrees well with that expected from theory [1], provide clear evidence that the spin accumulation indeed occurs in the Si and not interface states. These results demonstrate that spin accumulation in Si can be a viable basis for spin-based devices. Supported by ONR.

[1]Fert et al., PRB 64, 184420 (2001), IEEE Elect. Dev. 54, 921 (2007).

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