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Electrical Spin injection into Silicon: a comparison between Fe/Schottky and Fe/Al_2O_3 tunnel contacts G. KIOSEOGLOU, A.T. HANBICKI, C.H. LI, P.E. THOMPSON, R. GOSWAMI, G. SPANOS, B.T. JONKER, Naval Research Laboratory — We have recently demonstrated successful electrical injection of spin-polarized electrons from an Fe film through an Al_2O_3 tunnel barrier into Si [1]. The spin polarization in the Si is ∼30% at 5K, with significant polarization sustained to at least 125K. In this study we compare electrical spin injection from Fe into MBE grown Si n-i-p heterostructures using different tunnel barriers- a reversed biased Fe/Si Schottky contact and an Fe/Al_2O_3 barrier. For both types of structures the electroluminescence (EL) spectra are dominated by transverse acoustic and optical phonon emissions in the Si. The surface emitted circular polarization of the EL due to radiative recombination in the Si tracks the Fe magnetization, confirming that the spin-polarized electrons originate from the Fe for both types of samples. However, the polarization is lower for the Fe/Si contact than that of the Fe/Al_2O_3/Si system. Systematic TEM analysis has been performed to correlate the interface structure with the observed optical polarization, and reveals some Fe/Si intermixing which is absent in the Fe/ Al_2O_3/Si structure. [1] B.T. Jonker et al., Nature Physics **3**, 542 (2007). This work was supported by ONR and core programs at NRL.

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