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The Influence of the Doping Profile on Spin Transport in Fe/GaAs Schottky Tunnel Barrier Heterostructures Q. HU, E.S. GARLID, K.S.M. REDDY, J. ZHANG, T. KONDO, P.A. CROWELL, C.J. PALMSTRØM, University of Minnesota — A strong non-monotonic dependence of the spin polarization on the bias across the injector has been observed in recent studies of spin transport in Fe/GaAs heterostructures. We have conducted a study of spin transport in non-local Fe/GaAs spin valves in which the doping profile of the Schottky barrier has been systematically modified. The samples were Fe/n^+/n-GaAs heterostructures in which the thickness d of the n^+ layer (n^+ fixed at 5×10^{18} cm^{-3}) was varied from 5 nm to 50 nm while $n \approx 5 \times 10^{16}$ cm^{-3} in the 2.5 μm thick channel. We performed non- local spin valve measurements at 15 K for unannealed samples and after annealing at 200°C and 250°C. For d less than 10 nm, no spin accumulation is observed under either forward or reverse bias. For $d \approx 15$ nm, spin accumulation is observed under forward bias only. Spin accumulation is observed for both bias polarities at larger thicknesses, with an optimal $d \approx$ 20-25 nm. Although this overall trend with d is observed in both unannealed and annealed samples, the sign and magnitude of the non-local signal can change upon annealing. These results suggest that spin accumulation is sensitive to both the tunnel barrier profile and interfacial conditions. This work was supported by ONR and the NSF MRSEC, IGERT, and NNIN programs.

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