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Temperature dependence of the non-local spin signal in Cu-based lateral spin-valves M.J. ERICKSON, C. LEIGHTON, P.A. CROWELL, University of Minnesota — We report on measurements of the T dependence of the non-local spin signal in lateral metallic spin valves, focusing on the limit of transparent ferromagnet (FM) / normal metal (Cu) interfaces. Devices with channel width 250 nm and contact widths $\approx$100 nm ($Ni_{80}Fe_{20}$ or Co) were fabricated using in-situ shadow masking. We employed high purity sources in UHV, enabling one-shot deposition with no air exposure of the interface. Multiple contact separations (250 – 800 nm) were fabricated on a single substrate to facilitate measurement of the spin diffusion length (λ_s). NiFe/Cu devices with 250 nm contact separation show a maximum non-local transresistance of 420 $\mu\Omega$. Analysis of Hanle effect measurements yields spin lifetimes $\approx$ 8 ps at low T which compare well to those extracted from the measured λ_s (300 nm) and resistivity (1.5 $\mu\Omega$cm), demonstrating consistency of our analysis. We observe a qualitatively different T dependence of the non-local signal depending on the relative sizes of the contact separation and λ_s. When the separation becomes comparable to λ_s we observe a maximum in the non-local spin signal at 35 – 85 K, with strongly thickness dependent magnitude. These measurements of spin lifetime, resistivity, and λ_s vs T allow a quantitative comparison with the conductivity mismatch model. Work supported by the NSF MRSEC program.

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