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Spin transport at high temperatures in epitaxial Heusler alloy/n-GaAs lateral spin valves[1] TIMOTHY A. PETERSON, KEVIN D. CHRISTIE, University of Minnesota, SAHIL J. PATEL, University of California Santa Barbara, PAUL A. CROWELL, University of Minnesota, CHRIS J. PALMSTRØM, University of California Santa Barbara — We report on electrical injection and detection of spin accumulation in ferromagnet/n-GaAs lateral spin-valve devices, observed up to and above room temperature. The ferromagnet in these measurements is the Heusler alloy Co_2FeSi, and the semiconductor channel is GaAs doped at 3×10^{16} cm^{-3}. The spin signal is enhanced by operating the detection contact under forward bias. The enhancement originates from drift effects at low-temperatures and an increase of the detection efficiency at all temperatures. The detector bias dependence of the observed spin-valve signal is interpreted by taking into account the quantum well (QW) which forms in the degenerately doped region immediately behind the Schottky tunnel barrier. In particular, we believe the QW is responsible for the minority spin accumulation (majority spin current) under large forward bias. The spin diffusion length and lifetime are determined by measuring the separation dependence of the non-local spin valve signal in a family of devices patterned by electron beam lithography. A spin diffusion length of 700 nm and lifetime of 46 picoseconds are found at a temperature of 295 K.

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