Efforts to implement semiconductor-based spintronic devices have been crippled by the lack of an efficient and practical means to electrically inject spin-polarized carriers into a semiconductor heterostructure. Spin injection from semimagnetic semiconductor contacts (ZnMnSe/AlGaAs/GaAs) has produced electron spin polarizations of ~ 85% in the GaAs QW [1]. Several factors potentially limit spin transport across heteroepitaxial interfaces. We show that the stacking fault density at the contact interface correlates inversely with spin injection [2]. A theoretical treatment shows that the suppression of spin injection is due to enhanced spin-flip scattering at this common defect, and provides excellent agreement with the data. While these results are encouraging, the desire for room temperature operation leads one to consider other materials and avenues. Ferromagnetic metals offer high Curie temperatures and can be rapidly switched at low fields. We report spin injection from an Fe Schottky contact into an AlGaAs/GaAs LED structure [3], producing QW spin polarizations of 32%. These robust effects are attributed to spin tunneling [4] through the tailored Schottky barrier contact. The width of the depletion region at the Fe/AlGaAs interface is controlled by the semiconductor doping profile during MBE growth. Under reverse bias, electrons tunnel from the Fe into the semiconductor and radiatively recombine in the GaAs QW. The circular polarization of the surface emitted electroluminescence provides a quantitative measure of the QW spin polarization. We demonstrate via the Rowell criteria that tunneling is indeed the dominant transport process, and observe phonon signatures in the corresponding I-V spectra. Thus spin injecting contacts can be formed using a widely employed contact methodology, providing a ready pathway for the integration of spin transport into semiconductor processing technology.

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