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Spin-polarized sources for Si-based spin injection-detection devices SEBASTIAAN VAN DIJKEN, Trinity College Dublin, C. BOOTHMAN, Trinity College Dublin, M. THIEBAULT, Trinity College Dublin, C. MURRAY, Trinity College Dublin, G. FENG, Trinity College Dublin, J.M.D. COEY, Trinity College Dublin — We have explored magnetite/Si and Fe/MgO/Si contacts as possible sources of highly spin-polarized currents. Reactive sputtering of magnetite from a pure Fe target results in the growth of single crystal films with a (111) texture on both Si(001) and Si(111) substrates. The evolution of the film magnetization with temperature exhibits a sudden decrease around 120 K, which is characteristic for the Verwey transition in magnetite and indicates high quality film growth. Electrical transport across the magnetite/Si interface is dominated by tunneling through (at low temperatures) and thermionic emission across (at elevated temperatures) a Schottky barrier. The Schottky barrier height is 0.52 eV and 0.65 eV for magnetite films on Si(111) and Si(001), respectively. Direct rf magnetron deposition of MgO on Si(001) results in tunnel barriers with a weak (001) film texture. The injector current (at fixed bias voltages) varies non-monotonically with tunnel barrier thickness. This dependence is qualitatively explained by a competition between a reduction in current due to a thicker tunnel barrier and an increase in current due to a reduction of the Schottky barrier height and Si depletion width.

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