Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Room Temperature Tunneling Characteristics through SDT Nanoscaled Lines into n-Doped Si YU ZHANG, NAM H. KIM, JIAN-QING WANG, SUNY-Binghamton, JIM DAUGHTON, NVE Corporation — Nanoscaled spin-dependent tunneling (SDT) lines were patterned on n-doped Si layer and studied for tunneling characteristics from ferromagnetic nano-lines through an AlO_2 insulating barrier into the semiconductor. The functional magnetic layering was deposited on doped Si with phosphorus (n-type) having resistivity of 0.006-0.02 Ohm-cm. The configuration of the SDT film is 1.5 nm AlO_x / 4 nm NiFeCo / 1 nm FeCo / 15 nm Cu / 15 nm CrSi / 10 nm Si_3N_4 as spin injection contact. The patterned lines with line width and separation of 100 nm were produced using e-beam lithography. The tunneling characteristics versus temperature (80 to 300 K) were measured by wire bonding and with assistance of ohmic contacts of heavily doped regions. The tunneling studied through the barrier between layered-magnetic metals and semiconductor clearly showed the electronic transport as ballistic tunneling, showing weakly dependence on the temperature. This is qualitatively different similarly scaled-up SDT line-structures with 2 micron gap distance. In the later configuration, the electronic transport was observed to be mainly thermal emission dominant process at elevated temperatures, with characteristic activation energy in agreement with the impurity level.

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Date submitted: 21 Nov 2006 Electronic form version 1.4