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Electrical spin injection and detection in Fe/MgO/Si: influence of interface states YONG PU, JONAS BEARDSLEY, Center for Emergent Materials, The Ohio State University, ADRAIN SWARTZ, PATRICK ODENTHAL, Dept. of Physics and Astronomy, University of California-Riverside, ANDREW BERGER, DONGKYUN KO, VYDIA BHALLAMUDI, CHRIS HAMMEL, Center for Emergent Materials, The Ohio State University, ROLAND KAWAKAMI, Dept. of Physics and Astronomy, University of California-Riverside, EZEKIEL JOHNSTON-HALPERIN, JON PELZ, Center for Emergent Materials, The Ohio State University — We report electrical spin injection and detection in Fe/MgO/Si tunnel diodes using a 3-terminal (3T) geometry. Analysis of our Hanle curves yields an effective spin life-time of $\sim$0.1 ns and a spin-RA product $\sim$1 M$\Omega * \mu$m^2, both of which are in rough agreement with previous 3T studies. However, according to our analysis the spin-RA is $\sim$ 6 orders of magnitude larger than expectations for bulk Si, and the 0.1 ns effective spin life-time is much smaller than reported value in Si by ESR or non-local methods. Here we provide a detailed analysis of electrical injection and detection in the 3T geometry. We present an alternative expression for the 3T spin signal than is usually used, and we propose that spin is accumulating in localized states (LS) at the MgO/Si interface rather than just in bulk Si. Incorporating a theory of spin accumulation in LS developed by M. Tran *et al* (**PRL** 102, 036601), we propose an energy distribution for the density of localized states, and introduce a model that agrees well with our anomalously large spin-RA and can explain the strong bias dependence of both spin and charge transport.

[X] Prefer Oral Session
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