Abstract Submitted
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A graphene solution to conductivity mismatch: spin injection into Silicon OLAF VAN 'T ERVE, ADAM FRIEDMAN, ENRIQUE COBAS, CONNIE LI, AUBREY HANBICKI, KATHY MCCREARY, JEREMY ROBINSON, BEREND JONKER, Naval Research Laboratory — The classic FM/semiconductor conductivity mismatch prevents spin injection into silicon. Typically, an oxide barrier such as MgO, AlOx or SiO2 is used to overcome this mismatch. These oxide tunnel barriers introduce defects, trapped charge, interdiffusion and add significant resistance, which compromise device performance. Here we will show that a FM/graphene contact serves as a spin-polarized tunnel barrier. [1] Although graphene is very conductive in plane, it exhibits poor conductivity perpendicular to the plane. Its sp2 bonding results in a highly uniform, defect free layer, which is chemically inert, thermally robust, and impervious to diffusion. The use of a monolayer of graphene at the Si interface provides a much lower RA product than any oxide film thick enough to prevent pinholes. We will present electrical injection and detection of spin accumulation in Si above room temperature, and show that the corresponding spin lifetimes correlate with the Si carrier concentration. The RA products are three orders of magnitude lower than achieved with oxide tunnel barrier contacts on identical Si substrates. Our results identify a new route to low RA-product spin-polarized contacts, a crucial requirement enabling future semiconductor spintronic devices, which rely upon two-terminal MR. [1] van 't Erve et al., Nature Nanotechnology, DOI 10.1038/nnano.2012.161 (2012)

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