Efficient spin transport in silicon devices using magnetic tunnel contacts.

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Spintronics devices based on Si, the mainstream semiconductor, are expected to lead to novel information technology that could outperform CMOS technology. However, the electrical creation of a large spin polarization in Si remains a major challenge mostly due to the difficulty to grow high-quality magnetic contacts on Si. Here, I demonstrate that efficient spin injection, transport and detection can be achieved in Si devices using high-crystalline quality Fe/MgO tunnel contacts. Non-local spin-valve and Hanle measurements performed at various biases and temperatures indicate that the tunnel spin polarization of Fe/MgO reaches 53 % at 10 K, which is the largest reported value to date. The experimental data are very well described by numerical calculations based on the standard theory for spin injection and diffusion in a non-magnetic material. From our results, we deduce that a spin accumulation of 13 meV is present in the Si channel, proving that large carrier spin polarization can be created in Si spintronics devices.