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Exchange Splitting and 100% Spin Polarization in Monolayer level EuO Films[1] TIFFANY SANTOS, JAGADEESH MOODERA, Francis Bitter Magnet Lab, MIT, EZANA NEGUSSE, YVES IDZERDA, Montana State University — The exchange splitting of the conduction band in an ultrathin film of ferromagnetic EuO just 2.5 nm thick has been determined for the first time using tunneling techniques. In a Al/EuO/Y tunnel junction, a huge drop in junction resistance versus temperature was observed below the EuO Tc=69K, resulting from an exchange splitting of 0.3 eV, which corresponds to a spin filter efficiency of 98% ! Furthermore, substantial tunnel magnetoresistance = 280% has been observed in Cu/EuO/Gd quasi-magnetic tunnel junctions. From these observations, it appears that EuO is approaching its theoretical spin polarization P of 100%. Whereas previously, a value of only 30% was obtained using the Meservey-Tedrow technique of directly measuring P. This drastic improvement occurred after examining the chemical and magnetic properties of EuO at the monolayer level and its interfacial properties with metals, using SQUID magnetometry, XAS, XMCD and XRS. With the right combination of interface materials and deposition parameters, one can have a 1nm EuO film with a high moment of >7 μ_B. With this high spin filter efficiency and its compatibility with Si, the EuO spin filter shows promise for injecting highly-polarized spins into Si-based semiconductors.

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