Spin transport studies in organic semiconductors and spin filter tunneling

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The spin transport properties of organic semiconductors are a least explored area, especially for organic semiconductors (OSCs) which are pertinent for future spin-based electronics. Because OSCs are composed of mostly light elements (i.e. C, H, N, O) and thus have a weaker spin-orbit interaction compared to inorganic semiconductors, spin coherence lengths can be long in these materials. Our recent developments in electron spin polarized tunneling through ultrathin layers of the molecular organic semiconductors such as Alq3 and Rubrene will be discussed.

Eu chalcogenide semiconductor compounds such as EuO and EuS as a tunnel barrier shows a remarkable property of spin filtering. This stems from the large exchange splitting (0.3 to 0.5eV) of the conduction band below the Curie temperature. It is possible to achieve total spin filtering of the tunnel current starting from unpolarized electrons with careful control and tailoring of the interfaces down to atomic level. This can be an ideal spin polarized source for spin injection into semiconductors. Various aspects of this unique phenomenon with some of the latest findings, including a method of determining exchange splitting in ultra thin films of these ferromagnets by tunneling will be discussed.