Spin transport, spinterface and spin photovoltaics in molecular films

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Spin injection and transport into molecular semiconductors has attracted great interest recently, especially due to the small sources of spin decoherence in these materials [1]. However, there are still many open questions in this nascent field which range from the actual spin polarization at metal/molecular interfaces to the integration of molecular functionalities into spintronic devices.

In this talk I will review several experimental highlights from our group.

By using bathocuproine (BCP) and fluorinated copper phthalocyanine (FCuPc) we have unambiguously proved that spin transport occurs via molecular levels, finally dismissing any eventual role of metallic filaments or defects in the electronic transport [2,3]. Our experiments point to the critical role of the interfacial barriers for carrier injection into the molecular levels. Moreover, in the FCuPc case we have shown concomitant spin transport and photoresponse. Thanks to the emergence of two molecular-based properties, four distinguishable resistance states adjustable by light and/or magnetic field can be configured in a simple 2-bit memory cell [3]. Further recent results in this wide topic, merging spin transport with the photovoltaic effect of C_{60} fullerenes will be shown [4].

I also will present spin valves based on rare-earth quinolines. Here we highlight the role of metal/molecular hybridization in the spin polarization and its possible control [5-7].

References

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Figures

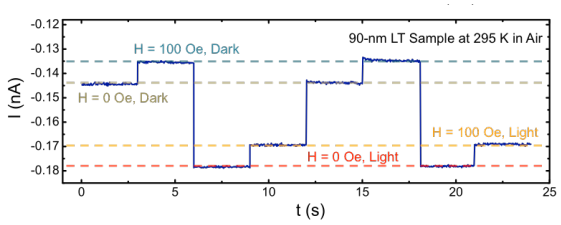

Figure 1. Demonstration of four distinctive resistance states reachable by operation of the magnetic field and the light irradiation in a FCuPc-based organic spin valve. Extracted from reference [3]

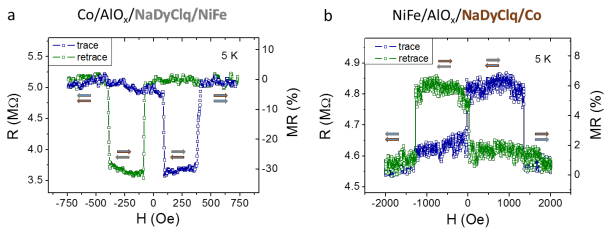

Figure 2. Inversion of the spin polarization (detected as magnetoresistance), due to the different hybridization between molecular NaDyClq and NiFe or Co ferromagnetic metals. Extracted from reference [7]