Building quantum spintronic devices using the ferromagnetic metal /molecule interface

M. Bowen[1]

[1] Institut de Physique et Chimie des Matériaux de Strasbourg, France

Molecular spintronics is emerging as a vibrant field that utilizes the properties of magnetic molecules toward additional device functionalities that can exploit quantum physics. One spectacular property is the high spin polarization of the ferromagnetic metal/molecule interface, measured at 300K using spectroscopy [1] and magnetotransport [2] experiments.

The magnetism of this so-called spinterface [3] can be controlled using an underlying ferroelectric [4], and can in principle be combined with the spin crossover (SCO) molecular property by inserting a noble metal spacer layer [5,6]. This would enable single-molecule magnet [7] behavior on a much wider range of molecules, at higher temperatures. To improve our understanding of SCO device properties, device in operando experiments using synchrotron radiation shed light [8] into the transport path across the SCO thin film.

The spinterface formation entails changes to the magnetic properties of the interface constituents, from magnetic hardening of the metal [9] to the magnetic stabilization of otherwise paramagnetic molecular spin chains borne by phthalocyanine (Pc) molecules [10]. These effects enable the encoding of information into the quantum state of a molecular spin chain [11]. This also lays the groundwork for a molecular implementation [12] of our recent proposal [2] (www.spinengine.tech) to harvest the energy of thermal fluctuations on paramagnetic centers using spintronics.

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