New applications, effects and fundamentals in single-molecule wires

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Inspired by the proposal that single molecules will be functional parts of future nanoelectronic and photovoltaic devices, there exists a considerable interest in understanding charge transport on individual molecular backbones.[1] To investigate these nanoscale devices, a scanning tunneling microscopy in the break-junction approach (STM-BJ)[2] allows us perform electrical measurements at the single molecule level.

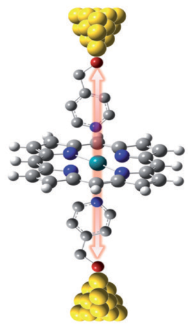

Fig.1 Molecular wire through the metal.

The first block of this seminar will present novel method of forming highly efficient molecular wires that hold great promise in this area. Using STM-BJ we show that when a single porphyrin molecule is wired from its metallic center, the conductivity is three orders of magnitude higher than porphyrins wired from side/contacts. This approach of wiring porphyrins mimics the natural way energy is transferred across porphyrins in photosynthetic systems and opens the door for. (*Fig. 1*).[3,4]

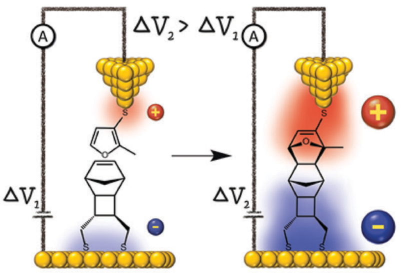

Fig.2 Single-molecular reactor

For the second block, we will present a novel method to catalyze chemical reactions at the nano-scale. We have designed a surface model system to probe Diels-Alder chemical reactions and the STM-BJ was used to deliver an oriented electrical field-stimulus across two reactants placed in both electrode (*Fig.2*). This method enable studying chemical reactions at the single-molecule level

Last topic of this contribution is about the STM not only provides a perfect voltage control between both electrodes, also offers the control of electron's spin using a magnetized tip. The interface magnetism or *spinterface* resulting from the interaction between a magnetic molecule and a metal surface as the STM electrodes, has become a key ingredient to engineering nanoscale molecular devices with novel functionalities, as a spintronic-switch (*Fig. 3*).

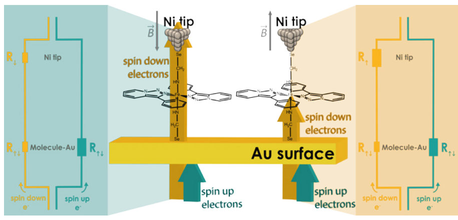

Fig.3 Fe-complex as a spintronic-switch

References

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