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Subject: ***Charge transport mechanisms in active organometallic layers: towards non-volatile organic memories***

Laboratory: Laboratoire Interfaces et Systèmes Electrochimiques (LISE – UMR 8235) – Sorbonne Université-CNRS

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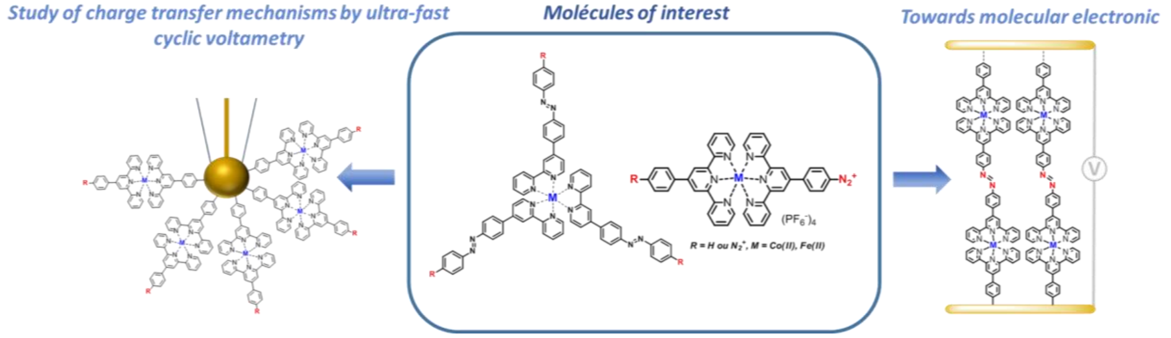
The miniaturization of electronic components is a perpetual challenge. As conventional silicon devices are now reaching their limits with sizes of a few nanometers, chemistry has a key role to play. Molecular electronics can also rely on the benefits of molecular chemistry to create new electronic functionalities. However, the understanding of the electron transfer mechanisms involved in most devices containing these molecular objects remains partial to date. In order to fabricate efficient and robust molecular devices, we are interested in the design of electro- or photo-switchable molecular compounds with an electropolymerizable function, which can be integrated in electronic devices.



Reduction of aryldiazonium salts to modify electrode surfaces and produce non volatile resistive memories.

Initially, the construction of active organic layers will be performed by reduction of purposely synthesized organometallic diazonium salts. One important goal will be to control the thickness and morphology of these layers. Then, the mechanisms of charge transport within the produced systems will be elucidated. More specifically, several factors may need to be taken into account for explaining the reaction kinetics: heterogeneous charge transfer towards (from) the redox centers close to the electrode, electron hopping within redox centers inside the layer, or counterions insertion within the layer. Besides, to be suitable for practical applications, the systems studied should present fast information propagation. Thus, to extract information, we will rely on ultrafast electrochemistry. The aim will be to evaluate the most promising molecular objects and grafting conditions for the fabrication of resistive memory type devices. In a second step, these molecular layers will be integrated into molecular junctions and the current-voltage characteristics will be evaluated, for example, the On/Off current ratios, the threshold voltage and the write-read-erase-read cycle number will be systematically evaluated.

As a complementary approach to identify which chemical bonds are affected during operation, we will rely onto Raman spectroscopy that is currently being used in our laboratory.

Domain: Electrochemistry, surface functionalization, molecular electronic

Applicant profile: The recruited candidate must have skills in electrochemistry and surface functionalization. The recruited candidate must be autonomous and have a strong interest in multidisciplinary subjects.

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