Post doctoral position

Single molecule conductance measurements on a four state molecular device

We are seeking to recruit a Postdoctoral research fellow to join a multidisciplinary research team involved in a 3 year ANR project. The applicant will be based at the Centre Interdisciplinaire de Nanosciences de Marseille. The post is associated with a salary in the range 22800-28800 € depending on experience, and is availaible for a 12 month period, starting in February-March of 2014.

Background and research objectives

Molecular-scale electronics have attracted a growing interest, both for basic science at the nanoscale and for possible applications in nano-electronics. In the first case, molecules are quantum objects by nature and their properties can be tailored by chemistry opening avenues for new experiments. In the second case, molecule-based devices are envisioned to complement silicon devices by providing new functions or already existing functions at a simpler process level and at a lower cost by virtue of their self-organization capabilities.
The most common approach is to use redox molecules to store charges like in flash-memory. We propose an interesting alternative which stores information by tuning the conformation of an organic molecule. Previous works have shown that upon a given excitation, molecules can undergo conformational changes. If such conformers are associated with conductivity levels of the molecule, this effect can be used to make molecular switches and memories.

CINaM
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In this project, we aim at extending the concept of conformational memory by synthesizing dedicated molecules with two addressable subunits that can undergo conformational changes upon irradiation and / or protonation. Such molecules would present 4 different electronic states (i.e 2 bits memory), that could be used for implementing basic logic function at the single molecule scale.
The properties of the candidate molecule have been studied in solution, and the challenge is now to demonstrate the presence of these 4 possible states for a molecule grafted to a solid surface.
The electronic properties of the different parts of the conjugated systems are chosen to be reversibly modulated by optical and chemical stimuli. In this aim, our goal is to relate the state of our molecules, i.e. photochromic switch and/or protonation rate, to a physical property, the electrical conductivity. Shall these two, conductance-altering fundamental processes, be combined and demonstrated in an electrical junction, the basis of a molecular 4-state logic will be established.

You will be involved in conductivity measurements at the single molecule scale. We have developped for that purpose a mechanically controlled break junction with an outstanding mechanical stability, able to stabilize metallic of molecular point contacts for several tens of seconds at room temperature. This MCBJ is coupled with an optical microscope. Single molecule conductance measurements will be performed in liquids.
Results will then be compared to those obtained at the micron scale in the *Molecular Nanostructures & Devices group* headed by D. Vuillaume at the IEMN (Lille).

Applicant profile

We are looking for someone who has

- a PhD degree in condensed matter physic, physical chemistry or materials science
- the knowledge, and the communication skills necessary to work in such a multi-disciplinary project involving chemists and physicists
- a proven experience in experimental physic in general, more particularly in surface science

A previous experience in instrumentaiton development and scanning probe microscopies while not mandatory, will be greatly appreciated.

Location and environment

You will be working in in the team of Pr. Philippe DUMAS, in close collaboration with the chemistry department of the lab where the molecules are synthetized.
The project will be conducted in a research team with a high level of expertise in the field of scanning probe microscopies and surface physics. We have expertise in developing the necessary instrumentation, and have worked for several years in single molecule characterisation.

How to apply

Applications should be emailed to : klein@cinam.univ-mrs.fr, including coordinates of two persons that may be consulted.
Any enquiries relating to the project should be directed to Hubert Klein at the same adress.

Contact

Hubert Klein , klein@cinam.univ-mrs.fr, +33 (0)662 922 876

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