UMR 6226 CNRS - UNIVERSITE DE RENNES

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PhD position

Photoswitchable Radicals for Soft-Matter applications

Keywords : Molecular materials, ligand synthesis, coordination chemistry, lanthanide complexes magnetism, photoactive molecules, supramolecular assemblies.

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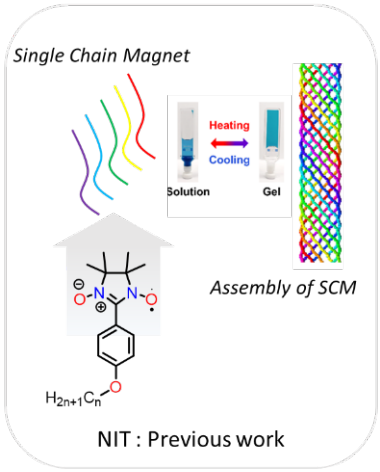
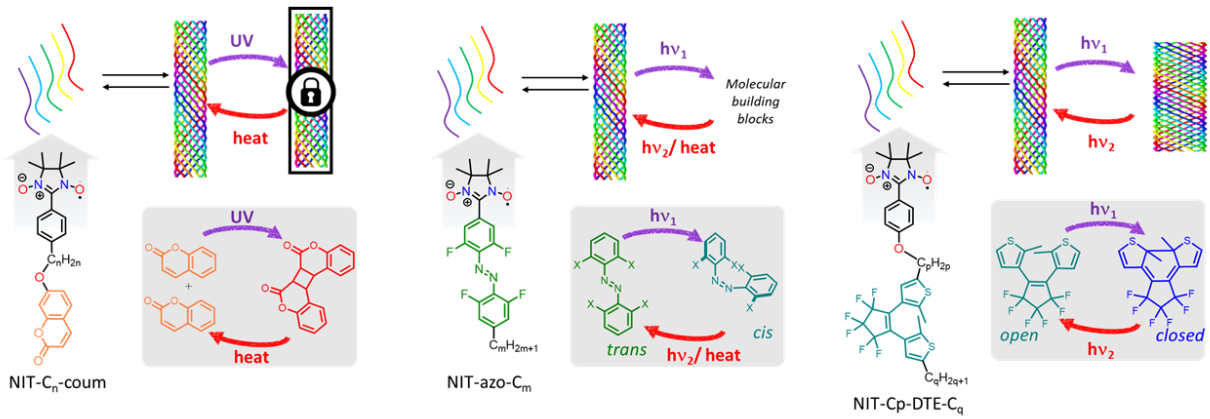
Context : Devices integrating molecular-scale components may ultimately allow the replacement of silicon-based electronics by high speed systems with low energy consumption. Because of the prominent use of magnetization-based information storage technologies in our daily life, Single-Chain Magnets (SCMs), which behave as magnets at the molecular scale, attract a great deal of attention. This project is developed in the framework of the ANR project "NANOCHAINS". It aims to create advanced molecular magnetic materials made of Single-Chain Magnets. An exciting challenge in this field, is to organize such objects in order to be able to address them individually. Recently, our collaborators developed an innovative technique to transfer SCMs on surfaces, thanks to the formation of supramolecular assemblies, which help maintaining the SCM intact during surface deposition.[1] In this project, we will target light switching of these supramolecular assemblies, in order to ultimately better control the deposition process. Light switching[2] will be introduced thanks to various light-reactive units such as coumarine, azobenzene and dithienylethene, targeting respectively cross-linking of the assemblies, disassembling, or tuning of the morphological properties (see Scheme 1).





Scheme 1: General strategy of the project

Project description : This is a molecular synthesis project embracing multistep organic synthesis and coordination chemistry. It targets the synthesis of new coordination complexes with photoactive ligands bearing nitronylnitroxide (NIT) radicals. It is expected that the development of the new radicals will require important multistep synthetic work. Then, coordination chemistry and photophysical studies will be performed according to the methodology already developed in our laboratory. The formation of supramolecular

structures, and the corresponding macroscopic properties (e.g. gel formation) will be a specific focus of the project. During this 3 years project, the candidate will interact with the group of Prof. K. Bernot, situated on the same campus, to perform the magnetic characterization and will have the opportunity to spend short research stays in the group of Matteo Mannini (LAMM, Firenze) in order to study surface deposition. Our laboratory has been involved for many years in the development of switchable metal complexes[3-4] and magnetic systems.[5-6] In addition, the hired PhD student will count on a unique scientific environment gathering specific expertise on every single aspect of the project (ligand synthesis, coordination chemistry, SCM, surface science). In addition, this collaborative project also involve specialists in computations (Dr. B. Le Guennic) and organometallic chemistry (Dr. Y. Sarazin). Participation to this project will allow the candidate to become an expert in molecule-based materials while exposing her / him to various flavors of chemistry.

Profile and skills required : We are looking for a young scientist (F / M) holding a master degree in molecular chemistry with good skills in synthesis and characterization of molecular compounds. A great deal of the work will concern multistep synthesis of metal complexes, eventually under controlled atmosphere. Previous experience in synthesis is required. The hired PhD student will also be involved in photophysical and magnetism studies. This requires a good background in physical chemistry but experimental skills in these fields are not mandatory. The success of this project will depend on the PhD candidate ability to acquire knowledge in several different fields of research including the ones in which his/her academic background is less developed and to adapt to different learning environments.
The candidate will be hosted in a friendly and multicultural group and must be ready and happy to participate in team duties. Finally, participation to national and international conferences are meant to be included in the training of the candidate as well as participation to summer schools. ISCR is a large chemistry institute with an active scientific life and Rennes is a medium size French city offering a relaxing life style with many cultural and sport activities.

Funding : The PhD is fully funded by ANR.

Application : Please provide your resume (including your academic records), a statement of interest and the name and email of two references we can contact.

Starting date of the contract : September or October 2024

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