



phD 2024-2027 Ecole Doctorale de Chimie de Lyon

Lanthanide complexes as photoluminescent nanosensors

Laboratoire des Multimatériaux et Interfaces (LMI UMR 5615)

Université Claude Bernard Lyon 1

Keywords : lanthanide complex, photoluminescence, optical properties, pressure sensing.

Project positioning

Measuring local temperature and pressure in tribological contacts is a major challenge for researchers as well as for potential important applications. The issue could be solved by the development of non-contact photoluminescent nanosensors and especially with the help of lanthanides complexes because of their interesting luminescent properties. Another advantage of these molecular entities can be found in their easy synthesis and their structural modulation that can be easily designed depending on the searched properties. A transfer of energy from an organic ligand to a rare earth ion is used to excite the lanthanide ion, and is known as the 'antenna effect'. Such complexes have potential applications in temperature or pressure measurement, thanks to their narrow emission bands and long lifetimes. We have recently studied a luminescent lanthanide complex that is sensitive to pressure, by measuring a luminescence intensity ratio (*Figure*). Further developments are needed to better understand and produce a real sensor.

phD project

The aim of the proposed internship is to develop the use of the complex and to evaluate the potential of new complexes. Work on shaping the crystals in a matrix is necessary. Similar complexes will be synthesized by varying the size of the ligands in order to modify the metal-metal distance. The project involves synthesis (organic and coordination chemistry), structural characterization (X-ray, mass spectroscopy, NMR, ...) and the study of optical properties. Initially, the ligand (organic chemistry) and metal complexes (coordination chemistry) will be synthesized.

Situation

The project is due to start from October 2024 at the Laboratoire Multimatériaux et Interfaces (LMI), in the Chimie Inorganique Moléculaire et Précurseurs (CIMP) group. It will be linked to partners in Lyon (ILM and LAMCOS for optical characterization).

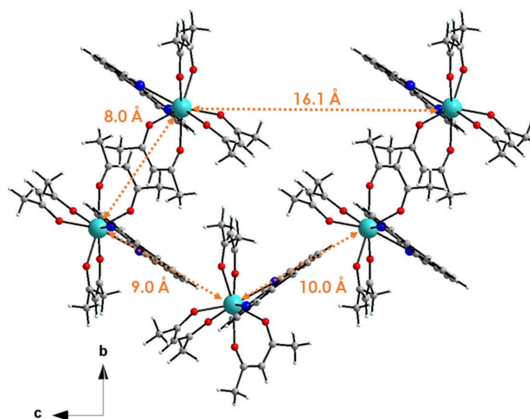


Figure: X-ray diffraction structure of the lanthanide complex



Candidate desired skills: Chemical synthesis (organic, inorganic). Structural characterization by X-ray diffraction and spectroscopic techniques (photoluminescence).

Contact : To apply, send your CV, master certificates *and two recommendation letters*, to Laurence Bois, and Guillaume Pilet and Laboratoire Multimatériaux et Interfaces (LMI), UMR 5615 CNRS- Université Claude Bernard Lyon 1, Bâtiment Chevreul, Campus de la Doua, Villeurbanne. laurence.bois@univ-lyon1.fr and guillaume.pilet@univ-lyon1.fr

References : [1] Y. Zhou. Adv. Opt. Mater. 2024, 10.1002/adom.202301800