Centre Val de Loire UNIVERSITÉ
Spirit of the Loire Valley

UNIVERSITE D'ORLEANS

AVIS DE SOUTENANCE EN VUE DE L'HABILITATION A DIRIGER DES RECHERCHES

Discipline : Chimie

Svetlana V. ELISEEVA

Présentera ses travaux en vue de l'habilitation à diriger des recherches intitulés :

Visible and Near-Infrared Lanthanide-Based Luminescence for Biological Applications and Materials Sciences

Le mardi 30 janvier 2018 à 14h
L'Amphithéâtre Charles Sadron, Campus CNRS, Orléans

Devant le jury constitué par les personnalités suivantes :

M. Luís D. CARLOS	Professeur, Université d'Aveiro, Portugal
M. Mir Wais HOSSEINI	Professeur, Université de Strasbourg, France
M. Talal MALLAH	Professeur, Institut de Chimie Moléculaire et des Matériaux d'Orsay, France
Mme. Anja-Verena MUDRING	Professeur, Université de Stockholm, Suède
M. Stéphane PETOUD	Professeur, Directeur de recherche INSERM, Centre de Biophysique Moléculaire CNRS, France
M. Hechmi TOUMI	Professeur, Université d'Orléans, France

Résumé des travaux

Trivalent lanthanide(III) ions, Ln^{3+}, due to their specific electronic configuration ($[Xe]4f^n$, n = 0–14) and the shielding of the 4f orbitals by the outer $5s^25p^6$ subshells exhibit unique optical properties, in particular (i) sharp characteristic bands arising from f-f transitions, in the entire spectrum from UV, to near-infrared (NIR), the wavelengths of which are insignificantly affected by changes in the local microenvironment around Ln^{3+} (pH, temperature, hydrophilic and hydrophobic character of biological molecules) and (ii) long luminescence lifetimes compared to organic fluorophores (ns-µs or µs-ms range for NIR- or visible-emitting Ln^{3+}, respectively). However, extremely low molar absorption coefficients of free Ln^{3+} require their sensitization by the "antenna effect" via appropriate chromophoric ligands in order to obtain sufficient emission intensity. Therefore, the design of highly luminescent Ln^{3+} compounds requires an optimization of the sensitization processes as well as the minimization of non-radiative deactivation mechanisms through overtones of high-energy vibrations, charge-transfer states, as well as back energy transfer processes. Moreover, if Ln^{3+} coordination compounds are thought to be used in a specific application, additional requirements such as thermal stability and easy processing for light-emitting diodes or water solubility, biocompatibility, low toxicity, high thermodynamic stability and/or kinetic inertness for biological applications, have to be taken into account. The research carrier of Dr. Svetlana V. ELISEEVA is mainly dealing with the design, synthesis, characterization and use of lanthanide(III) coordination compounds emitting in the visible and the NIR ranges for material sciences and biological applications. Detailed investigation of photophysical properties and rationalization of the design of highly luminescent Ln^{3+} complexes bearing in mind other functional properties required for a specific application are important aspects of her research activity and projects. Ln^{3+}-based compounds from different classes including small molecular complexes, macromolecules (dendrimers), coordination polymers and nanomaterials have been created to reach these goals.