PhD contract offer

Application deadline: April 30, 2025 at 11:59 p.m.

Subject: Multi-Functional / -Modal core@shell Nanoparticles With Magnetic, Optical and/or Piezoelectric Properties

General information

Workplace: Nancy, France
Type of contract: PhD contract
Contract period: 36 months
Expected date of employment: October 2025
Proportion of work: Full time
Remuneration: -
Desired level of education: Master's degree (or equivalent) in chemistry, materials science or physics.
Experience required: *cf.* § skills

Missions / Activities

The aim of this thesis is to develop multifunctional core@shell nanoparticles with magnetic, optical and piezoelectric properties. The synthesis of these nanoparticles will be based on soft chemistry techniques enabling precise control of the structure and composition of the layers. The core will be made of magnetic materials, while the shell will be built from semiconducting, plasmonic or piezoelectric materials to optimize physico-chemical properties.

In-depth characterization of these nanoparticles will be carried out using advanced techniques such as transmission electron microscopy (TEM and HRTEM), X-ray diffraction (XRD), UV-Vis-NIR spectroscopy and Raman spectroscopy, to analyze morphology, crystallinity and optical properties. Magnetic properties will be studied by vibrating sample magnetometry (VSM) or Mössbauer spectroscopy, while piezoelectric characteristics will be assessed by piezoelectric force microscopy (PFM).

The ultimate goal is to design nanoparticles with adjustable functionalities, for use in a wide range of applications such as nanomedicine (contrast agents or therapeutic vectors), photonics or energy conversion devices. This research will contribute to a better understanding of the interactions between physical properties within nanostructured systems, paving the way for new advanced technologies.

Keywords:
Core@shell nanoparticles, Chemical synthesis, Magnetic properties, Optical properties, Piezoelectric properties, Multifunctional nanomaterials

Work context

Thesis co-directed by Emmanuel Lamouroux (MCF) and Solenne Fleutot (MCF) of the Institut Jean Lamour's Nano-bio-materials for Life team (Team 401).

Skills

The candidate must have a Master's degree in chemistry, materials science or physics. He/she should have a good command of organic and inorganic chemistry. Knowledge of techniques for analyzing nano-objects, such as spectroscopy or microscopy, would also be useful. A grounding in materials physics would be a plus.

The candidate must also have good interpersonal skills to fit in well with the research team.

Level of English required: Intermediate (B1/B2) - You are able to express yourself clearly and coherently on familiar and everyday topics, and to understand the main points of a discussion when clear and standard language is used, and if it concerns familiar matters at work, school, leisure, etc.

Constraints and risks

The doctoral student will benefit from all the facilities of the Institut Jean Lamour - UMR 7198 (extensive equipment for synthesis, shaping and structural, chemical and physical studies).

Risks associated with working in a materials laboratory, using conventional chemicals and characterizing specific properties. Safety training for new students (NEO/CNRS) and presentation of the IJL procedure (meeting with safety officers and awareness of fire extinguisher handling).

About Institut Jean Lamour

The Institute Jean Lamour (IJL) is a joint research unit of CNRS and Université de Lorraine.

Focused on materials and processes science and engineering, it covers: materials, metallurgy, plasmas, surfaces, nanomaterials and electronics.

The IJL has 263 permanent staff (30 researchers, 134 teacher-researchers, 99 IT-BIATSS) and 394 non-permanent staff (182 doctoral students, 62 post-doctoral students / contractual researchers and more than 150 trainees), of 45 different nationalities.

Partnerships exist with 150 companies and our research groups collaborate with more than 30 countries throughout the world.

Its exceptional instrumental platforms are spread over 4 sites ; the main one is located on Artem campus in Nancy.

Application

Applications must include a letter of motivation, a detailed Curriculum Vitae, transcripts and the contact of at least one reference person.

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