

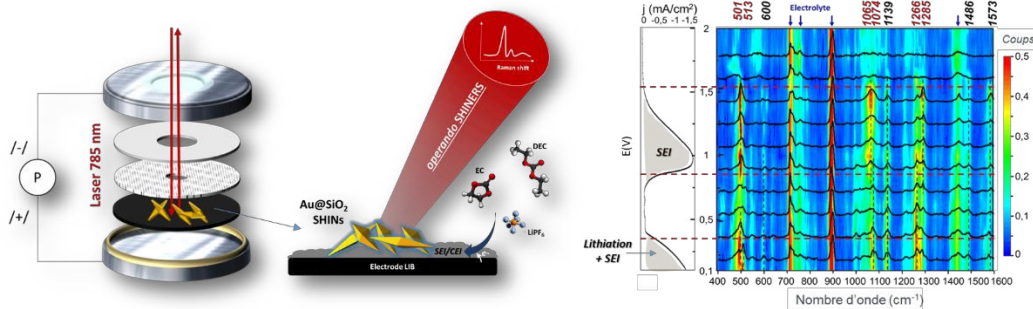
PhD candidate for: NANOSCALE CHARACTERIZATION OF INTERFACES IN OPERATING LI-ION BATTERIES

Temporary contract | 36 months | Fulltime | Nantes, France

The *Electrochemical storage and conversion of energy* team (**ST2E**) at IMN together with 10 world-leading research and technology organizations across Europe are launching the **OPINCHARGE** project funded by the Horizon Europe program. The project aims to develop advanced characterization methods and tools to investigate solid-liquid interfaces in Li-ion batteries (LIB) at unprecedented level of detail. In this context, the ST2E group is looking for a highly motivated with skills in analytical-chemistry (electrochemistry, spectroscopy) to perform their doctoral research within the framework of the OPINCHARGE project. The successful PhD student will be trained by experienced scientists & engineers and be granted access to state-of-the-art infrastructure to perform cutting-edge research.

The research project: Operando Raman with boosted sensitivity to resolve interfacial composition

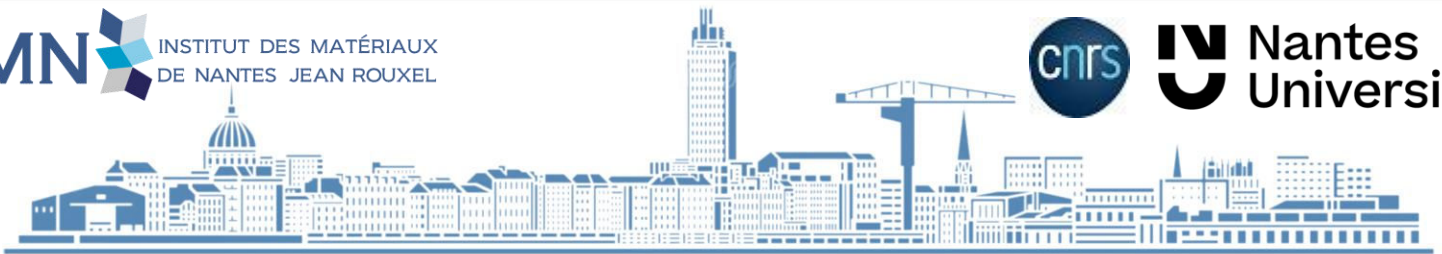
The PhD candidate will develop and apply a novel and high-sensitivity vibrational spectroscopy technique (**SHINERS**) to perform operando and in situ characterization of battery interfaces. Raman-signal enhancement techniques using plasmonic amplifiers (Shell-Isolated nanoparticles: SHIN) will be combined to confocal Raman microscopy and electrochemical methods to track and map the composition of thin and **semi-passive interfacial layers (SEI, CEI)** developing at the electrodes surface during the battery operation. The PhD student will work specifically on the design of SHINs and on the development and testing of **new spectro-electrochemical cells**, optimized for LIB-system operando characterization. **Operando SHINERS** will be first demonstrated on model battery materials and then applied to functional battery electrodes. In consultation with the project leader, the PhD student will design and perform relevant experiments, analyze, and interpret the results, write scientific articles and disseminate the results in international conferences and seminars with the *Opincharge* partners.



Dynamics of interfacial composition in Li-ion batteries by operando SHINERS – [Gajan et al ACS Energy Letters 2021](#)

Hosting institution: IMN lab in Nantes université, France

The research project will be hosted at the *Institut des Matériaux de Nantes Jean Rouxel* [IMN](#) whose research activities encompass the design, the characterization and the optimization of new materials for a diverse range of high technology applications, including next generation solar cells, fuel cells, electric car



batteries, nanotechnology, smart materials, materials for microelectronics, photonic and optical materials. The IMN lab is affiliated to CNRS and Nantes Université, two prestigious research institutions in France and worldwide. It is located on the campus “Lombarderie” of Nantes Université, 10 min from the city center by public transportation.

The team – The PhD candidate will join the ST2E research group (18 permanent researchers and twenty non-permanent), whose activity focuses on the synthesis and characterization of materials and on the analysis of the mechanisms that occur in the operation of electrochemical energy storage (batteries, supercapacitors) or transformation devices (fuel cells & electrolyzers). The project will be headed by Ivan LUCAS (Researcher at IMN/Ass. Prof at Sorbonne Université) experienced in operando nanoscale diagnostic techniques for energy storage applications. The co-direction of the PhD thesis will be ensured by Prof. Philippe Moreau.

Candidate profile

Master in analytical chemistry or material science.

Background/hands-on experience in at least one of the following fields: electrochemistry/Raman spectroscopy/fabrication of electrodes for electrochemical systems. Experience with inorganic nanoparticles synthesis will be an asset.

- Writing skills, ability to communicate and valorize his work
- Fluency in English (reading, writing, speaking)
- Ability to work in a team

Conditions

Starting date & duration: 1st of June, 36 months

Work location: IMN, Lombarderie Campus, Nantes Université

PhD enrolment at Nantes Université (Doctoral school [ED-3mg](#)). Please note the university costs (380€ / year) are to be paid by the student.

Compensation package: 2135€ gross salary (before taxes). Nantes Université holds a specialized [team](#) to help foreigners to manage French paper work.

Note that IMN is classified as restricted area (ZRR) requiring background check for new comers which can delay the recruiting process.

Application procedure

For any additional information on the project and/or recruitment process, please contact Dr Ivan LUCAS (ivan.lucas@cnsr-immn.fr). All applications must be sent through the “portail emploi CNRS” (<https://emploi.cnsr.fr/Offres/Doctorant/UMR6502-IVALUC-001/Default.aspx?lang=EN>) and must include a CV and a cover letter outlining your motivation • Contact details of 2 references.