Institute of Engineering and Management of Grenoble Alpes University

HR EXCELLENCE IN RESEARCH

Grenoble INP - UGA is a member of **international** engineering and management education and research **networks.** It is widely recognized in national and international rankings**.**

8 schools + **39** laboratories

8300 students

1 300 teaching, research, administrative and technical staff

Grenoble INP - UGA is a renowned public institution of higher education and research, and a major player in the Grenoble ecosystem. It is the engineering and management institute of Grenoble Alpes University, and plays a leading role in the scientific and industrial community.

PhD Student in electrochemistry

Job reference number	2024-PHDELECTROCHEM-LEPMI
Research field	Correlating 3D electrode microstructure and transport modeling to enhance fast charging of Li-ion batteries (PhD-thesis)
Host laboratory	LEPMI (UMR 5279 Grenoble-INP, UGA and CNRS) / Website : https://lepmi.grenoble-inp.fr/
Researcher profile	PhD
Location	Saint Martin d'Hères (38), France
Date of recruitment / contract term	01/09/2024 (36 months)
Contacts	Yann Bultel - Claire Villevieille yann.bultel@grenoble-inp.fr claire.villevieille@grenoble-inp.fr

Grenoble INP - UGA is a leading public institution accredited with the French label "Initiative d'excellence". It offers innovative engineering and management programs, with an increasing internationalization of its course offers. The courses are grounded in sound scientific knowledge and linked to digital, industrial, organizational, environmental and energy transitions. The Engineering and Management Institute of Grenoble Alpes brings together more than 1300 staff members (teacher-researchers, lecturers, administrative and technical staff) and 8300 students, located on 8 sites (Grenoble INP - Ense3, Grenoble INP - Ensimag, Grenoble INP - Esisar, Grenoble INP - Génie industriel GI, Grenoble INP - Pagora, Grenoble INP - Phelma, Polytech Grenoble, Grenoble IAE and the INP Prepa). Grenoble INP is also a highly-ranked institution of higher education and research, leading the way in the fields of engineering and management on an international scale. It is a member of a large number of international academic and research networks. It is part of the European University UNITE!.
As part of Grenoble Alpes University, Grenoble INP has associated guardianship of 39 national and international research laboratories and of technological platforms. The research conducted there benefits both its socio-economic partners and its students. Grenoble INP is at the heart of the following scientific fields: physics, energy, mechanics and materials; digital; micronanoelectronics, embedded systems; industry of the future, production systems, environment; management and business sciences.

Grenoble INP - UGA is an equal opportunity employer committed to sustainability. Grenoble INP-UGA celebrates diversity and equity and is committed to creating an inclusive environment for all employees. All qualified applications will be considered without discrimination of any kind.

Research

Grenoble, the cradle of white coal and electrometallurgy, had to host a major electrochemistry laboratory like LEPMI. The scientific orientation of LEPMI is based on the historical keywords and thematics of the laboratory: electrochemistry, materials, interfaces and electrochemical engineering. This disciplinary base is the driving force behind the development of our nationally and internationally recognised activities in the fields of energy and sustainable development.

The applications underlying LEPMI's research activities are thus oriented towards the development of electrochemical generators (batteries, fuel cells, photovoltaic cells), hydrogen production (electrolysis), recycling processes for strategic materials and corrosion. The scientific strategy of the unit is based on one of its specificities and strengths, which is to propose a balanced research between fundamental and applied approaches ranging from the synthesis of functional materials and their characterisation to the experimental study and modelling of devices for energy by integrating the recycling aspect of strategic materials.

The various scientific activities are carried out within the framework of three teams with their own specificities and around the development of tools and skills that are transversal to LEPMI, inter-team actions and technical platforms. Indeed, the laboratory's scientific activities require the use of numerous characterisation tools, and the various technical platforms allow the laboratory's equipment to be shared and rationalised. The laboratory is involved in economic issues.

Offer description :

Li-ion batteries are currently the most widely adopted technology for energy storage application, and the forthcoming E-mobility market leads to guide research for higher energy density and electrochemical performance. Li-ion battery is a very complex electrochemical system consisting of an electrolyte surrounding by two porous composite electrodes and two current collectors. The cell electrochemical performance relies solely on the intrinsic material properties as well as on the electrode microstructure, especially the electrode engineering that needs to consider the ionic and electronic percolation.

Currently, most research are dedicated to the development of new materials. However, the transport and transfer phenomena occurring within the porous electrode are of utmost important and highly rely on the electrode microstructure.

To achieve high electrochemical performance, manufactures are tuning the electrode engineering by increasing the electrode mass loading which directly impacts the percolation network and thus the electrode microstructure. In such case, mass and charge transport limitations will be exacerbated as well as additional issues will be popping up such as the electrode porosity/tortuosity hindering again the conductive pathways. These limitations are all the more restrictive during fast charging or low temperature operation conditions Thus, understanding the relationship between the electrode engineering, the electrode microstructure, and the transport properties is crucial for developing better batteries.

This thesis is then dedicated to understanding the effect from electrode microstructure on the electrochemical performance and aging of Li ion batteries. Several composite electrodes will be specifically designed by tuning the thickness of the electrode and the porosity which will be first link to their electrochemical performance.

Then, advanced characterisation techniques at multiple length scale (from nanometre resolution of the micrometre one) will be carried out to collect information about the 3D microstructure of the electrode. Among the techniques to be used, X-ray absorption tomography as well as FIB-SEM will be state-of-the-art to reconstruct the local microstructure of the composite electrode and to collect information to develop specific transport models. Indeed, porous electrode models from Newman group's has been used in research and industrial fields but they do not consider the microstructure of electrodes. By coupling our experimental approach based on electrochemical performance and 3D electrode microstructure, we will be able to propose alternative resolved models with explicit description of electrode microstructure taking into account the three phases: active material particles, electrolyte and carbon-binder field.

Specific requirements or conditions

Specifics of the position

The research will be carried out on the Saint Martin-d'Hères site.

Position assigned to a restricted area: YES

(Device for the protection of the scientific and technical potential of the nation, conditioning the appointment of the researcher to the authorization of the Defense Security Officer).

How to apply

Applications must be sent to : yann.bultel@grenoble-inp.fr and claire.villevieille@grenoble-inp.fr

Application deadline : 05/07/2024