Laboratory for Integrated
Micro-Mechatronic Systems
LIMMS/CNRS-IIS IRL 2820

Application instruction for LIMMS internship FY 2025 *On Optimization of geometry and electrochemical properties of a microfluidic channel for battery applications at Minami laboratory,* LIMMS/CNRS-IIS, The University of Tokyo

1. INTERNSHIP DESCRIPTION

- **Location:** LIMMS/CNRS-IIS (IRL 2820), Tokyo, Japan
- **Internship title:** ***Optimization of geometry and electrochemical properties of a microfluidic channel for battery applications***
- **Internship duration:** 1 to 6 months
- **Accommodation support:** 70 000 yens / month for maximum 6 months (420 000 yens max. per person)
- **Expenses:** Airplane tickets and incidental expenses are **NOT** covered by LIMMS.
- **Contract:** Up to 6 months. An internship contract between IIS-UTokyo and the French school will be finalized, which will define the rules and obligations (both overseas travel accident insurance and liability insurance) during the stay at LIMMS/CNRS, IIS UTokyo.
- **Starting & Ending dates:** The internship should start on the 1st of February 2025 or beyond and finish before the 31st of March 2026.
- **Visa:** Students who will participate in the program for more than 90 days must have a visa. An administrative procedure takes about 3 months.

Context of the internship:

The past few decades have shown a rapid and continuous exhaustion of the available energy resources which may lead to serious energy global crises. Researchers have been focusing on developing new and renewable energy resources to meet the increasing fuel demand and reduce greenhouse gas emissions. A surge of research effort is also being directed towards replacing fossil fuel-based vehicles with hybrid and electric alternatives. Electrochemical energy storage systems offer the best combination of efficiency, cost, and flexibility, with redox flow battery systems currently leading the way in this aspect.

The redox flow battery (RFB) is a highly efficient energy storage technology that uses the redox states of various soluble species for charge/discharge purposes. Currently the research in RFB development is a considerably hot topic: an important set of publications is regularly released in most of the top-notch journals illustrating the high impact of the advances made on this technology. Though, the challenges remain numerous to leverage RFBs toward the industrial scale. Their practical deployment in commerce and industry is still impeded by their relatively high cost and low energy density. For systems that are intended for both domestic and large-scale use, safety and cost must be considered as well as long-term access to metal resources, which places limits on the classical lithium-ion-based and vanadium-based RFB development [7]. In this context, the research team at Minami lab, in collaboration with CNRS researchers, aims at developing new optimized RFB based on optimization design with COMSOL Multiphysics, RFB microfabrications in clean room and experimental assessments.

Job Duties

The student will have to carry out the following tasks:

1) Optimizing the 3D channel design of the RFB to limit the mass transport and reactant mixing using a complete RFB CFD model developed at the Minami lab using COMSOL Multiphysics software
2) Fabricate the 3D channel using the clean room facilities at IIS
3) Evaluate the electrochemical and hydrodynamic performance of the fabricated RFB using the unique spectroelectrochemistry platform at Minami Lab.

Skills and Experience

If you have a taste for multiphysics simulations using COMSOL, a solid background in mechanical engineering, instrumentation, data processing and microfabrication, enjoy teamwork and want to develop your skills in energy transfer and top-notch electrochemical technology, then join our research team!

2. PLEASE SEND THE FOLLOWING ITEMS TO LIMMS DIRECTION PAR E-MAIL

<limmsadm@iis.u-tokyo.ac.jp>

1. CV
2. Motivation letter

- Candidates are kindly advised to send LIMMS direction the requested documents with an e-mail **subject "internship title" FY2025 followed by the candidate's full name**. Sending documents with a different e-mail subject might be at risk of being overlooked.
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- **Submission Deadline (Closing date) for applications is** 30 October 2024.
- Please note that due to our administrative procedure, we cannot accept your applications AFTER the deadline.
- Due to a large number of applications, it is not possible to reply to you if you are not shortlisted. If you have not heard from us within one month of the closing date, please assume that your application has not been successful on this occasion.

3. NOTIFICATION OF RESULTS

After approval by the screening committee in LIMMS, notification of the acceptance will be sent both to the intern and the host professor of LIMMS.