

Paul Scherrer Institut
5232 Villigen PSI
Schweiz
+41 56 310 21 11
www.psi.ch

Project Head
Dr. Claire Villevieille (Group Leader)
Electrochemistry Laboratory
OVGA/123
+41 56 310 24 10
claire.villevieille@psi.ch

Supervisor
Ms. Laura Höltzchi (PhD Student)
Electrochemistry Laboratory
OVGA/125
+41 56 310 21 15
laura.hoeltschi@psi.ch

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Electrochemical Energy Storage

Section of Prof. Dr. Petr Novák
<https://www.psi.ch/lec/electrochemical-energy-storage>

Master Thesis/Internship

Characterization and Electrode Engineering for All-solid-state Lithium-ion Battery

Project description:

Nowadays, batteries are used for various mobile and stationary applications. In the search for increased safety and higher electrochemical performance of batteries, all-solid-state batteries present a growing interest. The latter use a solid electrolyte and not anymore a flammable liquid organic electrolyte as in conventional batteries. Therefore, they promise a greater safety. Moreover, they could boost the energy density as they should enable lithium metal as anode material. Significant research is now being conducted in academia and industry on novel materials, both the electrolytes and electrodes. Nevertheless, a lack of fundamental understanding on the critical parameters such as fabrication (e.g. the external pressure needed for cycling), the interfacial resistances between the electrolyte and the electrode material is still hindering solid-state batteries from commercialization.

In this project, you will learn the key parameters to optimize the electrochemical performance of solid-state batteries by conducting systematic research on the electrode composition and morphology. You will also gain experience in solid state synthesis of the electrolytes and in possible synthesis routes to protect the electrode material during cycling. In order to evaluate the electrochemical performance of the cells, you will use different electrochemical characterization methods such as battery cycling tests and Electrochemical Impedance Spectroscopy. In addition, you will use characterization techniques such as SEM or XRD to elucidate possible material degradation mechanisms.

Your profile:

- Bachelor in material science, chemistry, engineering, physics
- Good command of English

Our offer:

- PSI : largest research center for natural and engineering sciences in Switzerland
- Excellent technical facilities

Compensation: Accommodation costs covered

Starting Date: December 2018-April 2019

Duration: from 3 up to 9 months

If you are interested, feel free to send an email or give a call to Dr. Claire Villevieille or Ms. Laura Höltzchi. Our team would be glad to discuss further the topic and offer you a visit in the electrochemistry laboratory.