Master's project/thesis call:

Data processing in Python for advanced battery characterisation

at the Laboratory for Thin Films and Photovoltaics, Empa (Dübendorf, Switzerland)

One of the main research topics in the Laboratory for Thin Films and Photovoltaics is solid-state thin-film batteries. We use the advantages of thin-film manufacturing processes to create micro- or nano-scale batteries that can find applications in wireless sensors and consumer electronics, but more importantly, serve as model systems to study the fundamental properties and phenomena governing the performance of specific battery materials and their interfaces.

This project aims to develop a Python library for fast, reliable and robust processing and analysis of battery data. Within the project, the student will learn how thin film battery manufacturing works, as well as how they are typically characterised using electrochemical methods. The student will learn the basic principles of battery cycling, electrochemical impedance spectroscopy (EIS), cyclic voltammetry and other electrochemical characterisation techniques based on transient phenomena. These experiments will provide data that will be used to develop Python-based data processing and analysis workflows. For example, the variation of thickness of the cathode layer combined with EIS measurements and appropriate data analysis approach will enable the determination of impedance contributions from the cathode, interfaces and electrolyte separately, leading to the determination of material constants from this thin-film model system. The project will improve the understanding of fundamental electronic and ionic transport properties of battery materials and lead to the creation of a robust data analysis tool that will be published as an open-source Python library.

This project requires multidisciplinary interests and will help you gather experience in many domains (electrochemistry, materials science, programming, data processing). Therefore we invite students with strong background in computer sciences, physics, chemistry, materials science, and/or electrical engineering to apply. It is possible to tailor the project to your specific area of interest. Feel free to contact us for further information.

Duration: 3 to 6 months
Starting date: Anytime
Contacts: Dr Jędrzej Morzy (jedrzej.morzy@empa.ch), Dr Yaroslav Romanyuk (yaroslav.romanyuk@empa.ch)
Website: https://www.empa.ch/web/s207/thin-film-batteries