Master's Thesis Project Available

Investigation of SEI Formation at the Li/Solid Electrolyte Interface Using *Operando* X-ray Photoelectron Spectroscopy (XPS)

Introduction

The shift toward electrified transportation calls for safer, higher-performance energy storage. Solid electrolytes compatible with lithium-metal anodes not only improve safety but also offer the potential to surpass the energy density of current Li-ion batteries.

A key challenge in developing next-generation all-solid-state lithium-metal batteries (Gen4) lies in identifying solid electrolytes that combine high ionic conductivity with a wide electrochemical stability window. Advancing these materials requires a deep understanding of degradation mechanisms at the Li/electrolyte interface and the nature of the solid electrolyte interphase (SEI).

Project Objectives

This project aims to explore SEI formation and evolution at the Li/solid electrolyte interface using *operando* X-ray Photoelectron Spectroscopy (XPS)—a non-destructive method that enables real-time monitoring during lithium plating and stripping [1]. The goal is to develop and apply *operando* techniques to track SEI growth and stability across cycles, providing insights essential for improving solid-state battery performance and durability.

What You'll Gain

By participating in this project, you will:

- Gain hands-on experience with advanced surface analysis techniques
- Develop in-depth knowledge of battery materials and interfacial chemistry
- Contribute to innovative research in next-generation energy storage

Interested?

We welcome motivated candidates to apply. Please send your application to:
raheleh.azmi@kit.edu

Relevant Literature

[1] S. Narayanan, U. Ulissi, J. S. Gibson, Y. A. Chart, R. S. Weatherup, and M. Pasta, "Effect of current density on the solid electrolyte interphase formation at the lithium|Li6PS5Cl interface," *Nat Commun*, vol. 13, no. 1, Dec. 2022, doi: 10.1038/s41467-022-34855-9.