

Cathode-Electrolyte interfaces in Li based batteries: Transition from liquid to solid electrolytes

Project Description

The cathode material still remains the limiting factor to achieve the predicted theoretical energy density of Li ion batteries. The major challenges being structural and electrochemical instability of the cathode material with both liquid and solid electrolyte. Due to which detrimental surface passivation by inactive interphases and unexpected transition metal ion mobility across interfaces occurs. To circumvent these problems, different structural, physiochemical and electrochemical modifications have been developed, although knowledge of the underlying parameters driving interfacial resistance is still lacking.

This project aims to understand the origins of interfacial resistance at the cathode- electrolyte interface, both with liquid and solid electrolytes, and with various coatings. It includes understanding how different experimental techniques can be utilised to better visualise the battery either directly or indirectly, and how different modifications influence the fundamental chemistry that drives interface formation.

Due to the ongoing COVID-19 situation, the entire project will be running remotely, unless the existing restrictions are removed.

Project Goals

- Introduction to batteries, practical challenges, different factors contributing toward overall resistance
- Evaluation of the current understanding of model cathode materials
- Comparison of the viability of different techniques to visualise interfaces directly or indirectly
- Understanding electrochemical methods including Cyclic voltammetry, Impedance spectroscopy and Galvanostatic Intermittent Titration technique, and their respective data analysis and interpretation.
- Exploring the origin of comparative interfacial resistance in liquid vs solid electrolytes, focusing with Impedance spectroscopy
- Communication and sharing of ideas with other group members working on similar systems

Understanding and implementing best practices for presenting experimental results, preparation of the final report and presentation to summarise overall project results

As part of The Faraday Institution's 2020 intern cohort you will enter an end-of-project poster competition – the winners of which will be invited to present their poster at the Faraday Institution Conference in November 2020.

Eligibility

In order to partake in the project you must be:

- A full-time registered undergraduate student at a UK university
- Undertake the internship within the years of undergraduate study (i.e. not be currently in your final year)

Funding

A salary of £9.30/hour across the UK or £10.75/hour in London will be provided. This will be determined by the working address of the appointee not the universities location. The internship is a full-time role for 8 weeks beginning in early July. The funding is provided by The Faraday Institution.

Deadline

Please send your two page CV and a no more than one page cover letter to sm2383@cam.ac.uk by 8 June.

For project information, please visit <https://faraday.ac.uk/research/lithium-ion/li-ion-cathode-materials/cathode-materials-catmat/>