THE FARADAY INSTITUTION LiSTAR
NEXT GENERATION LITHIUM SULFUR BATTERIES

Imperial College London

Lithium-Sulfur Battery Model Implementation in Python

Project Description

The need for high capacity batteries is increasing rapidly due to our more electrified and mobilised world. Lithium-ion batteries have served use-cases such as phones and electric vehicles well, but the demand for greater performance requires the next generation of beyond-Lithium-ion batteries. One promising new battery technology is the Lithium-Sulfur battery. Such batteries have a theoretical specific energy capacity 3-5 times larger than traditional Lithium-ion batteries and are far more environmentally friendly. However, the current understanding of Li-S batteries is limited due to their highly complex internal electrochemical processes. The difficulty in understanding such batteries hinders researcher's ability to enhance the technology enough for widespread adoption.

Physics-based mathematical models of Li-S batteries can play an important role in the development of this technology. Models allow experimental-based hypotheses to be made precise and verified. Models which succeed in explaining experimental results can then be used to guide further experiments and cell designs. However, it is currently difficult to directly compare the array of models in the literature. The project aims to add several models to a flexible new python-based platform called PyBaMM which will allow researchers to directly compare these models between each other and with experimental data. This is part of a broader effort to facilitate cross-institutional collaboration, democratise research progress, and aid rapid model development. The student will be supervised by Dr. Monica Marinescu and will work closely with Dr. Michael Cornish both based at Imperial College.

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

Project Goals

You should be comfortable with Python and Ordinary Differential Equations (ODEs). An understanding of how batteries work is desirable, but not essential. An option to extend the work to models involving Partial Differential Equations is also available. You will be working with a leading research group to develop models in Python which can be cited by subsequent researchers. You will become more familiar with Python, ODEs, and battery technology. 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 you CV and a brief cover letter to m.cornish14@imperial.ac.uk by June 1st

For project information, please visit www.listar.ac.uk