THE FARADAY INSTITUTION Modelling
MULTI-SCALE MODELLING

Exciting Faraday Undergraduate Summer Experience (FUSE) paid internship opportunities for summer 2023.

Studying a STEM degree? Wondering what career to pursue? Interested in finding out more about the battery sector? Keen to spend time with a dynamic community of pioneering battery researchers seeking to find solutions to support a fully electric future?

The Faraday Institution is offering a total of 55 internships, for undergraduate students to spend 8-weeks working on battery related projects.

Project title: Sustainability assessment of niobium-based batteries

Project description:

The significantly increasing demand for lithium-ion batteries (LIBs) for EV and grid storage applications puts pressure on critical raw materials such as lithium, cobalt and nickel. Development of niobium-based batteries (NbBs) has been hailed as being a sustainable alternative to conventional lithium-ion batteries (LIBs), because niobium displaces cobalt and nickel and provides improved energy density & efficiency, enabling a longer driving range and smaller batteries. The material is also safer and requires less thermal management. However, no in-depth analysis, comparing the economic and environmental gains/losses between all lifecycle stages of NbBs, and their impact on the overall life cycle cost and sustainability, has been done to confirm this.

To truly compare the two battery types, a lifecycle assessment (LCA) of both needs to be performed in a consistent manner, comparing the environmental impacts of all processes involved in extracting, processing, manufacturing, using and recycling or disposing of both NbBs and LIBs. In this work, the student will focus on assessing the environmental impacts of extracting and refining Niobium for batteries, investigating the inputs and outputs from each step and their impacts, based on data in the literature and lifecycle inventory databases.

The student will use openLCA to construct a flowchart of the process steps for producing battery-grade niobium and assess the impacts for each step, e. g. human- or ecotoxicity, eutrophication potential, global warming potential, etc. The student will compare the impacts incurred during the production of both lithium and niobium for batteries.

Learning Objectives:

- How to conduct a literature review
- How to do a partial lifecycle assessment, using openLCA
- Basic knowledge of how batteries work
- Understanding mining and refining processes and their environmental impacts
- Understanding the life cycle of lithium batteries

Supervisor: Dr. Jacqueline Edge

University: Imperial College London

Location: Online, with occasional in-person meetings, as required and if possible.

Start date: The internship is a full-time role for 8 weeks during June – September 2023.

Eligibility:
Experience of any kind with batteries (either experimentally, theoretically, or otherwise) would be useful, but not essential.

You should be familiar with the methodology behind life cycle assessment methods and experience with an LCA software package would be useful.

You **must**:

• Be a registered, full-time undergraduate student from a UK university.

• Undertake the internship within the years of their undergraduate study (i.e. not in final year or during a subsequent Masters' programme).

• Not have been a FUSE intern in a previous year

Funding:

A salary of £400 / week will be provided. The funding is provided by the Faraday Institution.

Additional activities:

During the FUSE internship you will be able to attend Faraday Institution cohort events which will focus on a variety of topics to further develop your understanding of career opportunities in battery sector. At the end of the programme, you will be invited to to share a poster about your work and prizes will be awarded.

Application:

In order to apply for this Faraday Undergraduate Summer Experience (FUSE) 2023 internship, you need to **complete this survey** and send a one-paragraph cover letter and CV to j.edge@imperial.ac.uk by **April 12th 2023** with 'FUSE Application' in the subject field. We will be in touch shortly after this date.

Diversity:

The Faraday Institution is committed to creating a dynamic and diverse pool of talent for the fields of battery technology and energy storage.

We at Imperial College are committed to equality of opportunity, to eliminating discrimination and to creating an inclusive working environment for all. We therefore encourage candidates to apply irrespective of age, disability, marriage or civil partnership status, pregnancy or maternity, race, religion and belief, gender identity, sex, or sexual orientation. We are an Athena SWAN Silver Award winner, a Disability Confident Leader and a Stonewall Diversity Champion.

Terms and Conditions:

By applying to this position, you agree that Imperial College London and the Faraday Institution can share information about you, such as your name, contact details and personal information, with each other, for the purpose of carrying out the Faraday Institution Summer Experience 2023.