Exciting Faraday Undergraduate Summer Experience (FUSE) paid internship opportunities for summer 2024.

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.

There will be 7 positions on offer within the School of Chemistry, University of Birmingham: Project titles and descriptions are given below:

1. Project title: Synthesis of Manganese-based Disordered Rock-salt phases via low temperature routes.

Project description: This project gives a unique opportunity for a UG student to develop synthetic skills using low temperature synthesis routes. Disordered rock salt cathodes using widely available transition metals such as Mn-based systems ($Li_{1+y}Mn_{1-y-z}(Ti,Zr)_zO_{2-x}F_x$) will be systematically investigated. The best samples will be characterised and electrochemically tested in Li-ion batteries. The student will investigate how precursors affect the obtained product, particle size and morphology. Samples will be characterised via a range of chemical and physicochemical techniques, which will help to determine crystal structure information and composition and allow the student to gain experience in different techniques used in materials sciences. The best samples will be electrochemically investigated, giving the student experience in coin cell assembly and testing.

Supervisors: Prof. Peter Slater and Dr Wilgner Lima da Silva

University: University of Birmingham

Location: *School of Chemistry (in person)*

Start date: The internship is a full-time role for 8 weeks during the period June – September 2024

2. Project title: Low cost mechanochemical approaches to battery materials

Project description: IUPAC recently named mechanochemistry as one of the top 10 emerging technologies in Chemistry, and it is now an approach that is finding a lot of interest in the battery field, particularly related to the production of new electrode materials. One of the challenges is, however, the fact that often very long milling times are utilized to synthesise such materials, which means that their commercial viability is limited. In this project we will explore the synthesis/modification of materials using lower cost, scalable mechanochemical routes with a view to bringing this exciting area into the industrial realm.

Supervisors: Prof. Peter Slater and Prof Tomislav Friscic

University: University of Birmingham

Location: *School of Chemistry (in person)*

Start date: The internship is a full-time role for 8 weeks during the period June – September 2024

3. Project title: Understanding mechanochemical processes for new electrode production

Project description: IUPAC recently named mechanochemistry as one of the top 10 emerging technologies in Chemistry, and it is now an approach that is finding a lot of interest in the battery field, particularly related to the production of new cathode materials. Nevertheless, there is a lack of understanding on how the milling conditions affect the synthesis, which generally leads to literature where extreme milling conditions that are not economically viable are used. We have recently shown that some of these syntheses can be performed under milder conditions which are more economical, and this project aims to build on these approaches and

enhance our understanding of the key factors that control the transformation process, which means that their commercial viability is limited. In this project we will explore the synthesis/modification of materials using lower cost, scalable mechanochemical routes with a view to bringing this exciting area into the industrial realm.

Supervisors: Prof. Peter Slater and Dr. Adam Michalchuk

University: University of Birmingham

Location: *School of Chemistry (in person)*

Start date: The internship is a full-time role for 8 weeks during the period June – September 2024

4. Project title: Characterisation of high power anode materials

Project description: Niobium based anodes are gaining increasing popularity for application in high-power lithium-ion batteries, due to their high theoretical capacities, inherent safety at high current densities, and long-term stability. In this project, detailed characterization of a range of niobium oxide based anodes will be performed to encompass X-ray diffraction, Raman and IR spectroscopy, with a view to understanding the effect of dopants and synthesis temperature/processing conditions on the structure and performance.

Supervisors: Prof. Peter Slater and Dr. Lizzie Driscoll

University: University of Birmingham

Location: *School of Chemistry (in person)*

Start date: The internship is a full-time role for 8 weeks during the period June – September 2024

5. Project title: Low temperature processing of solid state electrolytes

Project description: All solid-state batteries are viewed as the next key goal towards higher energy density batteries. To achieve this goal new stable highly conducting solid state electrolytes are needed, along with economically viable approaches to both prepare and densify these electrolytes. This project will examine low-cost processing routes for a newly developed solid state electrolyte with a view to identifying the optimum conditions for subsequent full cell tests.

Supervisors: Prof. Peter Slater and Dr. Josh Makepeace

University: University of Birmingham

Location: *School of Chemistry (in person)*

Start date: The internship is a full-time role for 8 weeks during the period June – September 2024

6. Project title: Preparation of stable water-based inks for high Ni content cathodes

Project description: High Ni content cathodes offer many benefits including high capacities. However, they are challenging to utilize in an aqueous environment due to proton-lithium exchange, which limits the use of aqueous inks, and consequently requires the use of toxic solvents in electrode production. In this project the effect of different surface passivation processes on the proton-lithium exchange will be investigated with a view to developing stable water-based inks that can be coated onto Al foils, and so lead to a greener route to battery production.

Supervisors: Prof. Peter Slater and Prof. Tomislav Friscic

University: University of Birmingham

Location: *School of Chemistry (in person)*

Start date: The internship is a full-time role for 8 weeks during the period June – September 2024

7. Project title: Advancing Sustainability: Recycling and Manufacturing Lithium-Rich Cathodes from High-Power Lithium-Ion Battery materials

Project description: High-power lithium-ion batteries are offer many benefits as energy storage solutions for portable electronics and electric vehicles. The recycling of end-of-life batteries from electric vehicles is crucial for promoting the sustainability of the future automotive industry. Lithium-rich transition metal oxides are attracting intense interest as the next generation cathode materials for lithium-ion batteries due to their high theoretical capacity. Generally, these materials incorporate transition metal ions for cation redox reactions, along with d^0 metal ions acting as anion redox centres. The objective of this project is to recycle cathode materials (such as NMC811) and anode materials (like lithium titanate) from the high power lithium-ion batteries by combining them to synthesise next generation lithium-rich cathodes for lithium-ion batteries.

Supervisors: Prof. Peter Slater and Dr. Bo Dong

University: University of Birmingham

Location: *School of Chemistry (in person)*

Start date: The internship is a full-time role for 8 weeks during the period June – September 2024

Eligibility:

- Be 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 £12.00/ hour across the UK or £13.15 / hour in London will be provided. This will be determined by the working address of the appointee, not the university's location. 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 share a poster about your work and prizes will be awarded.

Application:

In order to apply for a Faraday Undergraduate Summer Experience (FUSE) 2024 internship, you need to complete the application form (link below) (deadline 24th April 17.00) and send a copy of your CV to p.r.slater@bham.ac.uk .

https://forms.office.com/e/1QCBcVL275.

Diversity:

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

Equality and Diversity at the University of Birmingham