We are pleased to offer two summer internships with Dr Denis Cumming and Dr Rachel Smith. To apply for these positions please complete the corresponding Google Form.

The internships will run virtually, from 1st June to 1st September and will be paid at the national living wage. They are offered to undergraduate students that will be returning to their studies in September 2021 (ie, not final year students). Successful applicants will be invited to interview, likely w/c 17th May, for final selection process.

For general queries please contact myself - r.wormald@sheffield.ac.uk

Computational Fluid Dynamics (CFD) simulations of microfluidic system.

Microfluidic system offers a powerful lab-on-chip tool to generate highly mono-disperse emulsion droplets. Nano-particles can be inserted into these droplets to create particle agglomerates of desired properties. Strong agglomerates of active material nano-particles prove beneficial in improving the electrochemical performance of Li-ion battery electrodes. But multiple process parameters need to be adjusted to obtain particle-laden emulsions of desired properties. This trial-and-error is often done experimentally. This project aims to implement the design of experiments (DoE) study in a CFD simulation (ANSYS Fluent). The aim is to develop suitable multiphase model to simulate the 3 phase microfluidic system and further understand the effect of each parameter on the emulsion properties.

Following are some of the expectations from this project:

- Understand different multiphase models available in ANSYS Fluent.
- Choose a suitable multiphase model to simulate the 3-phase microfluidic system.
- Verify/validate different aspects of the model results and investigate the model limitations.
- Perform a parametric study to understand effect of different model parameters (density, viscosity, interfacial tension, contact angle, particle loading, flow rate ratio, channel geometry)
on the emulsion properties.
- Develop a set of guidelines to generate stable particle-laden emulsions with predefined properties.

This project requires intuitive understanding of fluid flow, analytical thinking to understand the model theory and limitations, and innovation to combine multiple models together. The applicant is expected to have some prior experience in CFD (preferably in ANSYS). The successful intern will be able to learn about the complexities associated with multiphase CFD and gain additional predictive modeling skills.

To apply for this role please complete this Google Form. For questions, please contact Dr Denis Cumming or Dr Rachel Smith.

The Department holds a Silver Athena SWAN Award and two gold awards for Green Impact.

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Programming based electrode schematic generation for Li-ion battery electrodes.

Li-ion battery is currently a very hot research topic, garnering attention of researchers from diverse backgrounds. Many different ideas are being generated to improve the performance of Li-ion battery electrodes. Although such ideas are easy to imagine, conveying them to a larger audience becomes a difficult task without proper use of schematics. Furthermore, creating a complex schematic containing all the necessary details is a time-consuming task. This project will aim to make this task easier by automating it. The goal is to develop a versatile code that can generate simple yet detailed schematics quickly. The code is expected to be flexible enough so that a wide range of ideas can be converted into a schematic and additional features can be continually added.

Following are some of the expectations from this project:

- Programming based automatic generation of electrode micro-structures.
- Programming to create complex non-spherical particles, 3D particles, separate binder polymers.
- Generating different sets and types of schematics to convey various ideas (well structured networks of CBD, graded electrodes, co-agglomerated AM particles etc.).
- Generating various possible schematics based on predefined proportions of AM & CBD.
- Generating pack level schematics to compare thick and thin electrodes.

This project requires creativity to visualize different ideas, analytical thinking to break down the idea into codable sub-problems, and some artistic instinct to beautify the schematic! The applicant is expected to have some prior experience in programming (preferably in Python). The successful intern will be able to learn about the complexities associated with Li-ion battery electrodes and gain additional programming skills.

To apply for this position please complete this Google Form. For questions, please contact Dr Rachel Smith or Dr Denis Cumming.

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