

SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

A project title and description with clear aims (300 words)

*Project Title: **Electrospinning as a Route to Design New Freestanding Materials for Flow Battery Applications***

Energy storage is increasingly becoming a topic of great importance worldwide, due to their intermittent nature of renewably sourced electricity. Among the electrochemical energy storage alternatives, redox flow batteries are well suited for large-scale energy storage, because of their perfect combination of flexible design, long cycle life, high reliability and low maintenance. This PhD project will design sustainable electrodes for flow batteries alternative to currently employed petrol-derived carbons. The new electrodes will be based on biomass-derived resources, and using electrospinning. Electrospinning is a very versatile technique that enables the fine control of the structural and compositional features of the materials produced. During the course of the project, suitable materials will be identified, prepared and characterized, in terms of their structure and electrochemical properties. For this, an extensive number of techniques available at QMUL will be used, including Raman spectroscopy, FTIR, TEM, SEM, XPS, BET, AFM, TGA and XRD. The new electrodes will be tested in real flow battery devices using multiple redox active species. Electrochemical techniques, including cyclic voltammetry, charge/discharge cycles, chronoamperometry, chronopotentiometry and electrochemical impedance spectroscopy will be conducted. New in situ and operando electrochemical cells will be designed to understand the structure-property relationships. This PhD project will produce a new generation of sustainable materials for flow batteries and will bring new understanding to the electronic mechanisms taking place at the interface electrode/electrolyte in these systems.

2. Project Scope

Three research project objectives

- *Synthesis and optimization of highly conducting freestanding electrode mats with controlled morphology, composition and structural features*
- *Structural characterization and testing of electrochemical properties to gain a deep understanding of the structure-property relationships in these materials*
- *Design of in situ and operando experiments that can help unravel the electrocatalytic mechanisms in the electrodes prepared*

3. Desired Skills from the Student

Key skills needed for the PhD project

The project would suit graduates from a chemistry or materials science background. Strong understanding of chemistry methods (synthesis and analysis). Motivated and driven.

4. Supervisory Team

Add supervisory team details

*Primary: (Name (inc title). **Dr Ana Jorge Sobrido***

*Secondary: (Name (inc title)/ department or company if outside SEMS). **Dr Patrick Cullen***

Additional: (Name (inc title)/ department or company if outside SEMS).