PhD topic in:

Synthesis of organic tailor-made macromolecular materials for solid organic battery

General context

Over the past few decades, the world has witnessed a revolution in energy storage development: Li-ion batteries. However, this rapid progress also comes with a major challenge in the context of sustainable development, namely compensating for the limited availability of mineral materials and the energy cost of their extraction from the earth's crust. Through this PhD Scholarship, we are seeking to promote the use of a new generation of organic materials in order to offer fewer impacting alternatives for energy storage. The potential of organic chemistry is immense, thanks to low energy costs and rich and versatile synthetic route that allow the creation of tailor-made organic materials.[1,2] Despite these advantages, organic materials do encounter some obstacles, such as their solubility in organic electrolytes and their low conductivity, necessitating respectively electrolyte engineering and the excessive use of carbon black.

Objective of the PhD project

Within the framework of this 3-year doctoral contract, the SPIDER project aims to explore the innovative use of tailor-made electroactive macromolecules as electrode materials for solid organic electrode and associated batteries. The objective of the thesis is to focus on new advanced macromolecular materials with controlled solubility and architecture. Project is divided in three interconnected tasks which are: Synthesis and spectroscopic characterization of electroactive macromolecules, Advanced characterization of organic-based materials and evaluation of electrochemical properties in battery configuration of synthesized compounds.

Skills of the applicant

For this ambitious and promising project, we are looking for a passionate, dynamic and motivated organic chemist to synthesize and characterize new macromolecular materials for organic batteries. As a consequence, very good experience in organic chemistry, multi-step synthesis and characterization of these materials (NMR, TG-DSC-MS, IR and X-ray diffraction) is mandatory. Prior experience in electrochemistry and in the characterization of polymers, supramolecular interactions, polymer electrolyte engineering, electrode formulation and cell assembly would be an advantage. An ability to communicate results clearly and concisely is preferred (French, English B2).

Contact information: sebastien.gottis@u-picardie.fr (LRCS) & matthieu.becuwe@u-picardie.fr (LRCS)
List of documents to provide: Detailed resume, motivation letter specific to this project, academic requirements for your master degree, markings of unit grade where available, names and contact details of 2 references persons (ideally from 2 different institutions).
Deadline for application Offer: open until end of June.
Date of start of the Project: October 1st 2024. The position is for 3 years
For more information about the hosting laboratory: https://www.lrcs.u-picardie.fr/

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[1] Sébastien Gottis *et al*, Voltage Gain in Lithiated Enolate-Based Organic Cathode Materials by Isomeric Effect, *ACS Appl. Mater. Interfaces* (**2014**), 6, 10870−10876

[2] Matthieu Becuwe *et al*, Toward Conductive Additive Free Organic Electrode for Lithium-Ion Battery Using Supramolecular Columnar Organization, *Small* (**2024**), 20, 2305701