



## PhD fellowship offer

### Synthesis of ferrocene derivatives as new electrolytes for energy storage (2023-2026)

**Location:** Teams COrint and MaCSE, Institut des Sciences Chimiques de Rennes, Campus de Beaulieu, 263 avenue du Général Leclerc, 35042 Rennes Cedex, France

**Doctoral school:** Matière, Molécules et Matériaux (S3M)

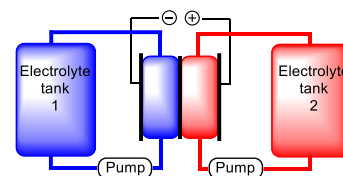
**Specialities:** Organic chemistry, Organometallic chemistry, Physical chemistry and electrochemistry

**Funding:** PEPR Batteries from ANR (2 135 €/month gross salary, revised each year)

**Keywords:** organometallic redox compounds, energy, storage, batteries

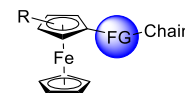
#### Project description

While the development of renewable energies is of main importance to address the current environmental challenges, they remain intermittent by nature, which implies the search of new energy storage conditions. Within this context, the use of aqueous redox flow batteries is especially promising, as it allows the storage of large amount of energy in electrolyte solutions which can be transformed back into electrical energy on demand in an electrochemical cell. However, while many redox active compounds soluble in water have already been studied, only a few of them can be used as polysolutes.



Since ferrocene discovery, derivatives of this organometallic compound have found applications in all areas of chemistry. This mainly results from their stability and reversible redox behaviour between a neutral and a cationic ferricenium species; properties fundamental for the development of ferrocene derivatives as electrolytes for energy storage, a research area still at its infancy.

This PhD fellowship project deals with the design and synthesis of new ferrocene derivatives meeting several criteria for an application as electrolytes in aqueous redox flow batteries. They will need to be soluble in aqueous solution, with stable neutral and oxidized forms, and with a redox potential compatible with the application. To reach such compounds, we will functionalise a ferrocene with some functional groups (FG - to adjust both the redox potential and the stability of the two species) having different chains (to favour the aqueous solubility). Polysubstituted derivatives will also be planned to finely tune the properties. Depending on the structures that will be designed, the development of synthetic methodologies in the ferrocene series will be studied. In addition to the synthetic work, an analytical part will deal with the evaluation of aqueous solubilities, of electrochemical properties and stabilities. The most promising compounds will be tested as polysolutes in aqueous redox flow batteries for concept validation.



#### Profil of the candidate

The PhD candidate needs to have a solid background in organic chemistry, in characterization techniques (NMR, IR, *etc.*) and have a Master 2 diploma. Knowledge in organometallic chemistry, as well as in electrochemistry, will be a plus but is not mandatory. However, interest for multidisciplinary projects is highly required.

The PhD will work at the Institut des Sciences Chimiques de Rennes, with all facilities to perform top quality researches, between the Organic Chemistry and Interfaces (COrint) and the Condensed Matter and Electroactive Systems (MaCSE).



Application deadline 12/07/2023

Document required

- CV, motivation letter and transcripts of marks for M1/M2 and/or ranking.
- Names and email of two contacts (for recommendations).

Contacts

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