



## PhD thesis

### Aqueous Redox-Targeting Redox Flow Batteries

In the context of the evolution of the energy mix towards a decrease in the share of fossil fuels, the development of new stationary energy storage systems is essential. Indeed, the intermittent and variable nature of renewable energy sources such as wind and photovoltaic power requires photovoltaic, requires storage. Redox-flow batteries, which allow for a decoupling of energy and power, are the perfect answer to this requirement. This technology has undeniable advantages over Li-Ion systems currently being developed for this type of application, particularly in terms of safety and recyclability.

However, the most mature and deployed Redox-Flow batteries (vanadium batteries, studied since the 1980s) remain expensive and limited in terms of stability and capacity. The project aims at developing a full circulation battery technology, based on the circulation of aqueous solutions (at near neutral pH) of redox mediators, in the presence of sodium insertion materials immobilized in the tanks. The use of these insertion materials will increase the energy density of these batteries, and thus potentially decrease their size. These materials will be free of any toxic or expensive metals. To carry out this work, we have built a multidisciplinary consortium (ANR Project NASTOR) that will make it possible to remove the technological barriers to the development of such innovative and efficient systems. In this context, we are looking for a motivated PhD student who will be in charge of the preparation and characterization of sodium insertion materials, their controlled incorporation into polymeric matrices and the development of a pilot battery. The candidate will have skills in materials science and electrochemistry with an interest in the development of experimental systems under flow.

**STARTING DATE:** Spring 2023 or at the latest in September 2023

#### CONTEXT/QUALIFICATIONS

The work will be located at the LRCS in Amiens with regular interactions and visits to the CERI-MP (Douai). The PhD student will be registered at the Doctoral School of UPJV (Amiens, France). PhD student will be part of the ANR consortium and scientifically exchange with the partners. The candidate must have a MASTER 2 or Engineer degree in chemistry, electrochemistry or materials sciences with high standard. Knowledge on energy storage, materials and polymer chemistry will be valuable. Excellent level of English, both written and spoken.

#### CONTACTS

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Dr. Cédric Samuel [cedric.samuel@imt-lille-douai.fr](mailto:cedric.samuel@imt-lille-douai.fr)

#### Selection process

The candidate should first contact anyone of the two contact persons above and provide (via e-mail):

- a detailed CV
- a motivation letter emphasizing the fit between the candidate's background and the proposed position
- the names and contact details of at least 2 reference persons

In parallel, the application will go through the CNRS employment website: <https://emploi.cnrs.fr/>

The candidate will be selected by a panel after interviews by between March and June 2023.