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Doctoral School: MEGeP
First year registration: 2017
Funding: ANR project VSL

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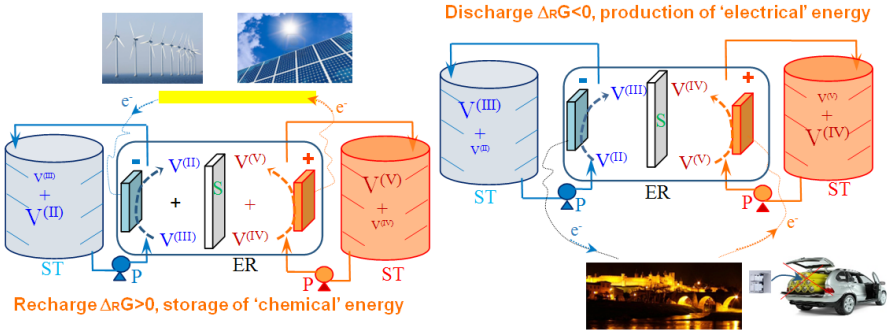
## REDOX FLOW BATTERIES OF AQUEOUS SOLID-LIQUID SUSPENSIONS FOR THE CONVERSION AND STORAGE OF RENEWABLE ENERGY

*Batteries à circulation de suspensions aqueuses solide-liquide pour la conversion et le stockage des énergies renouvelables*

This research subject focuses on the redox flow batteries which are devices that perform the electrochemical conversion of electric energy, from renewable sources, to chemical energy that will be stored. The reverse process aims to recover this stored energy in the form of electricity according to demand. The project is a part of the general tendency to reduce i) the usage of fossil fuels, ii) the emission of greenhouse gases such as $CO_2$ and iii) the production of pollutants (C particles, $NO_x$, …).

The first objective of the thesis is to optimize the formulation of the electroactive reactional mixtures (active species and supporting electrolyte concentrations) to increase the stored energy density. The first step consists i) in establishing electrochemical methods for the preparation, analysis and characterization of the anolyte and the catholyte in order to find their optimal composition and ii) on understanding the physico-chemical phenomena occurring during the charge-discharge cycling (dissolution/precipitation of the vanadium suspensions and their flow in the battery). This step of the study also includes measurements of conductivity, viscosity and flow rate as well as powder characterization techniques (SEM, Malvern-laser diffraction).

The second objective is to conceive and optimize a vanadium redox flow battery (laboratory scale) by intensifying the reactor, aiming to increase the power density. The studies will focus on the design of the reactor (geometry and shape of the heart of the electrolytic compartments), expecting to enhance mass and heat transfer and thus the conversion during a residence time of half a cycle. Mass and charge balances will be performed for charge/discharge operations under various conditions, expecting to establish correlations that will link the response of the system (current, voltage and reversibility), to the influencing operation parameters.




*Description of the structure and operating mode of a vanadium redox flow battery*