

Photo-assisted systems for Li-ion batteries based on coordination complexes

Laboratory : Laboratoire d'Electrochimie et de Physico-Chimie des Matériaux et des Interfaces

University : Université Grenoble Alpes

Planned recruitment date : 01/10/2022

Introduction - Soaring green and renewable stationary applications requires the development of a new generation of energy storage system generally relying on batteries. To date, lithium-ion batteries are the predominant technology but remain quite expensive for large scale application. In this context, designing a device acting as both a solar energy convertor and a battery represents a real solution and rewarding challenge. The underlying concept is to charge a battery at a significantly lower potential without any external power supply, *i.e.* the battery capacity is fully recovered for an amount of needed energy strongly reduced.

Aim - For this purpose, the thesis proposes to **combine photo-redox sensitizer with Li active material to obtain photo-rechargeable Li-ion battery**. Coordination complexes are materials of interest for such system thanks to their fast and reversible redox processes, tunable electrochemical potential, versatility and, depending on their structure and associated metal, their photo-activity. Moreover, to obtain an efficient photo-assisted battery, the photon absorption and trapping should be maximal within the wavelength range of incident light, such as sun light. In this sense, a transparent and eco-compatible thin film substrate is of high prospective materials owing to the control of its morphology and efficient UV photo-activity. The aim of this proof-of-concept is to highlight that, by taking the benefit of both the photo-induced oxidizing character of the coordination complex and photoactive substrate, it is possible to obtain a full photo-assisted Li-ion device.

Job description - This is a multidisciplinary project at the interface between **coordination chemistry, materials science, electrochemistry** and **photochemistry**. The project is divided in two main work packages: i) the synthesis and physico-chemical characterizations of both coordination complexes and substrates; ii) the investigation of the cathodic electrode by photochemistry in a battery system.

Candidate profile - The PhD student will be part of the MIEL (Matériaux Interfaces Electrochimie) team of **LEPMI** (Grenoble). He/she will also coordinate his/her work with the Nanoélectrochimie team from the laboratory **ITODYS** (Paris) to develop the coordination complexes. He/she should already have **some knowledges on coordination chemistry and electrochemistry**. Knowledge about **photochemistry** will be appreciate. He/she should be able to **work in a multidisciplinary group**. The candidate should be fluent in English. In addition, well-written English will be highly appreciated.

How to apply : Send a CV, motivation letter, references and transcripts (first and second year of Master) to laureline.lecarme@grenoble-inp.fr