PhD fellowship offer

Electrophotocatalysis and electrophotocoupling

Starting – Duration : October 2025 – 36 months
Location: Département de Chimie Moléculaire UMR CNRS 5250
301 rue de la Chimie, 38000 Grenoble, France
Contact : Cyrille Costentin (cyrille.costentin@univ-grenoble-alpes.fr) – EMPRE team
Frédérique Loiseau (frederique.loiseau@univ-grenoble-alpes.fr) – CIRE team

Working environment: The EMPRe team (https://dcm.univ-grenoble-alpes.fr/research/electrochimie-moleculaire-et-photochimie-redox), leading the project, conducts research in the field of molecular electrochemistry and redox photochemistry toward the understanding of bond activation triggered by electron transfer. The CIRE team (https://dcm.univ-grenoble-alpes.fr/research/chimie-inorganique-redox) is a partner of the project via its expertise in photophysics/photochemistry.

Project description : Electrochemistry is a convenient tool to initiate chemical reactions through electron transfer and for activation of bonds, making radical reactions with highly reactive species possible. However, activating inert substrates, such as aryl chlorides, remains challenging and often requires strong and hazardous reductants. Electrophotocatalysis (e-PC) has emerged as an innovative solution to overcome this difficulty. [1,2] This process involves electrochemically generating a species that absorbs visible light, reaching an excited state capable of reducing inert substrates. Despite its potential, the mechanisms of e-PC are still poorly understood and remain a topic of debate in the literature. This project aims to explore the reaction mechanisms of e-PC using an original methodology. This approach will be based on the use of cyclic voltammetry (CV) under irradiation, [3] enabling the identification of electron transfer steps and intermediate chemical processes. CV will be complemented by irradiated electrolyses and photophysical studies. By optimizing operational parameters (applied potential, light intensity, reagent concentration), the project seeks to enhance bond-forming reactions under mild conditions, particularly for C-C bonds between inert substrates via either electrophotocatalysis or electrophotocoupling processes. The addition of trapping agents to introduce functional groups onto substrates will also be considered. By developing these tools, this work could help rationalize electrochemically based synthesis processes, contributing to the electrification of chemical manufacturing.

Keywords : Electrophotocatalysis – Mechanism – Organic transformation

Profile: The candidate should hold a M.Sc. degree or equivalent in chemistry or physical-chemistry with interest for molecular electrochemistry/photochemistry, catalysis and mechanistic studies.

Funding: The project will be funded by the Labex Arcane (https://arcane.univ-grenoble-alpes.fr/). The candidate will be interviewed by a Labex jury on Tuesday May 13, 2025.

---

[1] M. C. Lamb; K. A. Steiniger, L. K. Trigoura; J. Wu; G. Kundu; H. Huang; T. H. Lambert *Chem. Rev.* **2024**, *124*, 12264.
[2] L. Grimaud; S. Lakhdar S.; M. Vitale. *Current Opinion in Electrochemistry* **2023**, *40*, 101307.
[3] C. Costentin; J. Fortage; M-N. Collomb. *J. Phys. Chem. Lett.* **2020**, *11*, 6097-6104