

# JOB POSTING

**Recruiting organisation:**

LEM Université Paris Cité

**Subproject title:**

Electrochemical detection and conversion of small molecules

**Starting date:**

1<sup>st</sup> September or 1<sup>st</sup> October 2023

**Salary:**

The Doctoral Network "MiEI" is financed by the European Union under the framework of the program HORIZON Europe, Marie Skłodowska-Curie Actions. The doctoral candidate will be hired for 36 months under contract by Université Paris Cité, with a monthly gross salary of approx. 3827 € (including mobility allowance, but excluding other allowances that depend on eligibility, e.g. family allowance, special needs allowance).

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**Background information:**

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Marie Skłodowska-Curie Doctoral Networks are joint research and training projects funded by the European Union. Funding is provided for doctoral candidates from both inside and outside Europe to carry out individual project work in a European country other than their own. The training network "MiEI" is made up of 10 partners, coordinated by Fraunhofer ICT in Germany. The network will recruit a total of 12 doctoral candidates for project work lasting for 36 months.

New industrial production strategies like "production on demand" and "Industry 4.0" are increasing the demand for new digital concepts for the chemical industry that are easily scalable and can work like a construction kit. In addition, the reduction of fossil fuel consumption requires novel synthesis concepts with on-demand capabilities paired with the use of electrical energy as a primary source for chemical processes.

MiEI will address this demand from the chemical industry, combining the advantages of electrochemistry, micro process engineering and flow chemistry. The recruited researchers will explore new models for electrodes and electrochemical flow cells, and develop innovative integrated prototype cells using printed circuit board (PCB) technology as a mass-scalable and flexible tool. These cutting-edge technologies will be applied to promising fine chemical and pharmaceutical synthetic routes, which will be further accompanied by techno-economic evaluation defining new business opportunities. The new MiEI technologies and processes will allow safe, flexible and sustainable synthetic routes for the chemical industry of the future.

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**Job description:**

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The advertised subproject is fully funded by the Marie Skłodowska-Curie European Training Network „MiEI“. It will be carried out by one doctoral candidate at LEM, Université Paris Cité (PhD supervision at LEM, Université Paris Cité) over a period of 36 months.

The activity of the Laboratoire d'Electrochimie Moléculaire UMR 7591 (LEM) at Université Paris Cité is centered on the study of chemical reactivity with electrochemistry as the main investigation tool. The research activities cover all aspects of chemical reactivity. Our research focuses particularly on the study of activation processes of small molecules (O<sub>2</sub>, CO<sub>2</sub>, N<sub>2</sub>) by metal complexes catalysts (Fe, Co, Ni, Mn) and the development supramolecular assemblies for electro-catalysis. Our ultimate goal is development of green electrosynthesis processes. We particularly emphasize the reactivity studies of the electrochemically generated complexes in catalytic reactions in homogeneous solution and at the liquid/solid interface. The recruited researcher will explore the topic of electrochemical detection and conversion of small molecules in aqueous and non-aqueous media.

In detail, two main cases will be studied: (i) The first is based on fundamental oxidation reactions to incorporate functional groups on an organic

backbone for oxygenation or halogenation reaction. We developed an original strategy for performing a mild oxidation reaction inspired by metalloenzyme using complementary synthetic, spectroscopic and electrochemical tools to reproduce their catalytic activities. Recently, we reported electrocatalytic oxygenation or chlorination of cyclooctene in solution in presence of metal-activated oxygen intermediates electrogenerated. The main objective of the recruited researcher will be to transfer these results to the liquid/solid interface with the catalyst complex grafted onto a conducting surface.

(ii) The second objective of this project focus on the new concept of electrochemical activation of halogen bonding (XB) for organocatalysis. It is well known that non-covalent interactions play central roles in supramolecular chemistry and in organocatalysis. At LEM, we have demonstrated the possibility to tune and control the strength of the weak interaction XB by electrochemically changing the oxidation state of the respective electroactive XB-donors or acceptors. The use of electrochemical methods to assist or to drive catalytic electron-transfer reactions can be a "green" alternative for the development of novel analytic and synthetic applications. Thus, the recruited researcher will focus his/her work on catalytic reactions (such as dehalogenation) with redox active catalyst capable of forming supramolecular complex in solution or at the interface liquid/solid.

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**Benefits:**

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The recruited researcher will have the opportunity to work as part of an international, interdisciplinary team of 12 doctoral candidates, based at universities and industrial firms throughout Europe. She/he will be supported by two mentors within the MiEI project, and will have multiple opportunities to participate in professional and personal development training. Through her/his work she/he will gain a unique skill-set comprising electrosynthesis, flow chemistry and process analytical technologies, as well as modern control engineering techniques.

She/he is expected to finish the project with a PhD thesis and to disseminate the results through patents (if applicable), publications in peer-reviewed journals and presentations at international conferences.

All employees at Université Paris Cité benefit from the university facilities (sport, culture...)

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**Requirements:**

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**Qualifications / experience:**

- In accordance with the European Union's funding rules for doctoral networks, applicants must NOT yet have a PhD
- Excellent Master's degree in chemistry or in chemical engineering with a focus on electrochemistry and/or organic chemistry
- Working knowledge in the field of electrochemistry is advantageous
- Laboratory experience in the design, organic synthesis and characterization of novel molecules (NMR, UV/vis, FT-IR, HPLC, GC etc.)
- Practical experience with modern synthetic methods in preparative organic chemistry, e.g. electrosynthesis, flow chemistry, microwaves etc., homogeneous catalysis and typical treatments (extraction, separation and purification via column chromatography, crystallization, lyophilisation)
- Strong interest in mechanistic understanding
- Familiarity with lab equipment, including chemical handling procedures as well as environmental, health and safety requirements
- Excellent communication skills and willingness to work in collaborative projects with multiple partners in the network.
- Ability to speak effectively in front of large groups (conferences, meetings, customers)
- Very good English language skills (French is beneficial)
- Self-motivation and the ability to achieve goals independently as well as to contribute effectively to the team



Doctoral network for microprocess  
engineering for electrosynthesis

***Mobility:***

The applicant must not have resided or carried out her/his main activity (work, studies etc.) in France for more than 12 months in the past 3 years.

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***How to apply:***

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Please send your CV by e-mail (preferred) or by post, quoting the reference 7DC-UPC  
[claire.fave@u-paris.fr](mailto:claire.fave@u-paris.fr)

Claire Fave  
Laboratoire d'Electrochimie Moléculaire UMR  
CNRS 7591  
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FRANCE

***Application deadline:*** 30th March 2023