University Paris Diderot

LABORATOIRE ELECTROCHIMIE MOLECULAIRE

Unité Mixte de Recherche 7591

POSTDOC POSITION

Molecular catalysis of the reduction of CO_2 with Fe(0) porphyrins. Developing an efficient and robust pilot electrolyzer for CO_2 splitting in neutral water using only earth abundant materials

Our group has been able in the past recent years to devise a family of compounds based on the most abundant metal (substituted tetraphenyl iron porphyrins) that are currently the most efficient and durable molecular catalysts for selective transformation of CO_2 into CO. Using the tools and methods of molecular electrochemistry, we have been able to decipher the mechanisms by which CO_2 is catalytically reduced in aprotic solvents and to devise new methods for rational benchmarking of catalysts. Recently, based on all these studies and discoveries we have set-up a small lab-scale electrolyzer for CO_2 splitting in neutral pH water.

Based on our latest generation of catalysts, we now intend to develop a pilot electrolyzer, with the objective of reaching a cell voltage lower than 2.5 V at current densities larger or close to 0.1 A cm^{-2}, over weeks of functioning. This project is developed in collaboration with Air Liquide (https://www.airliquide.com), in the framework of the recent international prize *Essential Molecules Challenge* that has been awarded to our group (https://www.airliquide.com/media/air-liquide-announces-winners-essential-molecules-challenge and https://www.youtube.com/watch?v=xyfVL9nScsk&feature=youtu.be).

Candidate profile:

The candidate must hold a doctoral degree in chemistry, physics, or material science. She/he should be a skilled experimentalist with experience in electrochemistry. Experience in fuel cells development would be appreciated. The position is for one year with possible extension for a second year.

Contact: Prof. Marc Robert (robert@univ-paris-diderot.fr) and Prof. Cyrille Costentin (cyrille@univ-paris-diderot.fr)

References

1. "Through-space charge interaction substituent effects in molecular catalysis leading to the design of the most efficient catalyst of CO_2-to-CO electrochemical conversion"
I. Azcarate, C. Costentin, M. Robert, J-M. Savéant, *J. Am. Chem. Soc.* **2016** DOI: 10.1021/jacs.6b07014

2. "Efficient electrolyser for CO_2 splitting in neutral water using earth abundant materials"
A. Tatin, C. Cominges, B. Kokoh, C. Costentin, M. Robert, J-M. Savéant,
Proc. Natl. Acad. Sci. USA **2016**, 113, 5526-5529.

3. "Current issues in molecular catalysis illustrated by iron porphyrins as catalysts of the CO_2-to-CO electrochemical conversion"
C. Costentin, M. Robert, J-M. Savéant, *Acc. Chem. Res.* **2015**, 48, 2996-3006.

4. "An efficient and selective molecular catalyst for the CO_2/CO electrochemical conversion in plain water"
C. Costentin, M. Robert, J-M. Savéant, A. Tatin, *Proc. Natl. Acad. Sci. USA* **2015**, 112, 6882-6886.

5. "Ultra-efficient homogeneous catalyst for the CO_2-to-CO electrochemical conversion"
C. Costentin, G. Passard, M. Robert, J-M. Savéant, *Proc. Natl. Acad. Sci., U.S.A.* **2014**, 111, 14990-14994.

6. "A local proton source enhances CO_2 reduction to CO by a molecular Fe catalyst"
C. Costentin, S. Drouet, M. Robert, J-M. Savéant, *Science* **2012**, *338*, 90-94.