

3 year PhD offer (Marseille)

Development of a new electrochemical cell and its use to study H₂-oxidizing enzymes

Keywords: Electrocatalysis; hydrogenases; fluid dynamics; mechanistic studies

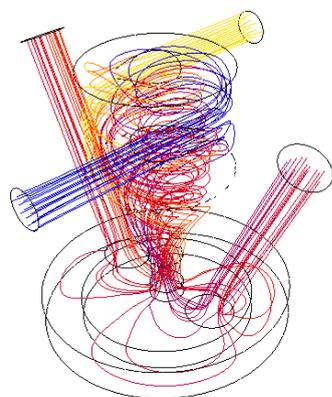
Description: This PhD offer aims to study hydrogenases, the enzymes that catalyze the reversible production of hydrogen:



They are very fast and energy efficient, although the molecular origins of this excellent catalytic performance are not fully understood.

One of the approaches to study the catalytic mechanism of hydrogenases is Protein Film Electrochemistry, in which an enzyme is immobilized on an electrode in a configuration where electron transfer is direct, and the current measured reflects the catalytic activity. One of the host teams is expert in this technique and has used it successfully to learn about many aspects of the chemistry of hydrogenases^[1], such as its reactivity with dioxygen^[2], an inhibitor, or insights about intramolecular electron transfer^[3].

In collaboration with specialists of fluid dynamics (in IUSTI, Marseille), the team has recently developed a new kind of electrochemical setup (figure) to study redox enzymes^[4], which allows great flexibility in terms of the experimental conditions: fine control over time of the concentrations in the electrochemical solution (substrate, inhibitors), and even possibilities of “pH jumps”, fast changes in pH that can bring substantial informations on the catalytic mechanism, and which are very hard to perform using other experimental approaches.



The aim of the PhD project is to finalize the development of this cell and use it to study several hydrogenases^[5,6]. This project will involve collaborations between a group of electrochemists and a group of biologists in the BIP as well as a group of physicists in the IUSTI.

Requirements:

Initial background in physics or chemistry or biology but with a strong motivation to work at the interface between the three.

Application:

Send a CV, transcript records and the contact of at least one former supervisor to vincent.fourmond@imm.cnrs.fr. Deadline: July 10th.

References:

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- [3] G. Caserta, C. Papini, A. Adamska-Venkatesh, L. Pecqueur, C. Sommer, E. Reijerse, W. Lubitz, C. Gauquelin, I. Meynial-Salles, D. Pramanik, V. Artero, M. Atta, M. Del Barrio, B. Faivre, V. Fourmond, C. Léger, M. Fontecave, *J. Am. Chem. Soc.* **2018**, *140*, 5516–5526.
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- [6] M. del Barrio, C. Guendon, A. Kpebe, C. Baffert, V. Fourmond, M. Brugna, C. Léger, *ACS Catalysis* **2019**, *9*, 4084–4088.