Ph.D position 2023-2026

Marseille, France

Electroenzymatic biosensor for H_2 detection

Laboratory: Bioenergetics and Protein Engineering (BIP), CNRS, Aix-Marseille University

Context : Within the current challenge of irreversible climate change, the search for CO_2-neutral energy sources and carriers is essential. Thanks to its transient storage and restitution during peaks of energy needs via fuel cells, hydrogen appears to be a sustainable solution. However, being a light and explosive gas, hydrogen represents significant risks when stored in large quantities. In addition, hydrogen is a colorless and odorless substance that makes it impossible to be detected by our human senses. The installation of reliable, sensitive and miniaturized sensors is therefore required to detect possible leaks.
In nature, hydrogenases are very efficient and selective enzymes for H_2 oxidation. We have shown in the lab that the membrane-bound Ni-Fe hydrogenase extracted from the bacterium *Aquifex aeolicus* has many of the essential characteristics to meet the requirements of an electrochemical H_2 sensor: thermostability, affinity for H_2, tolerance to O_2 and CO.

Job description : Capitalizing on our fundamental knowledge of hydrogenase-based electrodes, this Ph.D position will aim at overcoming three bottlenecks: the stability of the bioelectrodes, the increase in the linear range of response and detection limit, and the sensitivity to interferents. In particular, the Ph.D will focus on i) several types of bioelectrode conditioning (T°, buffer, stabilizing adducts, renewal of enzymes), ii) new conductive matrixes as enzyme platforms developing large specific surfaces and not limiting mass transport, iii) new electrode and sensor design and operating conditions to increase the performances of the biosensor. Beyond biosensor development, electrochemical techniques alone or coupled with surface analysis methods (e-QCM, e-SPR, confocal fluorescence e-microscopy) will make it possible to advance in the fundamental knowledge of the interactions between enzyme and electrodes.

Ph.D skills: The candidate should have a Masters' degree in chemistry, with major interest in analytical chemistry. Background/interest in electrochemistry, in 3D printing, and willing to work in a multidisciplinary environment and to learn biological approaches are highly welcome.

Applications: Candidates are invited to submit their CV, a motivation letter, copies of academic transcripts and degrees, and two recommendation letters by email to Elisabeth Lojou (lojou@imm.cnrs.fr). Dead line 15th April 2023.

[1]T. Kyrpel, V. Saska, A. de Poulpiquet, M. Luglia, A. Soric, M. Roger, O. Tananaiko, MT. Giudici-Orticoni, E. Lojou, I. Mazurenko, Biosensors and Bioelectronics, 2023, 225, 115106
[2]H-M Man, I. Mazurenko, H. Le Guenno, L. Bouffier, E. Lojou, A. de Poulpiquet, Anal. Chem, 94(2022)15604-15612
[3]X. Xiao, H Xia, R. wu, L. Bai, L. Yan, E. Magner, S. Cosnier, E. Lojou, Z. Zhu, A. Liu, Chemical Reviews 118 (2019) 9509-9558.

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