



Workshop

PARIS  
20 June  
2024  
9 am  
5:30 pm

Domaine de Recherche et d'Innovation Majeur



# Emerging Operando Strategies for the Electrochemical, Photochemical and Photoelectrochemical Conversion of Small Molecules



7<sup>th</sup> June 2024 : End of registration

<https://operando-strats-2024.sciencesconf.org>

Université Paris Cité - Amphi 1A Ernest Vilgrain - 16, rue Françoise Dolto - 75013 Paris

ESPCI  PARIS | PSL 

 Université  
Paris Cité

# Scope of the workshop

The workshop aims at gathering scientists working on **operando methods**, allowing for the characterization of (nano)materials activity towards the electrochemical, photochemical and photoelectrochemical activation of small molecules ( $H_2$ ,  $O_2$ ,  $N_2$ ,  $CO_2$ ,  $H_2O$ , ...) in the context of the **energy transition**. To name but a few, it includes in situ TEM, X-ray based, spectroscopy, optical and advanced electrochemical techniques. The paramount role of the **conversion of small molecules** in the energy transition has driven a lot of research in the past few years, and strong effort is being done to produce materials with enhanced performances and to decrease the need of unsustainable materials. Nevertheless, it is of crucial importance to get knowledge on the structure of the active sites, on the reaction mechanisms and on the degradation processes of these materials actually occurring in operating conditions, in order to improve their performances and stability by a rational design.

The recent improvements in temporal and spatial resolution, and fast data treatment allow for the emergence of operando multi-approach techniques that are becoming essential to establish structure-properties/activities relationships.

The workshop will be a unique opportunity to present an **overview of state-of-the-art operando techniques involved in such electrochemical, photochemical and photoelectrochemical processes** with their possibilities and limitations, as well as their future evolution. It will also present all the technical and scientific challenges that scientists are currently facing to explore these systems from **sub-nano to micrometer scale, and at various timescales**.



[www.dim-materre.fr](http://www.dim-materre.fr)

## Contacts @Université Paris Cité

Marion Giraud, Jean-Marc Noël  
*Laboratoire Itodys*

Jennifer Peron, Julien Bonin  
*Laboratoire d'Electrochimie Moléculaire*

9 am - 9:10 am **Introduction**

9:10 am - 9:35 am

*Exploring Electrocatalysis through Operando X-ray Absorption Spectroscopy*  
Andrea Zitolo, Synchrotron Soleil

9:35 am - 9:50 am

*Correlative multi-microscopies study of electrodeposited Pt nano-assemblies as precipitation platforms for Ni(OH)<sub>2</sub>*  
Nathaly Ortiz Peña, MPQ, Université Paris Cité

9:50 am - 10:05 am

*Operando XAS on Bio-Inspired Metal Oxides/Polymer for Electrocatalytic Water Oxidation*  
Sharlin Sharna, Synchrotron Soleil

10:05 am - 10:20 am

*Synchrotron-based in situ techniques for nanochemistry: from the synthesis to the electrocatalytic properties of nano-objects for water splitting*  
David Portehault, LCMCP, Sorbonne Université

10:20 am - 11 am **Break**

11 am - 11:15 am

*Utilizing In situ Raman Spectroscopy to Unravel the Mechanism of the Oxygen Evolution Reaction in NiFe-Layered Double Hydroxide*  
Smati Yakoub, LRS, Sorbonne Université

11:15 am - 11:30 am

*In-Situ Reflective Microscopy Insights into Hydrogen Permeation of Press Hardened Steels*  
Aleksi Makogon, ITODYS, Université Paris Cité

11:30 am - 11:45 am

*Coupled Scanning electrochemical and Fluorescence microscopies for analyzing plasmon driven chemistry*  
Vitor Brasiliense, PPSM, Université Paris-Saclay

11:45 am - 12 am

*Optical imaging of hydrogen storage at the single nanoparticle level*  
Jean-François Lemineur, ITODYS, Université Paris Cité

12 am - 2 pm **Lunch**

2 pm - 2:25 pm

*Operando FTIR Spectroscopy for Exploring reaction mechanisms in Photocatalysis*

Mohamad El-Roz, LCS, ENSICAEN

2:25 pm - 2:40 pm

*Design of ternary catalysts combining copper with p-block elements to control the electrochemical carbon monoxide reduction selectivity*

Carlos Inocêncio, LCMCP, Sorbonne Université

2:40 pm - 2:55 pm

*Time-resolved FTIR spectroscopy as a key operando technique to understand reaction mechanism. Focus on photo-reactions involving carbon monoxide*

Alberto Mezzetti, LRS, Sorbonne Université

2:55 pm - 3:10 pm

*Encapsulation of Polyoxometalates in MOF-545: A Strategy for Improving Photocatalytic CO<sub>2</sub> Reduction Activity*

Amanda Lyn Robinson, LCPB, Collège de France, UVSQ, Université Paris-Saclay

3:10 pm - 3:25 pm

*Zr-based Metal-Organic Frameworks loaded with highly dispersed small size Ni nanoparticles for CO<sub>2</sub> methanation*

Hongmei Chen, LCPB, Collège de France

3:25 pm - 4:05 pm **Break**

4:05 pm - 4:20 pm

*Operando infrared spectroelectrochemistry reveals the existence of Fe-CO intermediates during CO<sub>2</sub> reduction to CO catalyzed by an Fe porphyrin*

Aude Salamé, LEM, Université Paris Cité

4:20 pm - 4:35 pm

*Local pH evaluation in Urea Electro-Oxidation Reaction by Scanning Electrochemical Microscopy*

Maxime Decker, LISE, Sorbonne Université

4:35 pm - 4:50 pm

*H<sub>2</sub> carbon hydrogasification studied by <sup>59</sup>Co internal field NMR in near operando conditions*

Jean-Baptiste D'Espinoise de Lacaillerie, SIMM, ESPCI

4:50 pm - 5:05 pm

*ROCK quick-EXAFS beamline at SOLEIL: opportunities for operando characterization of photo-electro-catalysts*

Anthony Beauvois, Synchrotron Soleil

5:05 pm **Aperitif and poster**

*Metal-Organic Frameworks for Hydrogen Production through Light-driven Overall Water Splitting: XAS for Deeper Insights*, Edouard Vöggtli, IMAP, ESPCI