

Proposition de stage / Internship proposal

Date de la proposition : 04/10/2025

Responsable du stage / internship supervisor:	
Nom / name: Gamby Tél : 0170270670	Prénom/ first name : Jean Courriel / mail:jean.gamby@cnrs.fr
Nom du Laboratoire / laboratory name: Centre de Nanosciences et de Nanotechnologies (C2N)	
Etablissement / institution : CNRS /U Paris-Saclay Code d'identification : UMR9001	
Site Internet / web site: https://www.c2n.universite-paris-saclay.fr/en/	
Adresse / address: 10, boulevard Thomas Gobert, 91120 Palaiseau	
Lieu du stage / internship place: C2N Palaiseau	

Titre du stage / internship title: Development of nanofluidic devices for the study of memristive effects using electrochemical impedance spectroscopy

Résumé / summary

Nanofluidics is a prominent branch of nanotechnology that has garnered significant research interest over the past two decades across diverse fields such as biology, chemistry, physics, and engineering.^{1,2} This field focuses on the study and application of fluids and mass transport within nanometer-sized confined spaces, where intermolecular forces, along with long-range van der Waals and electrostatic interactions, play a dominant role. In these nanoscale environments, novel physical phenomena and unique characteristics emerge. One of the exciting developments in this domain is the nanofluidic memristor, which opens new possibilities for advanced neuromorphic computing by enhancing performance and reducing energy consumption in conventional computers, emulating the brain's parallel and energy-efficient processing.

Metal-Organic Frameworks (MOFs), a broad range of polymeric materials, have recently emerged as promising candidates for memristor development within nanofluidic channels.³ Their customizable pore sizes and surface charge characteristics make them ideal for further exploration in memristor technology. The goal of this project is to fabricate nanofluidic memristors using electrosynthesized MOFs within customizable nanofluidic channels. In collaboration with our partners, we aim to develop this MOF-based memristor within planar thick nanochannels, with future steps involving integration into a microfluidic device for neuromorphic computing applications.

Successful candidate will develop the following tasks:

- Perform the microfabrication steps in a cleanroom environment and validate the device performance.
- Electrosynthesize MOFs inside nanofluidic channels.
- Characterize the nanofluidic transport and memristive behaviour of the MOF-based nanofluidic devices.

Profile of the candidate

- Master's student (M2) in Physics, Chemical or Physical Engineering, Microfluidics or any relevant field.
 - Motivated to engage in cutting-edge interdisciplinary science involving micro/nanofluidics, electrochemistry, and physics.
 - Possesses scientific curiosity, critical thinking skills, and the willingness to collaborate with team members.
 - Complementary competences
 - Experience in MOF synthesis
 - Basic knowledge on electrochemistry
 - Micro and nanofabrication techniques: photolithography, PDMS molding,
- **Reference :** ¹ S. M Ngom, et al. *Electrochimica Acta*, **2021**, 374, 137930, 1-10. ² M. Giraud, et. al., *J Phys Chem A*, **2023**, 127, 33, 7012-7022. ³ Lu, J., et al., *Nature Materials*, **2020**. 19(7),767-774.

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : YES

Si oui, financement de thèse envisagé ou acquis / financial support for the PhD ?

Financement acquis / Secured funding		Nature du financement /Type of funding	
Financement demandé / Requested funding	YES	Nature du financement /Type of funding	ANR or Doctoral School ED EOBEP Paris-Saclay