Stage de master de physique / Physics Master Internship

Proposition de stage/ Internship proposal

Date de la proposition : 27/10/2022

Responsable du stage / *internship supervisor*:			
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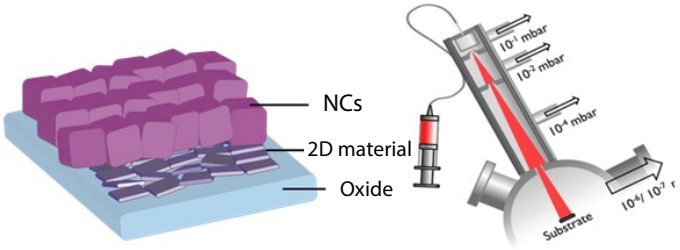
Nom du Laboratoire / *laboratory name*: INSP			
Code d'identification : UMR7588		Organisme : Sorbonne université, CNRS	
Site Internet / *web site*: https://w3.insp.upmc.fr			
Adresse / *address:* 4 place Jussieu, 75005 Paris, France			
Lieu du stage / *internship place*: Paris			

Titre du stage / *internship title*: **Optimizing *in-situ* deposition of Perovskite nanocrystals for solar cell applications**

Résumé / *summary*

Defect tolerant nanocrystals (NCs) representing lead halide perovskite lattice (PeNCs) have recently been demonstrated to display remarkable photoluminescence (PL) efficiency [1]. Owing to their exceptional optical properties, PeNCs are promising candidates as absorber layer for highly efficient photovoltaic devices [2].

Solar cells are produced by stacking different functional layers, to absorb photons and to maximize the extraction and separation of positive and negative charges. In such stack, the resulting power conversion efficiency depends not only on the light harvesting material alone but also on the ability of the transport layers to extract charges effectively, this process being highly dependent on the quality of the interface between the different materials.



A prototypical stack for a photovoltaic device with PeNC absorber layer, 2D material charge transport layer and oxide substrate, to the right a schematic view of the spray deposition system

To stabilize the PeNC during synthesis, ligands, consisting of long carbon molecules, are used to stabilize the structure. However, when deposited as a film the long carbon molecules leads to poor conductivity both between the NCs, and to the transport layers. Making it necessary to exchange them for shorter molecules to improve conductivity, a process normally performed by dipping the PeNC film in ionic solutions. We now want to move to a in vacuum exchange technique.

The goal of the project is to develop a process for in vacuum ligand exchange using *in-situ* spray deposition, a technique currently used at the institute. The student will be responsible for the development of the ligand exchange scheme and the characterization of both the exchange- and film quality using techniques such as, transport measurement, X-ray diffraction (XRD), Rutherford backscattering spectrometry (RBS) and photoelectron spectroscopy.

As the research team is multinational, the applicant must speak English.

[1] *Nano Lett.* 2015, **15**, 3692–3696 https://doi.org/10.1021/nl5048779
[2] *Science,* 2016, **354**, 6308 DOI: 10.1126/science.aag270

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : No**

Si oui, financement de thèse envisagé/ *financial support for the PhD***:**