Internship offered in M2
2017-2018

Responsible for internship

Name: Nadine Witkowski

Location:
4 place Jussieu, 75005 Paris
Tour… étage

Group: Surface et dynamique des surfaces

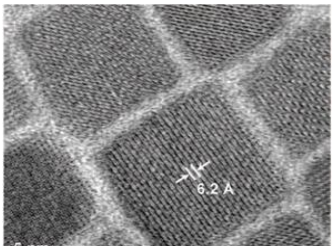
E-mail: nadine.witkowski@upmc.fr

Tel: +33 (0)1 44 27 4342

Group website: https://fr.linkedin.com/in/nadine-witkowski-a4a10797

Internship topic:

Perovskite nanocrystals for hybrid photovoltaics : proof of concept



CsPbI3Nanocrystal by TEM [1]

The objective of the 6 months internship is to demonstrate the feasibility for a lifelong and stable hybrid solar cell module based on inorganic perovskite nanocrystals that will bring a breakdown in this emerging technology.
Hybrid organic-inorganic halide perovskite is offering a very promising alternative to the silicon-based solar cells modules, reaching more than 22% of power conversion. Unfortunately, the modules suffer from severe drawbacks that hinder their large scale production : they degrade after few hours of operation. To extend the lifetime of the module, inorganic perovskite nanocrystals produced using chemical protocol with colloids have been demonstrated for the stabilization of high-efficiency photovoltaics [1]. These perovskite nanocrystals of CsPbI3 present a structural phase that is defect-tolerant allowing for an increased stability up to months under air conditions.

During the internship, the intern will have to prepare the colloid nanocrystals under the supervision of Sandrine Ithurria Lhuillier at ESPCI together with the optical properties (absorbance/photoluminescence). The student will then have to conduct experiments to characterize the structure by transmission electron microscopy and X-ray diffraction, the transport properties by electrical properties, the energy band alignment (HOMO level and work function) and the chemical composition by photoemission. The perovskite nanocrystals will be then integrated in a hybrid heterojunction solar cell made of anode/hole carrier/perovskite nanocrystal/electron carrier/cathode materials whose electronic levels are adapted to the ones of the nanocrystals. Test of power conversion will finally be conducted in collaboration with engineers in Denmark on the test module to demonstrate the proof of concept of long lifetime

hybrid solar cells.

[1] Swarnkar, A.; et al. Quantum Dot–Induced Phase Stabilization of α-CsPbI3 Perovskite for High-Efficiency Photovoltaics. Science 2016, 354, 92-95.
[2] Transport and GHz phototransport reaching recombination limited dynamics in CsPbX3 nanocrystal arrays, W. J. Mir, et al. submitted (2017).

Techniques involved: colloid chemistry, TEM, X-ray diffraction, optical spectroscopies, photoemission, transport

Type of internship: experimental
Paid internship: Yes
Can this internship be continued for a PhD? Yes
If yes, type of PhD funding envisaged is: funding through ED397

Unité mixte de recherche 7588 – CNRS / Université Pierre et Marie Curie
Campus Jussieu – Tours 22 et 23 – Case courrier 840
4 place Jussieu – 75252 Paris Cedex 5 – France
Tél. : +33 (0)1 44 27 63 72 – Fax : +33 (0)1 44 27 46 09 – www.insp.upmc.fr