Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 27 décembre 2016

Responsable du stage / *internship supervisor*:

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Nom du Laboratoire / *laboratory name*: Centre de Nanosciences et de Nanotechnologies

Code d'identification : UMR 9001 Organisme : CNRS / Université Paris Sud

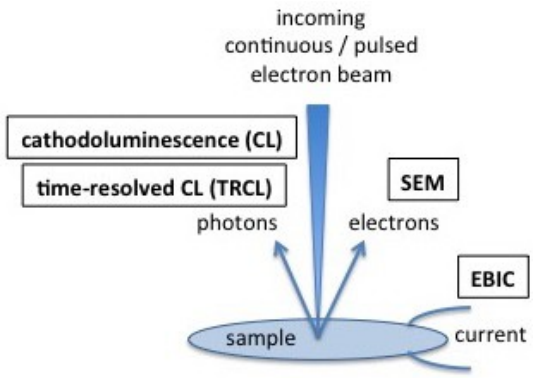
Site Internet / *web site*: http://www.c2n.universite-paris-saclay.fr

Adresse / *address:* Route de Nozay, 91460 Marcoussis

Lieu du stage / *internship place*: Route de Nozay, 91460 Marcoussis

Titre du stage / *internship title*: **Time-resolved cathodoluminescence: nanoscale characterization of photovoltaic materials**

A new cathodoluminescence (CL) setup has been installed at C2N/Marcoussis at the end of 2015. Its basic principle is the following (see the figure): a material is excited with an electron beam in a scanning electron microscope (SEM), providing a spatial resolution of 10nm. Secondary electrons (SE), emitted photons (CL) and even electron-beam-induced current (EBIC) are collected and recorded simultaneously in order to form 2D maps. For each spatial position, CL spectra provide information on the luminescence efficiency, band structure and defects. In our tool, laser-controlled bunches of electrons can also be used for excitation instead of a continuous beam, resulting in time-resolved CL measurements (TRCL) that provide valuable information on carrier dynamics and lifetime.



Our CL/TRCL setup has state-of-the-art specifications and is extremely versatile: wide ranges of wavelengths (200nm-1600nm) and temperatures (10K-400K), time-resolved measurements (temporal resolution 10ps). In addition, its very high collection efficiency on a wide field of view is perfectly adapted to CL and TRCL mapping of a wide variety of photovoltaic materials: defects and quantum structures (quantum wells, quantum dots,…) in bulk materials, polycrystalline semiconductors (CdTe, CIGS,…), nanomaterials (nanowires, nanopillars,…),...

Passivation is becoming a key for high-efficiency photovoltaics and nanostructured solar cells. However, the development of novel passivation solutions is hindered by the lack of direct characterization techniques. The goal of this internship is to investigate the passivation efficiency of semiconductor surfaces with TRCL/CL/EBIC measurements, in the framework of internal and collaborative projects. TRCL/CL/EBIC mapping should bring fruitful insights to asset the efficiency of various passivation techniques.

The candidate will be first trained on the CL/TRCL tool. Its first task will be to develop the methodology for the characterization of passivation layers using well-known GaAs reference samples. She/he will be involved in the preparation of samples in clean room. Next, she/he will apply this technique to the passivation of novel solar cell architectures (GaAs nanowire solar cells, nanotextured and ultrathin CIGS solar cells, localized ohmic contacts,…). In this context, she/he will work with several people in the team and she/he will be involved in internal and collaborative projects, in close collaboration with several partner labs of the new "*Institut photovoltaïque d'Ile-de-France*" (IPVF). We plan to offer opportunities for a PhD grant on CL/TRCL characterization of photovoltaic nanomaterials.

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

Si oui, financement de thèse envisagé/ *financial support for the PhD***: ANR/U. PSud**

Lumière, Matière, Interactions	**OUI**	Lasers, Optique, Matière	**OUI**