PHD SCHOLARSHIP – UNIVERSITY OF BORDEAUX

PRINTED BY-PASS DIODES FOR ORGANIC SOLAR CELLS MODULES

In order to reduce both the energy needed for the fabrication and the amount of waste at the end of life of photovoltaic (PV) modules, a new generation of lightweight and flexible PV is emerging. Fully printed PV modules are then expected to strongly reduce the energetic footprint because they combine low temperature manufacturing process and abundant and lightweight materials. Nevertheless, strong research efforts are needed for eco-responsible building blocks to make the next generation of lightweight and flexible PV modules a reality. The main challenge consists in the printing of the module itself including the protection of the module against partial shadow will require by-pass diodes in parallel of each cell of the module in order to prevent the drastic drop of the efficiency of the full module and hot spots that can dramatically damage the module. To date, no example of integrated by-pass diodes has been demonstrated in printed solar modules. Typically, the maximum current density that can flow across the by-pass diode is in the range of few A/cm^2. This current density is clearly too high for organic semiconductors that have limited stability against high current density.

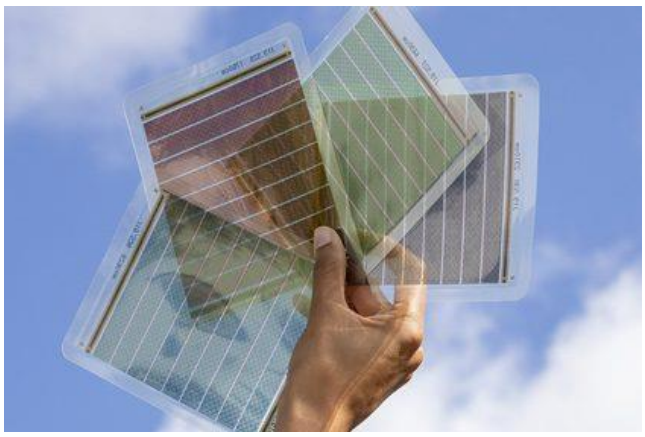

Figure 1: example of printed OPV (source ASCA)

- The first part of the thesis will consist in the electrical design of a typical OPV/perosvikte module in order to obtain a global PV module model and then the electrical potential constraints on by-pass diode (LAAS).
- The second part of the thesis will be the selection of the materials to prepare efficient diodes with the required electrical characteristics defined by the modelling of the expected printed modules.
- The third part will consist in fabrication and characterization of optimized printed by-pass diodes compatible with the printed connectors.

The PhD student will be involved in a national project on emerging solar technologies. The fabrication and electrical characterization of printed bypass diodes will be made at IMS and electrical and thermal modelling will be made at LAAS as well as the thermal characterization. IMS has a strong expertise in printed electronics and more specifically in OPV. IMS has all the technological platform to prepare and characterize both the materials and the diodes. All the details can be found in the website: https://oembordeaux.cnrs.fr. LAAS has a strong expertise on diode by-pass impact on standard silicon modules. LAAS has the electrical engineering expertise developed on the ADREAM platform (www.laas.fr/public/en/adream) dedicated on PV studies and characterizations.

Candidate's Profile:
For this study, an electrical engineer or material scientist is expected. Strong knowledge in the physics of the semi-conductor is mandatory. Good experimental skills are also required.

Starting date:
PhD position is opened for September/October 2023.

Scholarship:
1 750 €/month (neto)

Localisation and Supervision:
The PhD student will be mainly located in the « Laboratoire de l'Intégration du Matériau au Système (IMS – CNRS UMR 5218) », in Bordeaux, France. He/She will be working in the ELORGA team. This project will be developed under the supervision of Dr. Lionel Hirsch (IMS) and Pr. Corinne Alonso (LAAS)

Application:
Applications have to be sent by mail at: Dr. Lionel HIRSCH (Research Director at CNRS - lionel.hirsch@ims-bordeaux.fr) and Pr. Corinne Alonso - alonsoc@laas.fr.

The application will include a complete CV, a motivation letter, transcripts of Master 1 and 2, references and 2 recommendation letters.