M2 Master Thesis Project:

Three terminal tandem Heterojunction on interdigitated back contacts Silicon Solar cell

Keywords: Photovoltaics, solar cell, clean room technology
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Duration: 6 months in 2021 (starting in March or late February)
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Subject

To increase solar cell efficiency above 30% one solution is to couple a silicon solar cell with another semiconductor having a larger bandgap. This is called a *tandem solar cell*. Currently, silicon based tandem technology follows two paths: the monolithic two terminals tandem (2TT) where the top and the bottom sub-cells are electrically and optically connected, and the four terminals tandem (4TT) where the two sub-cells are electrically independent. However, the 2TT architecture needs to manage the photocurrent matching and the electronic coupling between the top and the bottom sub-cells, while the 4TT device has to deal with issues related to the buried contacts shadowing and access. The THESIS project aims at developing an *original 3 terminals tandem solar cell (3TT)* (Figure 1).

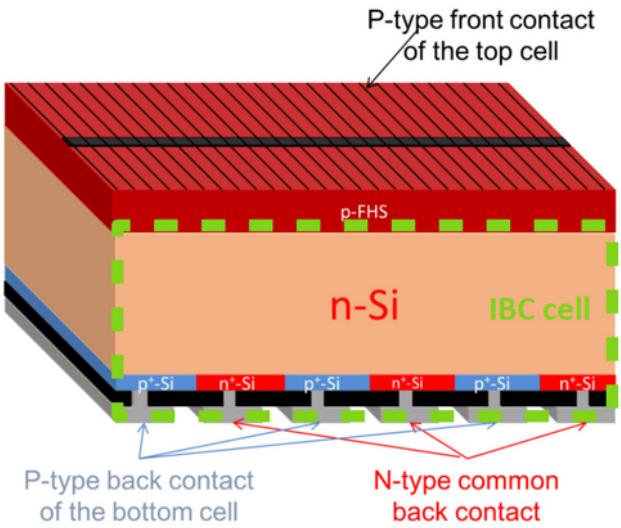

Figure 1: 3 terminals tandem heterojunction p-FHS/n-Si solar cell, featuring an IBC solar cell on the back-side.

This new 3-terminals tandem cell technology is made possible in an innovative and simple way by using a *silicon PV cell with interdigitated back contacts* (IBC) on the rear as a bottom sub-cell. A larger bandgap semiconductor is deposited on the top of the c-Si surface with a selective band offset barrier at the interface in order to form a front heterojunction stack (FHS) realizing a top heterojunction sub-cell.
In the frame of this project, the photovoltaic group (i-Lum team, INL) is in charge of the realization and the optimization of the silicon IBC solar cells (Figure 2).

The THESIS project is funded by *Agence Nationale de la Recherche (ANR),* and the description can be found online.

Role of the M2 student to be recruited

The master student will take part in the development and optimization of the fabrication of the silicon IBC solar cell. Every fabrication steps will be carried out in the clean-room facilities and equipment of INL (Nanolyon).
He/She will use standard equipment usually involved in micro-technology, such as lithography, thin layer deposition, etc. He/She will also have access to all the equipment related to solar cell characterization: I(V) measurement, quantum efficiency analysis, etc. Some simulation may be of interest depending on the project progression.
The master student will work with the permanent teacher/researchers involved in this project, and in particular with a research engineer specially recruited for this project.

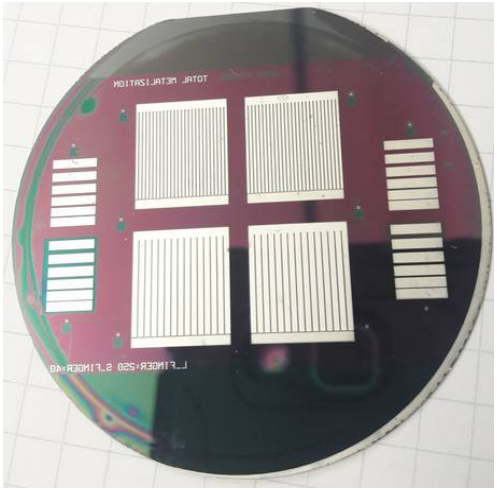

Figure 2: Silicon IBC solar cell on 2 inches wafer (back side)

Candidate profile

Candidates are expected to have a background in Micro/nano componants and technologies. Physics of semiconductors knowledge is mandatory, and silicon solar cells knowledge would be appreciated. **A strong motivation for experimental work is necessary**.