Master Thesis Project

Nm-Scale Characterization of the Electrical Properties of *p-n* Junctions by Transmission Electron Microscopy

General Scope: Semiconductor *p-n* junctions serve as fundamental building blocks in devices like solar cells, avalanche photodetectors or light emitting diodes. Nonetheless, the visualization of electrically active doping levels in semiconducting materials with nanometer precision remains a formidable challenge, particularly in wide bandgap materials characterized by high dopant activation energies..

Internship Objective: This internship aims to make a significant contribution to the investigation of p-n junction semiconducting materials, focusing specifically on their electrical properties at the nanometer scale. The selected student will become an integral part of a multi-institutional, interdisciplinary research team. Their primary responsibility will involve the fabrication of electrical contacts for p-n junction nanowires and thin films composed of various materials, including GaN and AlN. These p-n junctions will be electrically connected to membrane chips that are compatible with transmission electron microscopy (TEM) measurements. Additionally, the student will be responsible for conducting initial electrical characterization. By combining *in-situ* biasing techniques with 4D scanning TEM (4D-STEM) methods sensitive to electric fields, our goal is to achieve a precise quantitative description of the electrical properties of these objects at the nanometer scale.

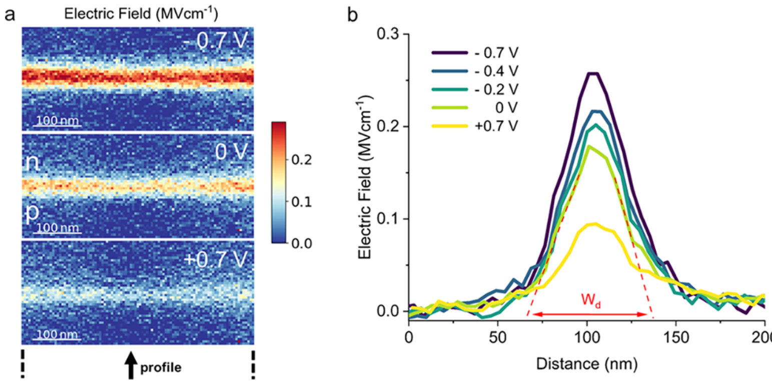

Figure 1. (a) 4D-STEM electric field maps of a silicon p–n junction. (b) Profiles of the electric field obtained from the maps in (a) by integration along the entire map. The measured depletion length for zero bias is indicated. [https://doi.org/10.1021/acs.nanolett.2c03684]

The student's work will involve:

- Nanowire contacting in a cleanroom environment. It implies nanowire dispersion, mapping using scanning electron microscopy, and assisting electron beam lithography.
- Current-voltage measurements to assess the electrical properties and performance
- The student will participate in the 4D-STEM characterization in a cutting-edge microscope.

Required skills: Interest in solid-state physics, electrical and optical properties of semiconductors and advanced characterization techniques like transmission electron microscopy.

Starting date: Jan/Feb/Mar 2023

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APPLY NOW!

To apply for this position, send your application (including CV) by e-mail to: eva.monroy@cea.fr

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