- Axe de GANEX : Axe 5: Capteurs, MEMS
- Titre du sujet : **Gas sensor based on GaN/Oxide nanowires**
- Nom et e-mail du porteur du projet : N. Gogneau, noelle.gogneau@lpn.cnrs.fr
- Date souhaitée de démarrage : Winter/Spring 2017
- Durée du stage : 5 months
- Lien avec un projet ANR ou H2020 : no
- Lien avec un autre partenaire de GANEX : PE 5.51 Des nanofils cœur/coquille GaN/Ga2O3 à la détection de gaz
- Sujet développé :

The development of autonomous sensor devices allowing accurate monitoring and controlling simultaneously and in real time the harmful Green House Gases (GHGs) is of the utmost importance in areas as diverse as monitoring industrial processes or personnel tracking using smart objects. Such devices must be reliable, responsive, highly sensitive, miniaturized and low cost. Furthermore, they must be capable to operate on a large temperature range (smart objects), from ambient temperature to high temperature (up to 600°C for industrial combustion processes).

The project aims to **fabricate and test a first CO-specific sensor integrating core/shell GaN/Ga_2O_3 nanowires** as the active material. The interest of NW form to develop gas sensors is well established, with their higher sensitivity, higher response and superior special resolution in comparison with thin films, due to their high aspect-ratio and dimensions compatible with the size of sensed species. The choice of Ga_2O_3-shell is motivated by the efficient detection of CO and their high stability to operate at high temperature.

Through our exploratory project funded by GANEX in 2016, we have demonstrated the synthesis of core/shell GaN/Ga2O3 NWs, by post-oxidation of GaN-core NWs grown by plasma-assisted MBE. Following this fabrication process, the Ga_2O_3-shell presents an epitaxial relationship with the facets of the GaN NW-core. This first result opens the way towards the fabrication of a first **CO-specific sensor prototype integrating core/shell GaN/Ga_2O_3 nanowires** as the active material.

This exploratory project is part of a collaboration between the C2N and the UMI CINTRA of Singapore on the detection of combustion gases from nitride nanowires and is based on the complementary expertise of the two laboratories. C2N has expertise in the growth and characterization of III-N NFs by catalyst-free Plasma Assisted Molecular Beam Epitaxy (PA-MBE), as well as in nanofabrication of devices based on either single nanowires or on nanowire ensembles. CINTRA, for its part, has a very strong expertise in simulation, design, manufacture and characterization of gas sensors.

The Master 2 student will focus his/her work on the following point:

1- He/She will participate to the fabrication of core/shell GaN/Ga2O3 NWs with a nanometer scale control of the oxide shell thickness (30 % of the time).
2- He/She will be actively involved in both the gas sensor fabrication and testing (70% of the time). Field Effect Transistors-like (FET-like) in-plane configuration will be developed at C2N. The detection characteristics of the device will be measured electrically in a dedicated station where atmospheric conditions can be precisely controlled. The device characterization will be performed at CINTRA, Singapore, where the student could be localized for few weeks at the end of its training period.

The Master 2 candidate will present good background knowledge in material sciences. He/She will also present a strong interest for experimental work. A first experience abroad will be a plus for this internship based in two countries.