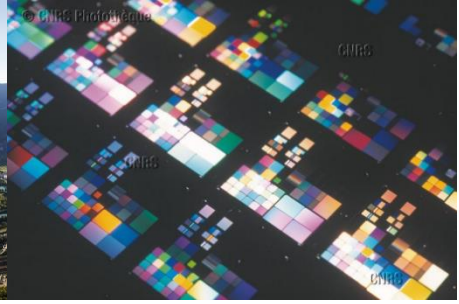


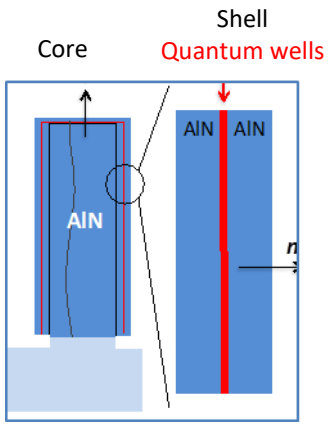
Master 2 project offer

Plasma etching processes for the fabrication of UV Nanosources.

Key words: plasma etching process, Material characterization (SEM, AFM, XPS, ellipsometry), III-N Semiconductors(AlN, GaN), nanowires, UV Light electroluminescence diode (LED)

Context :

UV light-emitting diodes (LEDs) are gradually replacing traditional mercury lamps thanks to their very low consumption, long life and compactness. Today, these UV LEDs are made from III-N nitride semiconductors (GaN, AlN and InN) grown by thin-film epitaxy to make quantum wells or dots that emit strongly. Unfortunately, UV LEDs based on $Al_xGa_{1-x}N$ have internal quantum efficiencies much lower than those obtained for blue LEDs based on GaN (less than 40% compared to 80% for blue LEDs). The low quantum efficiency values of AlGaN wells are partly related to the high dislocation density of the AlN or AlGaN layer on sapphire which is used for the growth of AlGaN wells. An alternative solution to overcome the harmful impact of dislocations would be to replace the planar technology used to manufacture these LEDs by an approach based on 3D nanostructures, i.e. AlN and/or GaN nanowires on which the quantum wells would be grown radially. This core-shell nanostructure approach offers the prospect of a better structural quality for the quantum wells and thus an increase of the internal quantum efficiency and a better light extraction than planar technology.



Core/shell architecture for UV LED fabrication

Objective :

In this context, the objective of the Master's internship is to meet the first technological need in the fabrication of these UV nanosources: the patterning of AlN and GaN wires with a diameter of less than 200nm and a length of 3-4µm using plasma etching technology. The challenges related to the process is the capability to achieve high aspect ratio nanowires without damaging the sidewalls. These developments will be carried out on the LTM/CNRS inductive source industrial etching reactors (ICP) located in the CEA/LETI clean rooms. Characterization techniques such as ellipsometry, X-ray spectrometry (XPS) and electron microscopy (SEM) will be used to assist the process development. This work will be carried out within the "Plasma etching process" team of the LTM in collaboration with the PHELIQS laboratory of the Fundamental Research Department (DRF) of the CEA. The nanowires thus obtained by the LTM will be exploited by PHELIQS which will study the growth of active structures in AlGaN by MOCVD to realize UV nanosources.

Laboratory:
Laboratoire des Technologies de la Microélectronique (LTM/CNRS)
17 avenue des martyrs
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- ✓ **Education: M2**
- ✓ **Duartion: 6 mois**
- ✓ **Beginning: mars 2021**

APPLY

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