Project 6.2 Nitrogen-polar GaN-based light emitters

Supervisor: dr hab. Henryk Turski, prof IWC PAN
Institute: Institute of High Pressure Physics PAS
Unit: Molecular beam epitaxy laboratory (NL-14)
www: http://www.unipress.waw.pl/mbe/en

Background:

A key feature that distinguish III-nitrides from other materials is their wide bandgap tunability enabling light emitting diodes (LEDs) and laser diodes (LDs) that emit light across the spectral range from deep ultraviolet (UV) to infrared. Wide application of nitrides in everyday life, especially in light emitting diodes (LEDs), can give an impression that "everything" is already known about nitride emitters. However, in fact the situation is different. Despite unquestionable success of nitride LDs, none of the structures were ever obtained on N-polar GaN substrates. Furthermore, achievement of a LD is often regarded as an irrefutable evidence of high optical quality of obtained material and maturity of the growth method. In this project we will explore completely new areas of nitrides growth on N-polar GaN to present such a device for the first time.

Institute of High Pressure Physics Polish Academy of Sciences possesses experience in various epitaxial processing techniques of gallium nitride. This project will be conducted in plasma-assisted molecular beam epitaxy (PAMBE) laboratory. Our laboratory has long traditions in nitride LD epitaxy and achieved the first PAMBE-grown LD in the world in 2004. Over the next years we made a significant progress by improving lasing parameters, expanding accessible wavelengths spanning from UV into green and performing epitaxy on semi-polar GaN substrates what proves versatile capabilities of our technique.

Aim:

To understand and exploit advantages of the growth of III-nitrides on N-face. We will investigate the origin of low luminescence efficiency of N-face nitride emitters and use recently defined growth window to limit the amount of incorporated point defects and present improved optical quality of N-polar structures. Combining improved active region with p-n junction to obtain efficient light emitters on N-polar GaN. Within the project N-polar grown laser diode will be presented.

Requirements:

- MSc degree in Physics, nanotechnology, material science engineering or similar,
- good knowledge of basic physics of semiconductors,
- basic programing and data processing skills,
- good command of spoken and written English,
- good organization of work and ability to work in a team.