

Project 6.2 Nitride photonic structures fabricated using selective ion implantation and electrochemical etching

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Background:

A particular type of GaN-based lasers emitting in the visible range of 380-530 nm are distributed feedback laser diodes (DFB LDs). They are characterized by a single-mode emission spectrum. Stable operation and high side-mode suppression are required for applications such as: high-speed short-range communication based on plastic optical fibers, precise time measurements by atomic clocks or advanced sensors based on interferometry. Nitride DFB lasers are not yet available on the market due to serious material limitations of (In,Al,Ga)N alloys, namely: low refractive index contrast and high lattice mismatch. So far, the concepts of producing this type of devices involved electron beam lithography in order to create a diffraction grating on the surface of a laser mesa. The project will experimentally verify a new approach to the technology of GaN-based DFB lasers, where the diffraction grating will be buried inside the structure to ensure its high coupling with the optical mode. The periodic air/GaN channels will be fabricated using a combination of electron beam lithography, ion implantation and electrochemical etching techniques. Lateral etching will enable integration of the diffraction grating with the structure of the blue laser produced by the PAMBE method.

Aim:

The aim of the project is to verify the concept of obtaining photonic structures buried inside the nitride structure and to characterize them. The final result of the project is the DFB laser structure grown by plasma-assisted molecular beam epitaxy (PAMBE), in which the diffraction grating is buried inside the structure, below the active area.

Requirements:

- The candidate must have completed higher education (MA) in the field of: physics, materials science and engineering, electronics or similar or provide the date of the planned defense (before 01/10/2021);
- knowledge of the English language;
- motivation and willingness to work, good organization skills and self-discipline;
- knowledge of the properties of nitride materials and work experience in clean-room laboratory will be an asset