Contribution to the fabrication of an electron-pumped UV laser

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PhD may follow: Yes

Summary :

During the internship, the student will contribute to the design of the active region of a semiconductor laser structure emitting at 350 nm. He/she will participate to the growth of test structures containing quantum wells and quantum dots as active media. He will characterize the structure by x-ray diffraction, photoluminescence and cathodoluminescence. In view of the results in terms of internal quantum efficiency and linewidth, a decision will be made on the optimum structure for the fabrication of optimized laser structures.

Full description :

There is a strong demand for deep-UV lasers for applications such as Lidar remote detection, non-line-of sight communication, chem-bio sensing, 3D printing, etc. This spectral range is currently covered by gas lasers or lasers based on frequency conversion, which are bulky, inefficient, and inflexible in wavelength. Laser diodes should provide an alternative solution, but their implementation is held back by the difficulties to fabricate highly-conductive p-AlGaN cladding layers. In this project, we will develop a new compact UV-laser technology based on the excitation of AlGaN nanostructures by a highly energetic electron beam from a carbon nanotube cathode. We target Peltier-cooled quasi-continuous-wave devices at 350 nm and 265 nm, with an average output power > 50 mW. The choice of wavelengths aims at a direct comparison with the Nd-YAG technology.

During the internship, the student will contribute to the design of the active region of the laser structure emitting at 350 nm, from the electronic and optical viewpoints. He/she will participate to the growth of test structures containing quantum wells and quantum dots as active media. He will characterize the structure by x-ray diffraction, photoluminescence and cathodoluminescence. In view of the results in terms of internal quantum efficiency and linewidth, a decision will be made on the optimum structure for the fabrication of the laser.

The strudent will be trained in molecular beam epitaxy, photoluminescence, cathodoluminescence, x-ray diffraction, and modelling using nextnano and comsol.

Requested skills :

Knowledge of semiconductor physics. Taste for experimental work on optoelectronics.