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Center of Excellence Physics and Technology of Photonic Nanostructures CEPHONA G5MA-CT-2002-04061

COORDINATOR

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PROJECT DESCRIPTION

During realization of the project new technologies for photonic devices and systems have been developed and the level of applied research has been increased. The research concentrated on high power semiconductor lasers and and other sources of IR radiation as well as on various types of photodetectors. Recently activities were initiated in the field of mid-infrared (IR) photonics; quantum cascade lasers and systems for detection of gases for industrial, medical and environmental applications.

Increase of the strength and competitiveness of local electronic industry and faster commercialization of the results was possible due to cooperation with European research and industrial institutions within a framework of EU projects. The research partnership with leading European laboratories established through the Center activities resulted in a marked increase of the number of EU projects realized in the Institute in recent years.

We have succeeded in the increase of the number of young people in science by offering them better working environment and demonstrating to them that quality research can lead to both their personal development and in selected predefined areas to concrete applications. On the basis of the CEPHONA facilities and selected laboratories from Department of Physics, Warsaw University of Technology, there was formed a new organization, i.e. Laboratory of Epitaxy of Nanostructures, whose main goal is to train graduate students and PhDs. This is the first laboratory of that type in Poland.

Finally, the important part of our activity as a Center of Excellence was organization of workshops, schools and training seminars. Workshops and schools with participation of foreign specialists as lecturers were targeted mainly on educating PhD students and young researchers.

RESULTS

Fig 1. Photograph of RIBER Compact 21 Molecular Beam Epitaxy reactor.

Fig 2. Thermoreflectance 300μm x 100μm map of the facet of NIF LD operated at 1000mA (left). Thermoreflectance signal distributions across the facet at different driving currents (right).

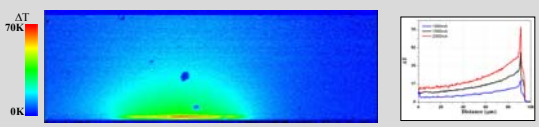


Fig 3. Temperature distribution 300μm x 100μm map of the facet of NIF LD operated at 1000 mA (left). Temperature line scans across the facet at different driving currents (right).

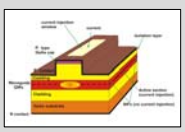


Fig 4.Scheme of Non Injected Facet (NIF) laser diode.

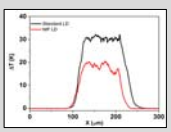
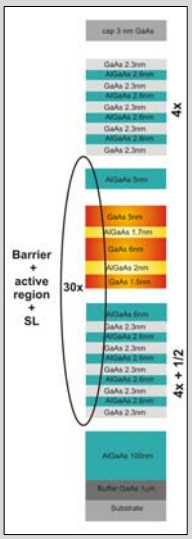


Fig 5. Comparison of temperature distributions across the facet of NIF LD and standard LD.



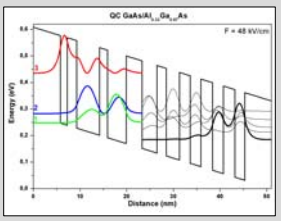


Fig 6. Photoreflectance spectrum of QCL structure at room temperature.

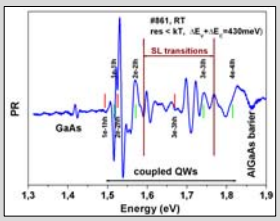


Fig 7. Calculated electronic structure of conduction band oc QCL structure in electric field.

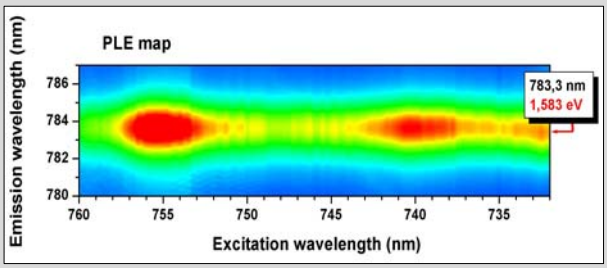


Fig 8. Scheme of Quantum Cascade Laser (QCL) structure grown at Molecular Beam Epitaxy Laboratory (left). The Photoluminescence Excitation (PLE) map of QCL active region structure detected at 1,583eV [1e-1hh] (right).

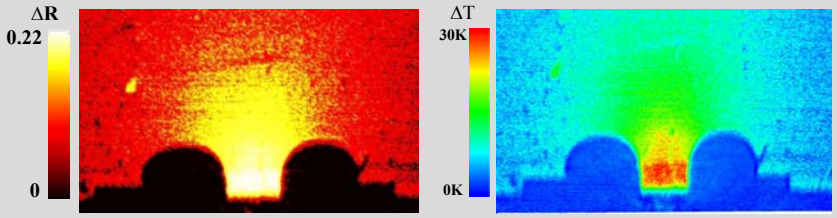


Fig 9. The thermoreflectance and temperature distribution maps (110μm x 100μm) of the front facet of QCL.

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