APPLICATION NOTE

HIGH POWER 1.3 µm QUANTUM DOT EDGE EMITTING LASERS FROM RIBER'S PROCESS TECHNOLOGY CENTER

MBE 49 Production System

1.3 µm Edge Emitting Lasers (EEL) based on a Quantum Dot (QD) active layer are the "driving force" in the development of low cost and high performance lasers for optical communications.

During the installation of their new MBE49 production system, NL-Nanosemiconductor GmbH performed 1.3 µm QD active layers calibrations structures in order to optimize growth conditions (300K PL measurement) at the Riber's Process Technology Center (PTC) in Lille (North of France).

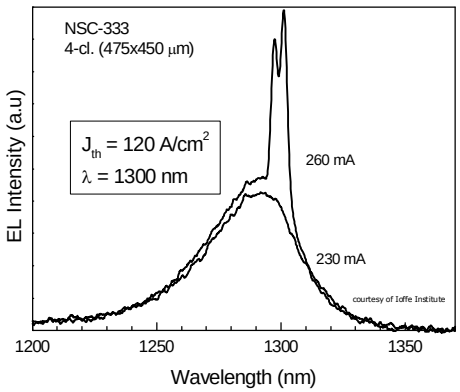
Afterwards, complete EEL structures were achieved while the Distributed Bragg Reflectors (DBR) structures were grown and characterized by means of Photo–Reflectance and High Resolution X-Ray Diffraction, in order to prepare the growth of fully doped DBR QD VCSEL (Vertical Cavity Surface Emitting Lasers) structures.
Calibration, optimization and QD EEL structures were grown at the Riber's PTC on the same MBE49 system and electrically pumped VCSEL QD structures at NSC facility (bottom mirror Si-doped and top mirror C-doped). The goal was first to transfer QD growth process from a MBE32 Research system to a multiwafer MBE49 Production one and prepare NSC to develop, in house, their own EEL and VCSEL to start production faster.

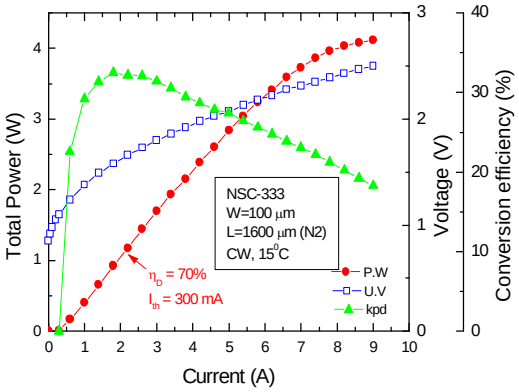
EEL QD structures were grown on 3" GaAs: Si N+ substrates (5x3" platen). The active layer consists of InAs QD with an InGaAs overgrowth quantum well embedded in a GaAs matrix (barrier/separation layer).
This active part of the device is surrounded by Si- and Be-doped AlGaAs cladding layers.
QD were generated by the Stranski-Krastanov growth mode using sub-monolayer deposition and low growth rates. Key points are the optimization of the growth rate, layer thickness and growth temperature.

Structures were then run through a basic processing line for preliminary study of device performances. Results being encouraging, an advanced processing were consequently performed at Ioffe Institute (St Petersburg – Russia).

Results

- 300 K electro luminescence at 1.3 was measured on 4-cleaved EEL samples at a threshold current density of 120 A/cm².
- 300 K measured optical power under continuous wave operation is as high as 4.2 W which is among the best value reported, demonstrating the excellent quality of the active region and laser structure.
- These structures, realized in a multiwafer production system, clearly demonstrate the MBE 49's potential as a powerful enabling tool for the next generation of datacom systems.





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