

# Characteristics of an In<sub>0.02</sub>Ga<sub>0.98</sub>N QW Laser at a 462 nm Wavelength

## 1. Introduction

III-nitride semiconductor materials:

- Advantages:
  - high emission efficiency
  - extended lifetime of continuous operation
  - relatively wide bandgap energy

InGaN applications:

- blue
- green
- deep violet (all cited references are from 2019-2022)

This paper: InGaN QW laser, blue, 462 nm

## 2. Background of the research

Structure – starting point for simulations:

-First proposed in Chang and Kuo, 2003

-Simulations in Drăgulescu, 2009: effect on threshold current and laser power:

- Different doping concentrations
- Different indium compositions
- Different layer thicknesses

-Simulations in Drăgulescu, 2013a: effect on several parameters:

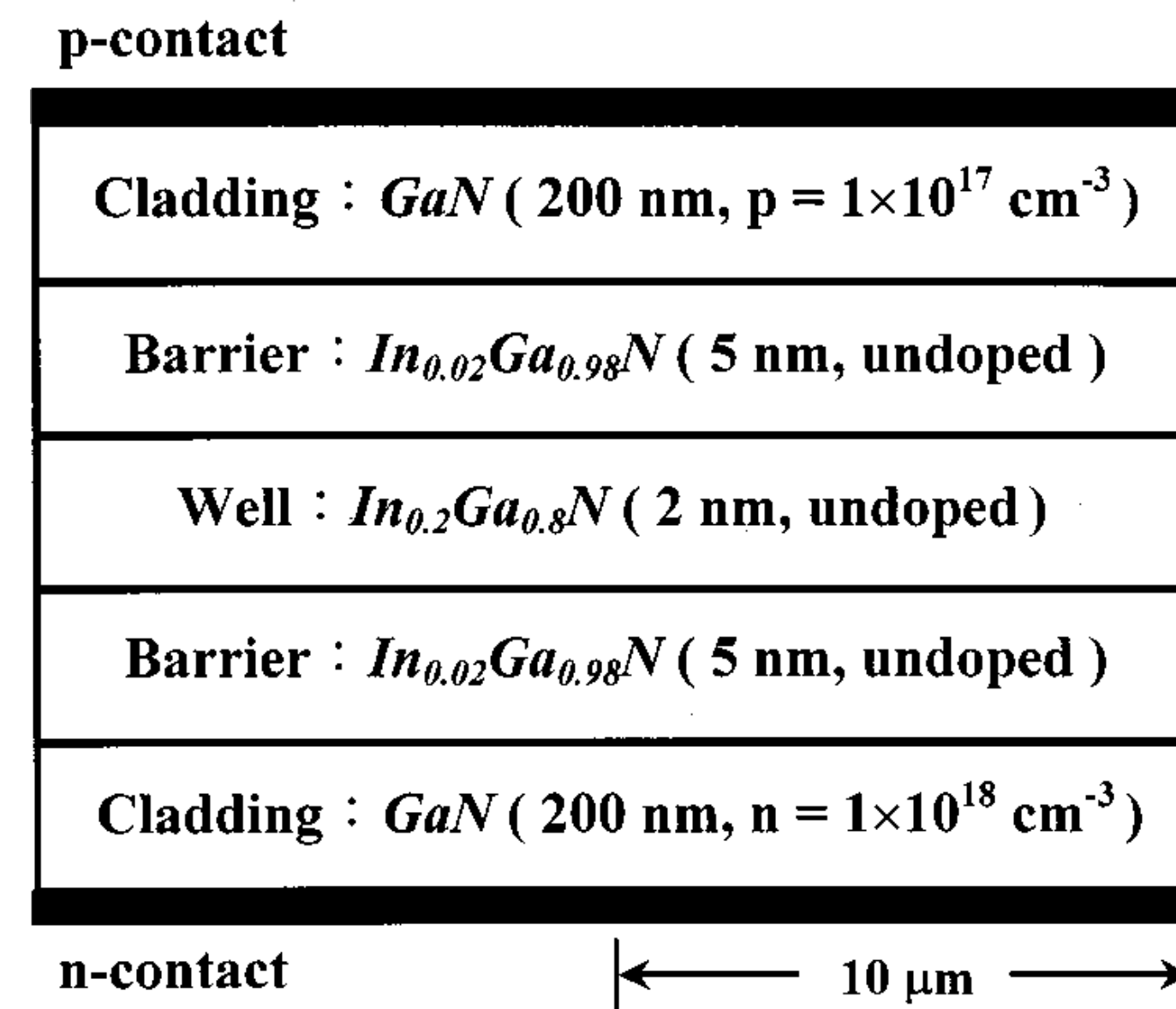
Different dopings in barrier layers

-Simulations in Drăgulescu, 2013b: effect on several parameters:

Different In compositions in active region and barrier layers

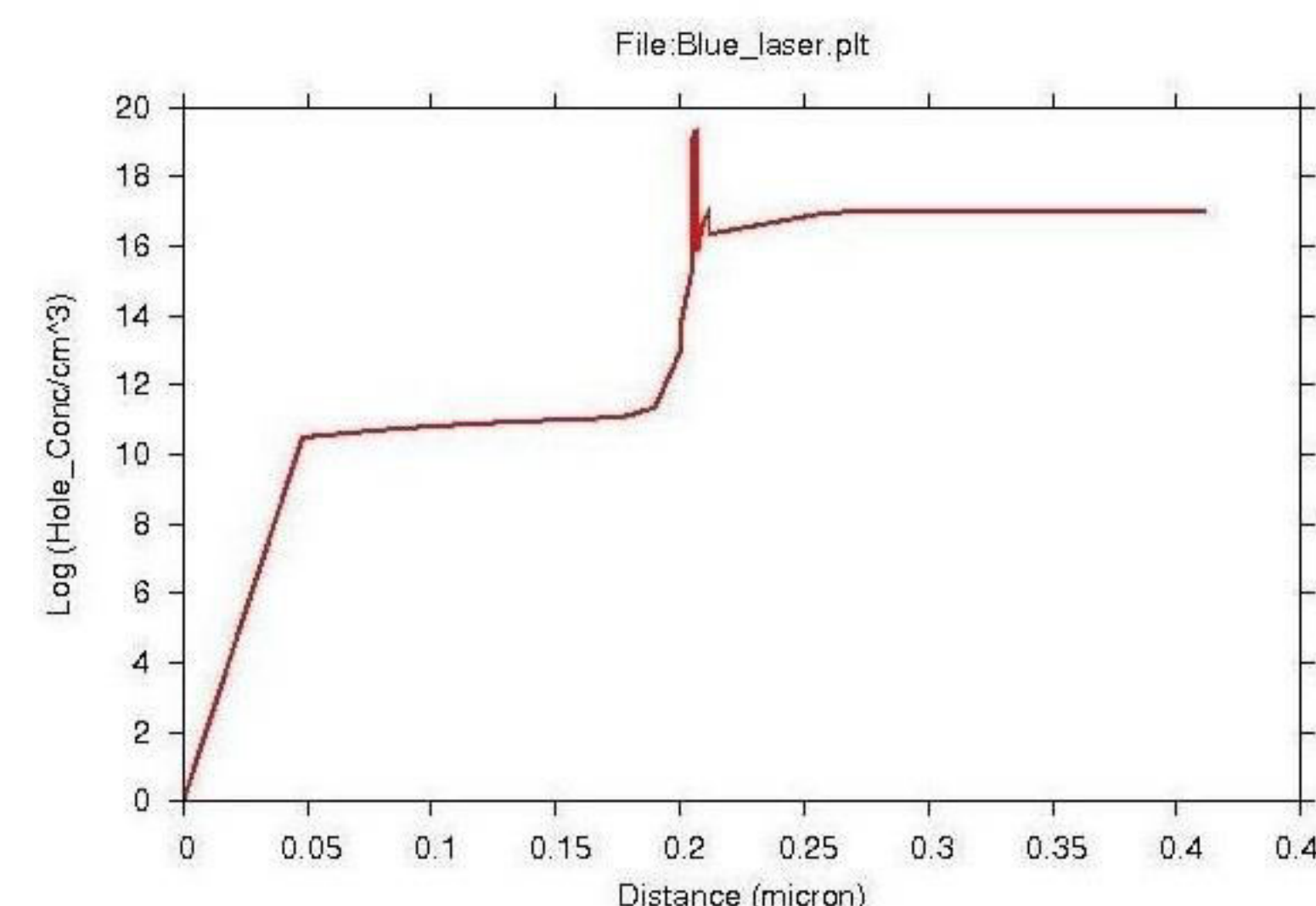
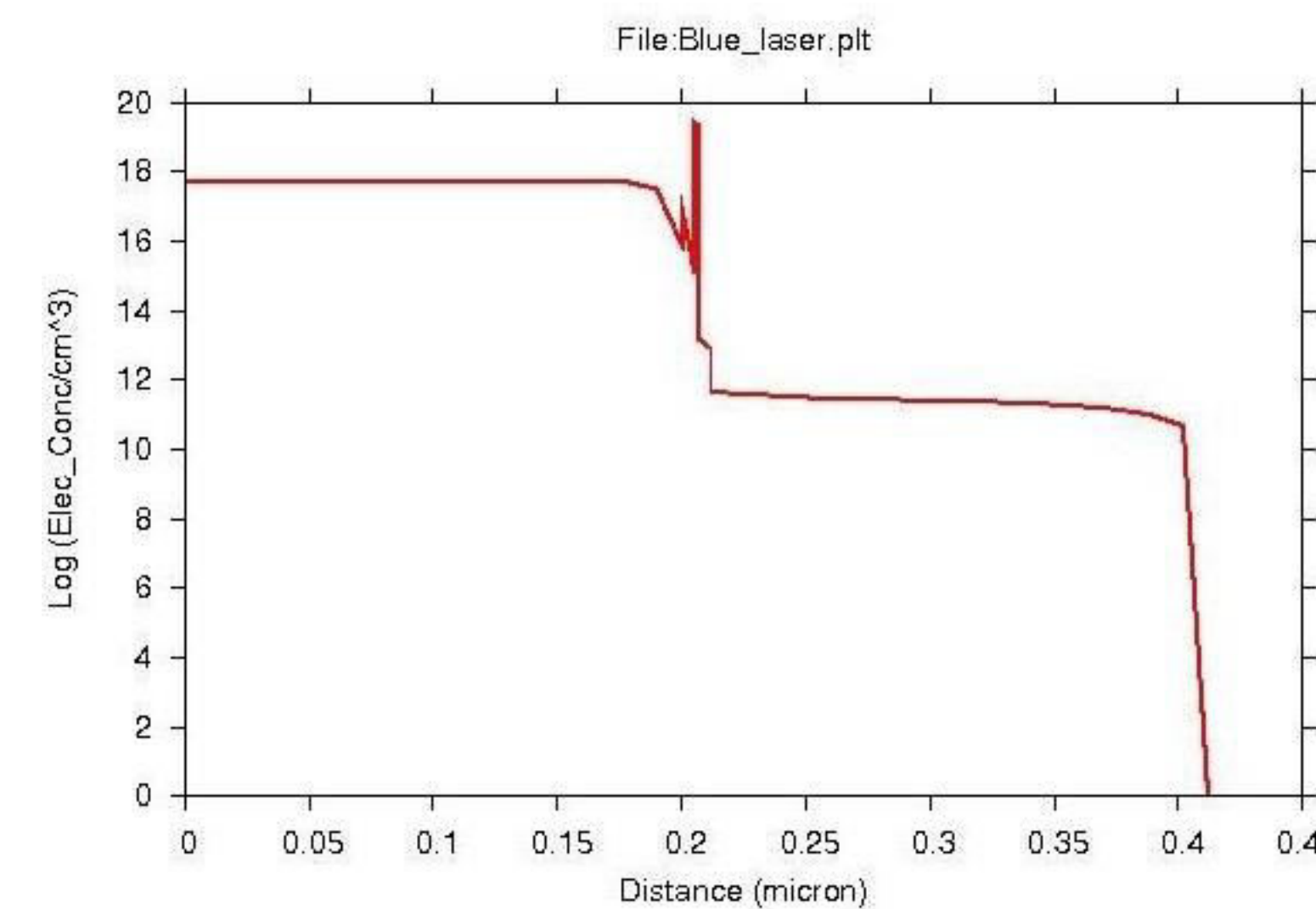
-This paper: simulations (LASTIP) of 13 different characteristics of the original structure

-Further basis for comparison

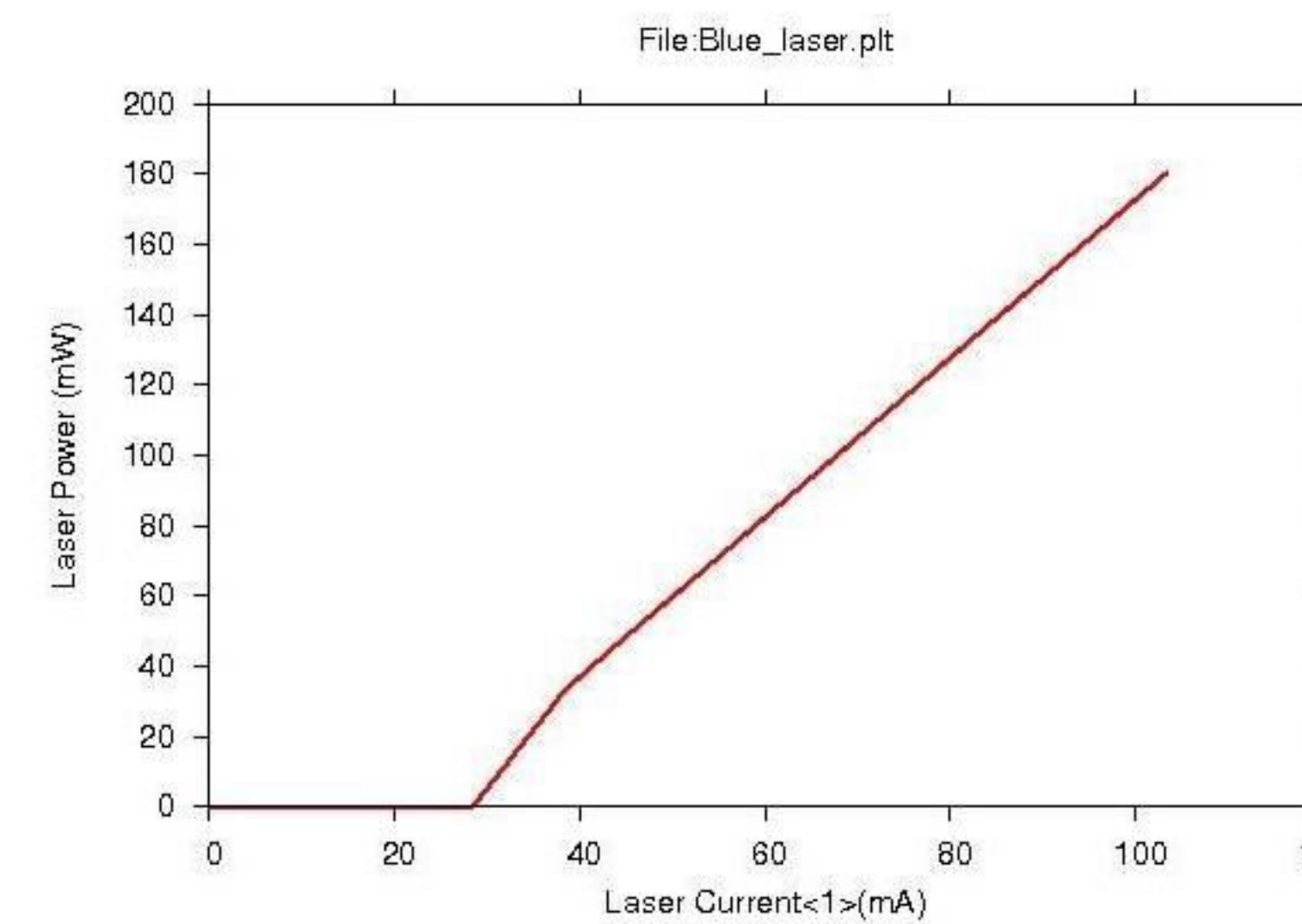
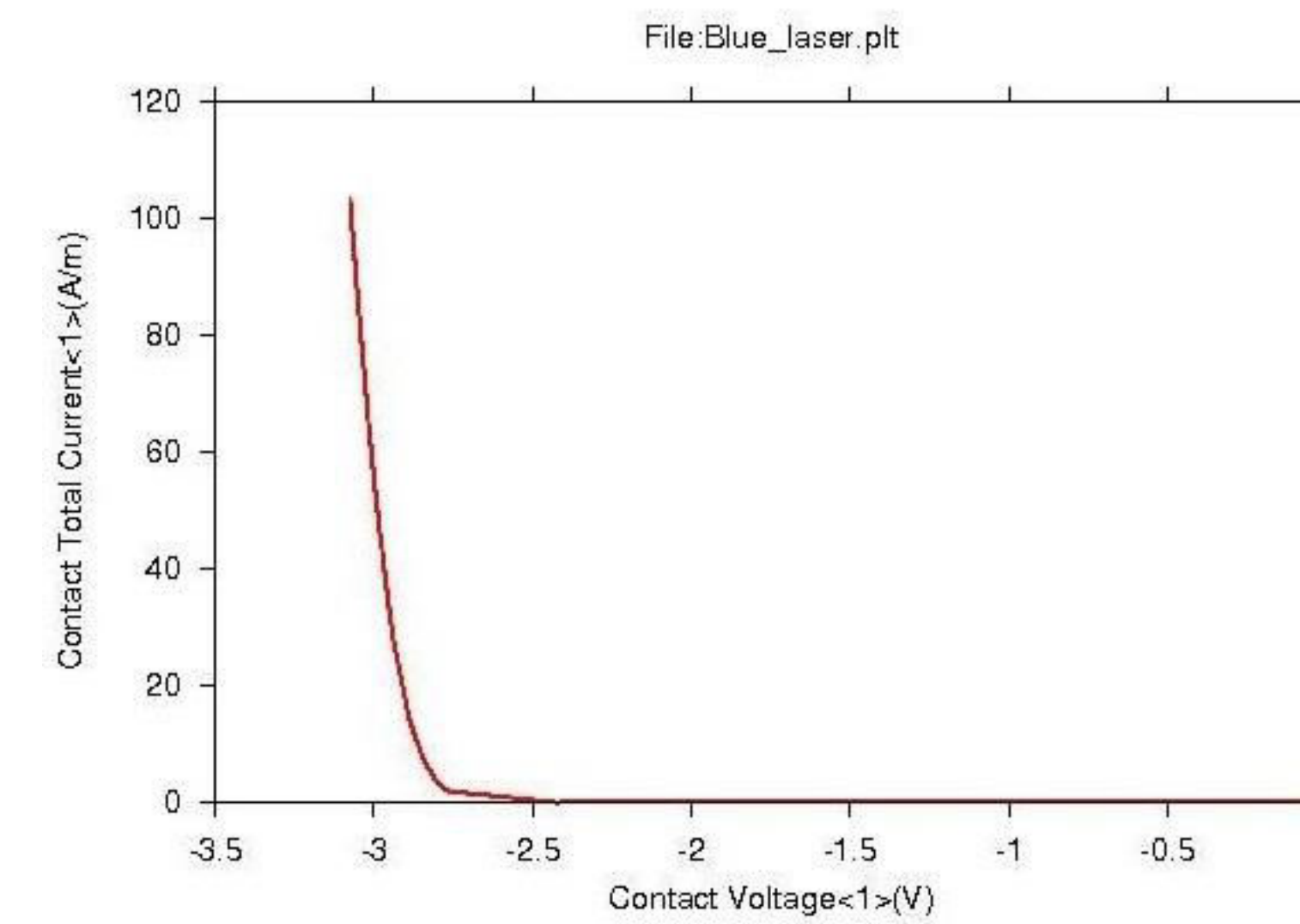


## 3. Simulation results (selection)

### (I). Carrier concentration distribution



### (II). I-V and L-I characteristics



### (III). Radiative, Auger, SRH and stimulated recombination

Recombination process type	Radiative	Auger	SRH	Stimulated
Amplitude peak (cm <sup>-3</sup> /s)	$0.81 \cdot 10^{28}$	$0.2 \cdot 10^{25}$	$0.11 \cdot 10^{28}$	$6.7 \cdot 10^{28}$

### (IV). Other simulated parameters

Cavity parameters for the simulated structure	Length	Width
Value	500 μm	20 μm

Parameter	Threshold current density	Slope efficiency	External differential quantum efficiency
Value	0.29 kA/cm <sup>2</sup>	2300 mW/A	85.50%

## 4. Conclusions

462 nm InGaN QW laser structure: Simulation – numerous performance characteristics

Comparison with other structures: Optimum structure for various applications

Advantages of lasers and LEDs with InGaN barriers - Further experiments and simulations

### References

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