

Research on Deep-UV semiconductor Laser Lasing in 205-250 nm Region

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【 Outline of survey 】

In 2003, October, we have succeeded in room temperature lasing of AlGa_N Multi-Quantum-Well Lasers under optical pumping at 241.5 nm. This lasing wavelength is the shortest one succeeded by a hetero-structure semiconductor laser.

However, the reasons why the shortest lasing has been demonstrated by only our AlGa_N MQW lasers have not been made clear. And the Deep-UV MQW laser structure includes many “ riddles ” .

The aims of this research are to scientifically make clear the riddles. Then, the Deep-UV laser operating in the lasing wavelength from 205nm to 250nm spectra region.

Therefore, target of our research are summarized as follows,

- 1) The possible shortest lasing wavelength operation of optical pumped AlGa_N MQW laser.
- 2) Researching of the smallest dislocation density AlGa_N epiaxial layer technique, and achievement of highest optical gain by the lowest dislocation density epitaxial layer.
- 3) Accumulation of fundamental technical data on Deep-UV laser structure by our optical pumped AlGa_N MQW laser, and fine desing of high performance Deep-UV injection laser structure.
- 4) Research on electronic conductivity control of p-type and n-type AlGa_N epitaxial layers with relatively high Al composition for the fabrication of an injection Deep-UV laser diode.

【 Expected results 】

Currently, semiconductor laser diodes are utilized as a laser light sources of near infrared and red spectral region in an optical communication system for high rate data transmission and, CD and DVD for high dense optical data storage system. On the other hand, UV and Deep-UV semiconductor laser diode make it possible, in future, not only to fabricate an ultra high dense optical disc, but also laser light sources for bio and gas-sensors, and white (high rendering) light sources for high efficient illumination system.

However, lasing wavelength of developed semiconductor laser diodes is, restricted in infrared, red, blue, and purple spectrum regions. And then, UV and Deep-UV semiconductor laser diode is under development or not.

Therefore, the aim of this research project is the spreading the spectrum region of the possible semiconductor laser diodes down to the UV and Deep-UV of 205nm-250nm and developing the Deep-UV semiconductor laser diode.

【 References by the principal researcher 】

T. Takano, Y. Ohtaki, Y. Narita and H. Kawanishi, “ Improvement of Crystal Quality of AlGa_N Multi Quantum Well Structure by Combination of Flow-Rate Modulation Epitaxy and AlN/Ga_N Multi-Buffer Layer and Resultant lasing at Deep Ultra-Violet Region ” , Japan, J. Appl. Phys., Vol. 43(10A), pp.L1258-L1260(2004).

T. Takano, Y. Narita, A. Horiuchi and H. Kawanishi, “ Room-temperature deep-ultraviolet lasing at 241.5nm of AlGa_N multiple-quantum-well laser ” , Appl. Phys. Lett. Vol.89(18), pp. 3567-3569(2004).

【 Term of project 】 FY 2005 - 2009

【 Budget allocation 】 66,500,000 yen

【 Homepage address 】 Under Construction