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Thermal Analysis for 1.3 μm High Power Laser Diodes

Jung Hwa Jung[1,2], Sang Yeol Lee[1], I. K. Han[2]

[1]Electronic Device and Materials Lab, Yonsei University, Seoul 120-749, Korea
[2]Nano Device Research Center, Korea Institute of Science and Technology, Seoul 136-791, Korea

High power laser diodes (LDs) has various applications in the fields of optical communication, medical treatment and various sensors. In high power laser diodes, thermal management is one of critical issues for stable operation and long-term reliability. The junction temperature is important parameter that characterizes thermal effects of LDs and packaged structures. The word "junction" refers to the active layer of LDs.

In this work, we analyzed thermal characteristics of LDs, especially InAs/InGaAs/GaAs quantum dots LDs, by using the finite element method. A change of junction temperature relative to some kinds of oxidation layer and its thickness. The junction temperature for SiN_x oxidation layer is more lower than SiO_2, which is caused by the difference of thermal conductivity between SiN_x and SiO_2. And as the thickness of oxidation layer decreases, junction temperature goes down to a certain limited temperature,

By lowing junction temperature, it is possible to increase the maximum forward current and enhance the slop efficiency of LDs. And the thermal resistance (R_{th}) is also calculated by heat modeling and simulation. These results would be helpful to improve performance of high power LD module.