Effect of temperature and injection current on characteristics of TO-can packaged Fabry-Perot laser diode

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Due to the recent huge growth in the field of optoelectronics, novel devices and related technology are incessantly introduced. However, these progresses are at risk until thorough verification of qualification is completed. Furthermore, in the case of optoelectronic devices, they are frequently used in environment where safety and reliability are very crucial. Therefore, to improve the problems of reliability, various methods of tests are carried out ahead the field applications.

Lasers in equipment and systems are used under constant current or constant output power conditions. The degradation during constant current operation is usually monitored as a reduction of optical output power, whereas the degradation durng constant output power is usually monitored as an increase in operating current. These changes are introduced by the increase in threshold current and the decrease in slope efficiency (external differential quantum efficiency). The main changes in device parameters during the degradation are the decrease in injected carrier lifetime for long-wavelength InGaAsP/InP devices. The failure criteria, and thus the device lives, are mainly determined by the change in current-light otput charactersitics. However, there are changes in lasing characteritics for laser diode.

We investigated the thermal characteristics of TO-can (transistor-outline-can) packaged long wavelength GaInAsP/InP Fabry-Perot laser diode. We obtained the characteristic temperature, and center wavelength shift depending on the temperatures and injection currents of the optoelectronic laser diode. Furthermore, overheating of semiconductor laser originated from thermal resistance is analyzed and evaluated by measuring junction temperature. Results from experiment and estimation are compared at extreme operating conditions.

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