Report: Optical Semiconductor Device - 3

Operation of a 25-Gbit/s Direct Modulation Ridge Waveguide MQW-DFB Laser up to 85℃

We developed a 25-Gbit/s direct modulation InGaAlAs ridge waveguide (RWG) multi quantum well (MQW) distributed feedback (DFB) laser. By optimizing the device structure we obtained an output power higher than 5 mW up to 105℃ and we successfully demonstrated error-free operation after a 10-km transmission up to 85℃.

The IEEE High Speed Study Group is in the process of establishing new standards for 40G/100G Ethernet. It is anticipated that one of the new standards (100GBASE-LR4) will optically multiplex 4 x 25 Gbit/s to realize a 100-Gbit/s 10-km transmission.

Direct modulation lasers (DMLs) are one candidate for 100GBASE-LR4 because DMLs are suitable for realizing a low cost system. It is important to develop lasers that can operate at higher temperatures because high temperature operation can allow us to reduce the power consumption required for a thermoelectric cooler. We optimized the device structure to realize high-speed and high-temperature operation. Figure 1 is a diagram of structure of a InGaAlAs RWG-MQW-DFB laser. The use of InGaAlAs MQWs is suitable for high-temperature operation because it has a large conduction band offset (Δ Ec) compared with InGaAsP MQWs. We set the cavity length at 200 μm to achieve a good balance between high-speed and high-temperature operation

Figure 2 shows the light-current characteristics. An output power higher than 5 mW was obtained up to 105℃.

Figure 3(a) shows eye diagrams. The laser was directly modulated with a 25-Gbit/s signal. Clear eye openings were observed at 85℃. The bit error rate (BER) performance before and after a 10-km single-mode fiber transmission is shown in Fig. 3(b). Error-free operation was obtained up to 85℃.

These results indicate that this laser is promising for use in new optical communication systems.

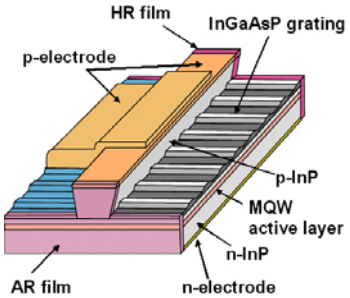

Fig.1 Ridge waveguide MQW-DFB laser.

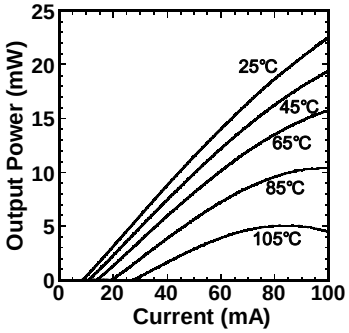

Fig.2 Light-current characteristics.

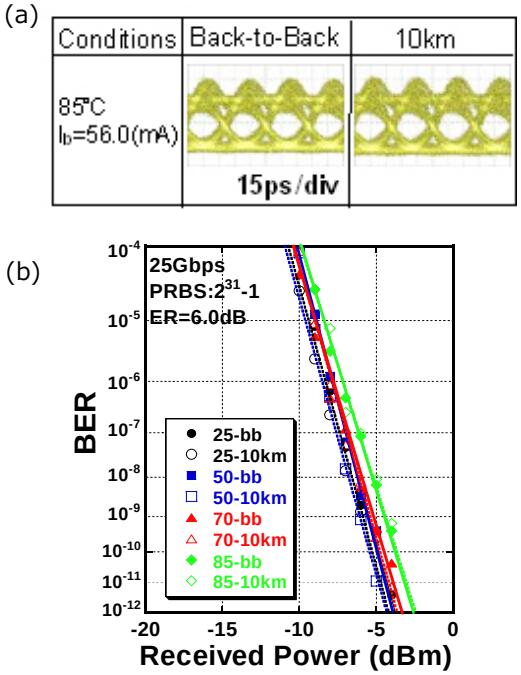

Fig.3 (a) Eye diagrams (b) Bit error rate performance.