

Extremely High Direct Modulation Bandwidth Mode Selective Light Source Based on Active-MMI

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The mode selective light source extends the communication speed of inner links of machines such as super computer, mode division multiplexing (MDM) systems is one of the solutions [1]. Mode selective light source based on active-Multimode interferometer (MMI) has been proposed and demonstrated for such system. Targeting bandwidth such as 100 GHz level, BW enhancement scheme utilizing multiple PPRs has been proposed and demonstrated on active-MMI LD in 2017 and at least 34 GHz bandwidth was obtained [2]. In this work, mode selective active-MMI LD was fabricated to realize high speed modulation on the both 0th and 1st order modes simultaneously. As a result, individual stable lasing of 0th mode and 1st mode was obtained. Experimentally measured 3 dB modulation bandwidth of the both modes exceeded 40 GHz. Figure 1 shows the schematic view of the active-MMI LD. Three arms joint with an MMI section as well as

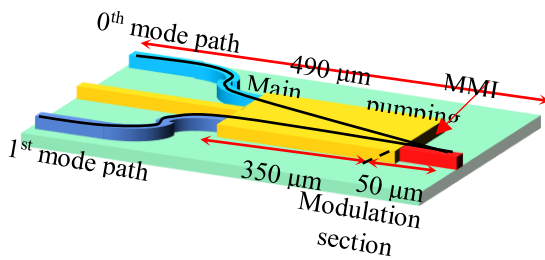


Fig. 1. Schematic view of active-MMI LD



Fig. 2. (a) Only 0th mode lasing. (b) Only 1st mode lasing.

modulation section provides three different lengths oscillating cavities. High mesa configuration was introduced for the waveguide structure. Such structure provides inner reflection at MMI edge, which enables another three inner oscillating cavities consist of three arms and MMI section. Thus at least six oscillating cavities exist within single laser. Consequently, multiple PPRs are introduced by such structure. By switching on/off current of bending arms, 0th mode and 1st order mode lasing is selected. Figure 2 shows the near field pattern results of the device at different current injection conditions. Small signal frequency response (FR) of mode selective active-MMI LD was evaluated under single mode operation condition for both 0th and 1st order modes. Figure 3 (a) and (b) shows measured FR results. Different colors represent different pumping current. It is clearly shown in the figure that, for the both 0th and 1st order modes, FRs were enhanced as pumping current increase. For both modes, 3 dB bandwidths were extended over 40 GHz with pumping current above 170 mA.

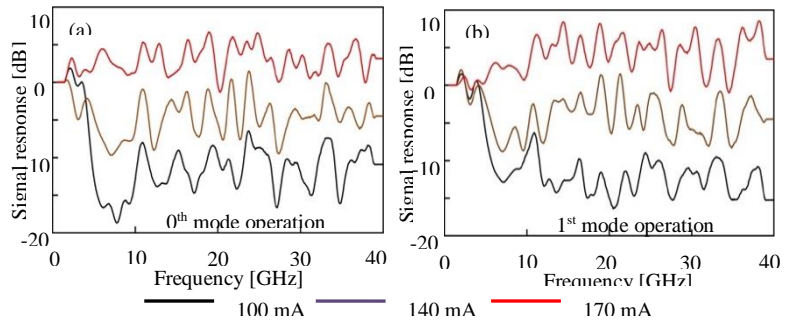


Fig. 3. Bandwidth enhancement scheme and measured small signal response results. (a) Measured frequency response at 0th mode operation. (b) Measured frequency response at 1st mode operation

References

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- [2] B. Hong, et al., "Bandwidth Enhancement Scheme Demonstration (from 5 GHz to 34 GHz) on Direct Modulation Laser Diode using Multiple PPR (Photon-Photon Resonance) Active MMI," *ECOC*, P1.SC2.22, 2017.