Mode Selective Light Source Based on Active Multimode Interferometer Laser Diode

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Abstract: Mode selective active-multimode interferometer laser diode (active-MMI LD) was designed and fabricated. By integrating separated transverse mode paths in single laser diode, the gain for different mode can be controlled individually. As a result, by adjusting current into mode-selector section, individual lasing of fundamental mode and first mode was confirmed successfully.

I. Introduction:

Mode division multiplexing (MDM) as an approach to enhance transmission capacity of optical fibers has attracted attentions [1-3]. Mode selective light source is attractive because it may extend MDM toward short distance network including fiber to the home (FTTH) and data center because of its potential toward low cost and compact MDM light source [4].

II. Device concept:

Figure 1 shows the fabricated device structure [4]. Based on this structure, simulation of propagation paths of 0^{th} and 1^{st} mode by beam propagation method (BPM) [5] are shown in Fig. 2. As can be seen in the figure, 0^{th} mode and 1^{st} mode have individual propagation paths. The two lateral modes share common propagation area in waveguide, which is indicated as section *C* in Fig. 1. The two straight waveguides (section *A* and *B*) at mode selector region in Fig. 1 permit only 0^{th} mode and 1^{st} mode. Separated electrode pads for different sections was constructed to control the gain of each lateral mode by adjusting current injection. By controlling the gain of each lateral mode, output mode could be selected.

III. Results and discussion:

Table 1 shows current injection plan to obtain different lateral output modes. When all electrodes have current injection, both 0^{th} and 1^{st} modes could start lasing. Only 0^{th} mode lasing condition could be obtained when only section *A* has no current injection. For only 1^{st} mode lasing case, only section *B* has no current injection. Section *C* as pumping region for both 0^{th} mode and 1^{st} mode always has injecting current. Obtained near field pattern (NFP) results are shown in Fig. 3. Plan 1, 2 and 3 correspond to Fig.3 (a), (b) and (c), respectively. As can be seen in the figure, only 0^{th} mode and only 1^{st} mode lasing cases were obtained successfully.

IV. Conclusion:

Mode selective active MMI LD was demonstrated for the first time. Controllable output lateral mode lasing was confirmed.

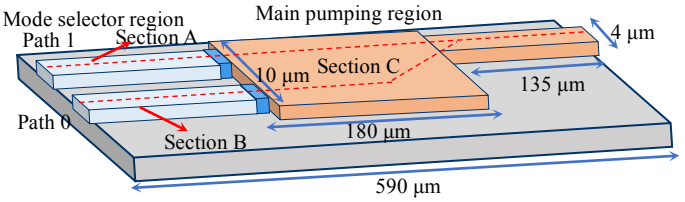

Fig. 1 Schematic view of active MMI LD

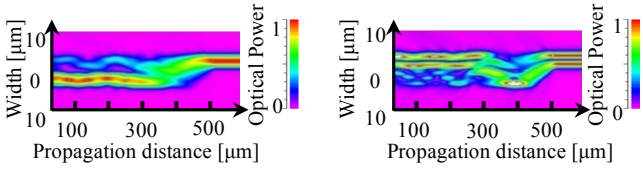

Fig. 2 Propagation path of (a) 0^{th} mode and (b) 1^{st} order mode

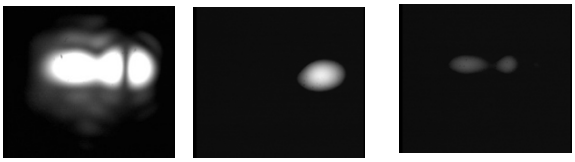

Fig. 3 NFP of (a) both modes lasing (b)0^{th} mode (b) 1^{st} mode

V. Acknowledgement

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Tab. 1 Current injection plan and corresponding NFP in Fig. 3

Plan	Current C	Current B	Current A	NFP
1	Total 100 mA			a
2	43 mA	43 mA	0	b
3	100 mA	0	26 mA	c