

# Research of Multi-Mode Transmission Device

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Present data traffic is significantly increasing, and spatial multi-mode multiplexing is expected to become one of the next generation transmission technologies to catch up such that huge demand for data traffic [1]. As present transmission system is in principle based on wavelength division multiplexing (WDM), it is important to realize wavelength independent multi-mode devices. We have proposed MMI structured multi-mode devices for future spatial multi-mode multiplexing transmission, and we have successfully confirm that the designed MMI (Multi-Mode Interference) based multi-mode combiner showed superior multiplexing (0<sup>th</sup> and 1<sup>st</sup> order modes) characteristics of below 0.5 dB excess loss for full C-Band theoretically [2].

Figure 1 shows the schematic of the MMI multi-mode combiner and its layer structure. When 0<sup>th</sup> mode is incident upon the upper access waveguide and 1<sup>st</sup> mode incident upon the lower, two modes will be combined together in output waveguide. Odd modes like 1<sup>st</sup> mode also get 85 % output, but input port has to be lower port at the same circumstances. Figure 2 shows the wavelength and polarization dependency of MMI multi-mode combiner. 0.5 dB down bandwidth is the bandwidth where both TE and TM modes transmission had dropped for 0.5dB.

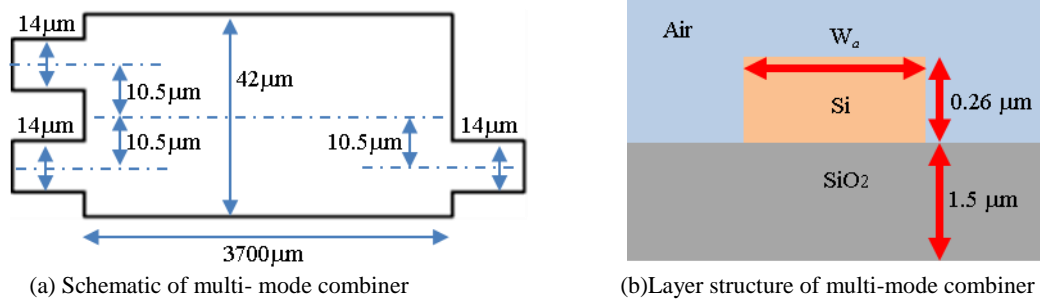


Fig.1. MMI structure and layer structure of MMI multi-mode combiner

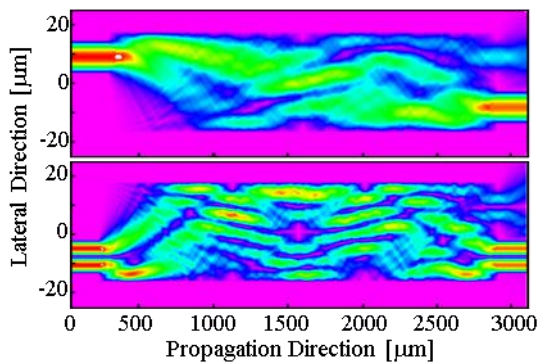


Fig.2. Simulation result of light propagation inside multi-mode combiner. Upper shows 0<sup>th</sup> mode and lower shows 0<sup>th</sup> mode

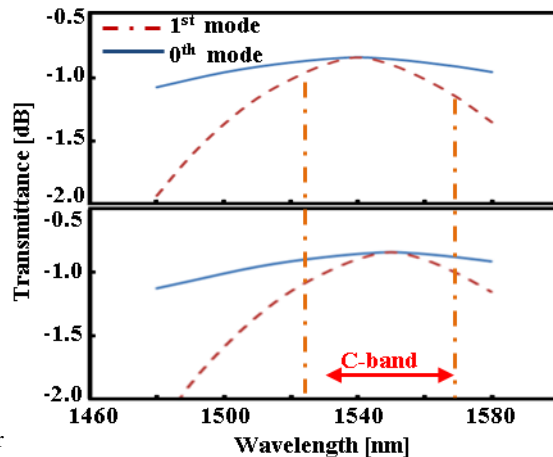


Fig.3. Wavelength dependency of multi-mode combiner for TE and TM polarization

## References

[1] M. Nakazawa, ECOC, 2<sup>nd</sup> Plenary Talk, pp. 31, 2010

[2] Y. Chaen, et.al., MOC, 2011