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Study on loss reduction toward 100GHz channel spacing Si wire waveguide AWG

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1. Introduction

We reported on 200 GHz channel spacing arrayed waveguide grating (AWG) using Si wire waveguide [1]. In this report we present an AWG for 100GHz-class channel spacing with improved loss characteristics.

2. AWG fabrication

The structure of AWG is shown in Fig.1. Similar to the previous report, parallel arrangement of the slab waveguides is used to eliminate the curved waveguide lengths difference in the arrayed waveguide. The stray light reduction structure is placed at both sides of the slab waveguides. The arm length is designed to attain 130 GHz wavelength channel spacing for the TE mode. A 1 μm wide wire waveguide is used at the arrayed waveguide and free spectral range (FSR) is enlarged 200% against total channel range to shorten the waveguide length so that the phase error generated by width fluctuations is minimized. Core thickness of 300 nm and 5.5 μm wide aperture (500 nm gap) at the slab to arrayed waveguide interface was used to decrease the mode mismatch loss.

The device was fabricated using SOI wafer, the immersion ArF lithography and dry etching. Measured wavelength response is shown in Fig. 2. The device was designed for 8ch output. The insertion losses of 3 dB and extinction ratio of 25 dB were attained.

3. Loss reduction at slab-channel waveguide interface

We have studied some loss reduction structure at the slab to arrayed waveguide interface. The total loss from both interfaces obtained by 3D-FDTD simulation is shown in Table 1. Simple taper requires long length (L_t) and MMI-rib waveguide aperture showed the lowest insertion loss and highest uniformity. Some devices in table are also fabricated.

4. Conclusions

The Si wire waveguide 8ch AWG with 130 GHz channel spacing showing 3 dB insertion loss and 25 dB extinction ratio has been reported. Some insertion loss reduction schemes at the slab to arrayed waveguide interface were also discussed.

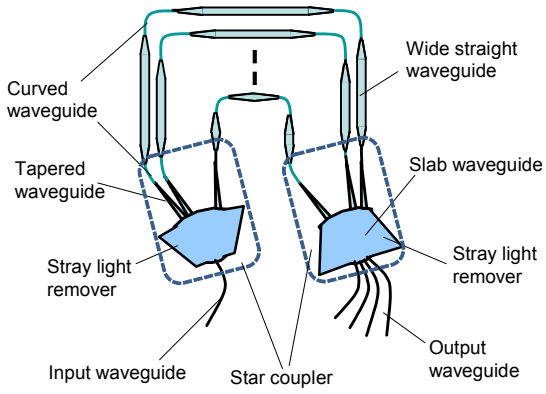

Fig. 1 AWG device structure

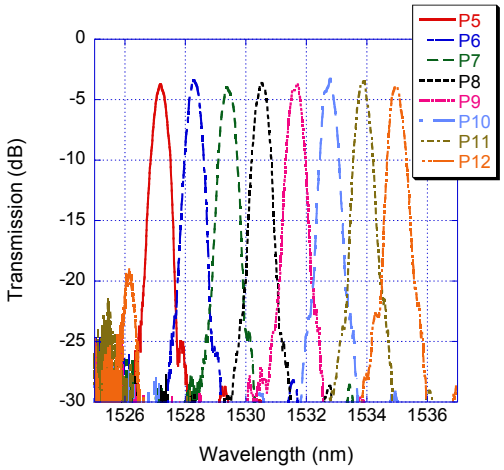

Fig. 2 Measured wavelength response

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References

[1] H. Okayama et al., Electron. Lett., vol. 49, pp.1401-1402, 2013 .

Table 1

Loss (dB)	Wire (L_t 25um)		Rib (L_t 50um)		MMI-wire		MMI-rib	
Thickness (nm)	220	300	220	300	220	300	220	300
Aperture 1.5 um	3.1-4.4	3.2-4.6	1.3-2.8	0.75-1.4	2.5-3.1	2.4-3.1	0.65-1.0	0.74-0.93