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# 1550nm-band Low Polarization Dependence Wavelength Demultiplexing Using Bragg Reflector Waveguide

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**Abstract** We demonstrate a compact Bragg reflector waveguide beam deflector with large angular dispersion for full C-band wavelength demultiplexing. This demultiplexer has low polarization-dependence and ability in supporting large channel-count operation.

## Introduction

A wavelength (de)multiplexer is an indispensable element in dense WDM systems. In the past, diffraction grating, arrayed waveguide grating (AWG) and virtually imaged phased array (VIPA) are popular choices [1-3]. However, it is difficult to obtain a large number of channels in those devices with a compact fashion either limited by a small angular dispersion or by the device's free spectrum range (FSR). Recently, our group reported a novel type of demultiplexer with a large angular dispersion based on a Bragg reflector waveguide [4,5]. But the demonstration was carried out at ~1 μm band. It is interesting to shift the operation band to a communication band. In this paper, we report the first experimental demonstration of beam-steering in a Bragg reflector waveguide covering the whole C-band with low polarization dependence.

## Device Structure and Principle

An illustration of demultiplexing, model of Bragg reflector waveguide and a photo of fabricated devices are shown in Fig. 1. A special eigenmode, which we call "slow-light" can be excited in the waveguide. The propagation constant for slow-light is highly dispersive thus we could steer the radiation beam by tuning input light wavelengths. In Fig. 2, we show the captured far-field patterns of the radiation. Clear shifting was observed for a wide wavelength band. The deflection angles are plotted together with simulations in Fig. 2. We could see a good agreement between theory and experimental results. Full C-band steering was realized with a deflection angle change over 40º. Polarization dependence is significantly improved in this work than our early reports. From the FFP intensity profile in Fig. 3, we could see the deflection angle differences between TE- and TM- modes are very small comparing to the divergence angle.

## Discussions

The presented demultiplexer is highlighted for its large angular dispersion and broad FSR. As a result, it is easier to make a super-high-resolution demultiplexer in a smaller size. A comparison between different dispersion elements is illustrated in Fig. 4. Advantages over other approaches can be seen. If we are able to extend the effective propagation distance by reducing the propagation loss, a demultiplexer with an ultra-large channel-count of several hundred can be made on a millimeter-order device.

## Conclusions

We demonstrated a miniature beam deflector based on a Bragg reflector waveguide for wavelength demultiplexing with a large number of channels. Large improvement in reducing the polarization dependence was shown by precise core thickness control.

## Acknowledgement

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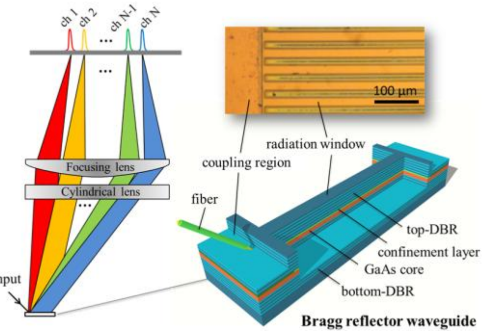


Fig. 1. Illustrations of the proposed demultiplexer and a Bragg reflector waveguide.

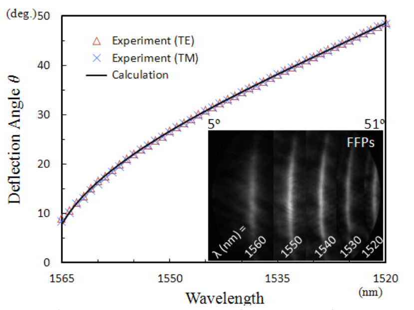


Fig. 2. Deflection Angle as a function of wavelength. Far-field patterns for several wavelengths are illustrated.

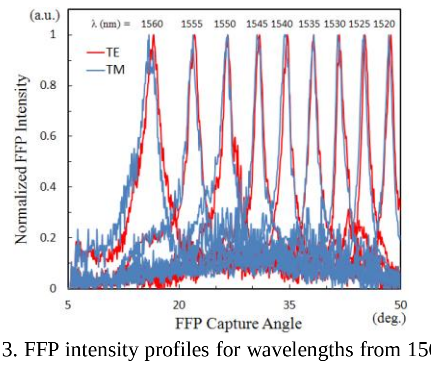


Fig. 3. FFP intensity profiles for wavelengths from 1560 to 1520 nm.

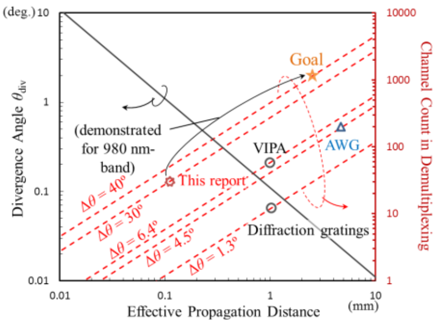


Fig. 4. Comparisons of different dispersion elements. $\Delta\theta$ stands for a maximum beam-deflection range at output.