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A Literature Review on Optical Add Drop Multiplexer (OADM) in Wavelength Division Multiplexing

Pankaj Gupta[1],(M.Tech Student), Prof. Mukesh Tiwari[2] (Professor)
[1,2] Department of Electronics and Communication Engineering .
[1,2] Sri Satya Sai University of Technology & Medical Science.

ABSTRACT

In this show a literature survey of difference reviews techniques of OADM methods in WDM. The OADM based on DWDM technology is moving the telecommunications industry significantly closer to the development of optical networks. An optical add-drop multiplexer is a device which is wavelength-division multiplexing systems for multiplexing and routing different channels. An optical add-drop multiplexer is a device which allows the insertion or extraction of one or more wavelengths from a fiber at a network node. Also discuss the type of OADM and importance of OADM. Discuss the different generation of OADM and its functions.

Keywords: Optical add-drop multiplexer, Multiplexer, DE multiplexer, Optical fiber and Wavelength division multiplexing (WDM).

I. INTRODUCTION

OADM is a critical device used in wavelength-division multiplexing systems for multiplexing and routing different channels of light into or out of a single mode fiber. It is the fundamental constructional block of optical telecommunications networks. OADM has passive and active mode depending on the wavelength. In passive OADM, the add and drop wavelengths are fixed beforehand. But in dynamic mode, OADM can be settable to any wavelength after instillation. OADM can be deployed for both expensive remote core networks and shorter distance networks, which are also called metro networks. An optical add/drop multiplexer (OADM) is a device which allows the insertion or extraction. of one or more wavelengths from a fiber at a network node. For example, an OADM might have the capability to drop and insert three wavelengths from a set of N being transported over a single fiber.

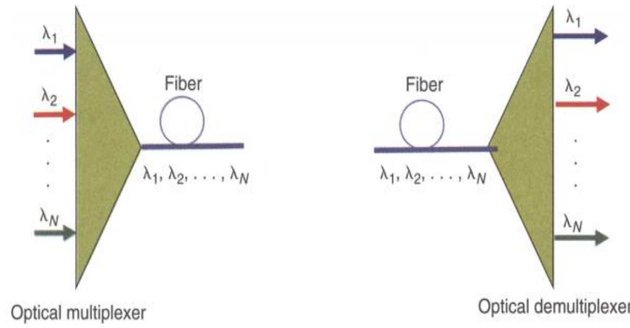

Figure 1 Wavelength division Multiplexing

II. STRUCTURE OF OADM

There are three stages in a traditional OADM: an optical de-multiplexer, an optical multiplexer, and between them a method of reconfiguring the paths between the optical multiplexer and a set of ports for adding and dropping signals. The multiplexer is used to couple two or more wavelengths into the same fiber. Then the reconfiguration can be achieved by a fiber patch panel or by optical switches which direct the wavelengths to the optical multiplexer or to drop ports. The de-multiplexer undoes what the multiplexer has done. It separates a multiplicity of wavelengths in a fiber and directs them to many fibers. The following diagram shows the working principle of OADM.

III. FUNCTION OF OADM

The main function of an optical multiplexer is to couple two or more wavelengths into the same fiber. If a de-multiplexer is placed and properly aligned back-to-back with a multiplexer, it is clear that in the area between them, two individual wavelengths exist. This presents an opportunity for an enhanced function, one in which individual wavelengths could be removed and also inserted. Such a function would be called an optical wavelength drop and add de-multiplexer/multiplexer- and for brevity, optical add-drop multiplexer. OADM is still evolving, and although these components are relatively small, in the future, integration will play a key role in producing compact, monolithic, and cost-effective devices. The main function of an optical multiplexer is to couple two or more wavelengths

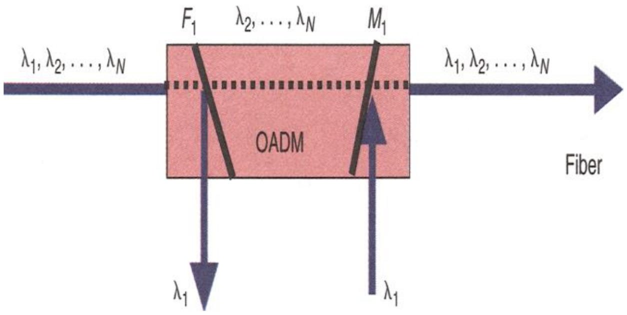

Figure 2 Optical add-drop multiplexer is a DWDM function.

The OADM selectively removes (drops) a wavelength from a multiplicity of wavelengths in a fiber, and thus from traffic on the particular channel. It then adds in the same direction of data flow the same wavelength, but with different data content. The model of an OADM, for wavelength 11.), is schematically shown in Figure.2, where F) signifies a filter selecting wavelength 11.) While passing through all other wavelengths and M1 signifies a multiplexer that multiplexes all wavelengths.

IV. GENERATION OF OADM

There are different types of OADM. In this literature explain the different generation of OADM.

Type-I ROADM

The First Generation of Type- I Reconfigurable OADM-

It is the most elementary type of ROADM with fixed (colored) ports relies on the silica-on-silicon arrayed (SSA) referred to as Type-I, costs less. Individually packaged chips were spliced all together, namely SSA-waveguide grating (AWG) chips and polymer-on-silicon chips comprised of switches. De-multiplexing / multi plexing, add/drop switching, and optical power monitoring/ load balancing is performed with SSA-based type- I-ROADM. It comprised of three AWG's of thirty two channels and two switches of sixteen channels, thus in total of five packages channels (N) in totality, on the both sides of a PCB complete package are mounted, along with control electronics.

The Second -Generation Type-I Reconfigurable OADM

The Reconfigurable OADM of second generation are also based on silica-on-silicon arrayed (SSA) and implementation is through chip-to-chip connection along with additional integration, well referred to as the Second Generation Type I ROADM. Together with numerous benefits, it diminishes excess loss by replacing two fiber array pigtails with a single chip-to-chip coupling, the space needed for fiber ribbons, splices were removed ,removal of fiber arrays amid chips and a sub-assembly of hybrid ROADM, thus number channels are increased thus resulting in less expenditure.

Type II ROADM

These types of networks offer colorless Add/Drop ports, and are based on the wavelength blocker (WB), SSA approaches and may be further classified into number of generations.

First -Generation Type-II Reconfigurable OADM

This type of Reconfigurable OADM are mostly applied for the long-haul networks along with 50GHz inter-channel spacing and these type of Reconfigurable OADM are based on free-space optics that utilizes MEMS or LCD actuation. These are based on the generation-1 WB and SSA schemes, the WB-based systems are also referred to as 'Broadcast and Select' architecture. Together with use of tunable filters at the Drop ports and tunable lasers at the Add ports the ports, are made colorless without having impact on the path.

Currently used Optical add-drop multiplexer

The waveguide OADM is configured by inserting a silicon waveguide Bragg reflector between two silico waveguide optical circulators as shown in Figure 3(a). In the drop operation, an input light launched into the input port (left-upper) is transmitted to the cross port of the left circulator and propagates to the Bragg reflector. A light with the particular wavelength is reflected by the Bragg reflector and back to the left circulator. Then, the light is transmitted to the straight port of the circulator and is output at the drop port (left-lower). The light passing through the Bragg reflector is transmitted to the cross port of the right circulator and is output from the through port (right-lower). In the add operation, an input light launched into the add port (right-upper) is transmitted to the straight direction in the right circulator and propagates to the Bragg reflector. The light having the particular wavelength defined by the Bragg reflector is reflected, which is transmitted to the cross port of the circulator and is output at the through port. Figure 3(b) shows the silicon waveguide OADM fabricated by the direct bonding technique. The length of the optical circulator was about 400 μm and that of the

Bragg reflector was just 180 µm. These were aligned so that whole elements were fully integrated and covered by Above is a configuration for the add-drop operation with one wavelength channel (band). By cascading the circulators and Bragg reflectors having different reflection wavelengths alternately, an add-drop operation can be achieved for several wavelength channels (bands).

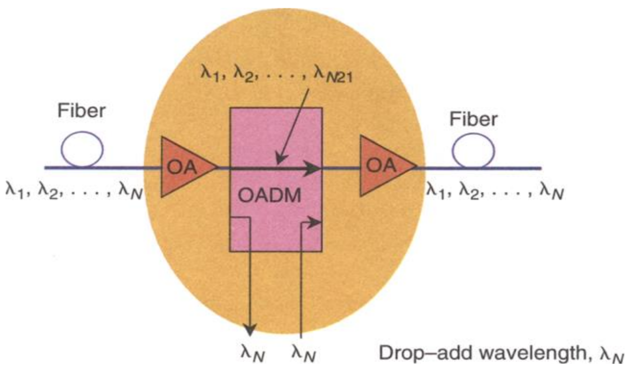

Figure 3 The main function of an optical drop-add multiplexer is to selectively remove a wavelength and add the same wavelength in the fiber (OAs are optional).

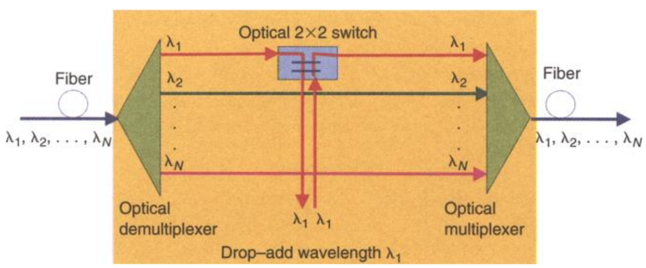

Figure .4 The main function of an optical drop-add multiplexeris to selectively remove a wavelength and add the same wavelength in the fiber.

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V. LITERATURE SURVEY

Keita Kato, Yuya Shoji, and Tetsuya Mizumoto," OADM Integrating Silicon Wave guide Optical Circulators And Bragg Reflector" (2015) –

An optical add-drop multiplexer (OADM) is demonstrated by integrating silicon waveguide optical circulators and a wave guide Bragg reflector. Two magneto-optical circulators and one vertical groove grating Bragg reflector is successfully integrated on a silicon-on-insulator plat form to achieve optical add and drop operations with a 10-nm wavelength band. We fabricated a silicon waveguide OADM integrating two optical circulators and a wave guide Bragg reflector. The optical add and drop operations were achieved for a 10-nm wavelength band. [01]

Y. Shoji and T. Mizumoto, "Magneto-optical non-reciprocal devices in silicon photonics," (2014) –

A four-port optical circulator based on a Mach– Zehnder interferometer is fabricated in a silicon nanowire waveguide. A magneto-optical garnet is directly bonded to the silicon waveguide using a surface activated bonding technique. Four-port circulator operation is demonstrated with a maximum isolation of 15.3 dB at a wavelength of 1531 nm. We fabricated a Mach-Zehnder interferometer-based silicon nanowire waveguide optical circulator employing a magnetooptical nonreciprocal phase shift. Circulator performance is demonstrated for all four input/output port combinations with a maximum isolation of 15.3 dB at a wavelength of 1531 nm. This is, to the best of our knowledge, the first demonstration of a silicon waveguide optical circulator.[02]

K. Mitsuya, Y. Shoji, and T. Mizumoto, "Demonstration of a silicon waveguide optical circulator" (2013) –

Silicon waveguide optical non-reciprocal devices based on the magneto-optical effect are reviewed. The non-reciprocal phase shift caused by the first-order magneto-optical effect is effective in realizing optical non-reciprocal devices in silicon waveguide platforms. In a silicon-on-insulator waveguide, the low refractive index of the buried oxide layer enhances the magneto-optical phase shift, which reduces the device footprints. A surface activated direct bonding technique was developed to integrate a magneto-optical garnet crystal on the silicon waveguides. A silicon waveguide optical isolator based on the magneto-optical phase shift was demonstrated with an optical isolation of 30 dB and insertion loss of 13 dB at a wavelength of 1548 nm. Furthermore, a four port optical circulator was demonstrated with maximum isolations of 15.3 and 9.3 dB in cross and bar ports, respectively, at a wavelength of 1531 nm. Optical non-reciprocal devices developed on silicon waveguide platforms were reviewed. The magneto-optical effect plays an important role to obtain an optical non-reciprocal function. Two different approaches, deposition and bonding, were investigated for integrating a magneto-optical garnet on a silicon waveguide. Compared to state-of-the-art deposition techniques, the bonding technique is advantageous because a single-crystalline magneto-optical garnet containing a large Faraday rotation can be used. This reduces the required magneto-optical interaction length. We developed the surface activated direct bonding technique to integrate a magneto-optical garnet on a silicon waveguide. As a surface activation process, it was shown that the oxygen or nitrogen plasma irradiation was effective for bonding a garnet on a silicon waveguide. This technique was applied to fabricate an MZI silicon waveguide optical isolator and circulator that use the magneto-optical phase shift. The low refractive index of a buried oxide layer enhances the magneto-optical phase shift in an SOI waveguide. [3]

Stylianos Sygletos, Simon Fabbri and Filippe Ferreira, "All-optical add-drop multiplexer for OFDM signals" (2015) –

We summarize our research work on the design and development of an add-drop multiplexer for spectrally overlapping OFDM signals. The standard node functions of sub-channel drop, extraction and insertion were obtained whilst the signals remained fully in the optical domain. Numerical simulations have been carried out to identify the main sources of degradation and to benchmark the architectural performance against critical design parameters, whereas the experimental demonstration of the scheme has been achieved for both single quadrature and dual quadrature signals. The reported scheme enables a fully flexible node compatible with future terabit per second super-channel transmission. [04].

Xian Xiao Xiangdong Li Xue Feng Kaiyu Cui Fang Liu Yidong Huang, "Eight-Channel Optical Add-Drop Multiplexer With Cascaded Parent-Sub Microring Resonators" (2015) –

An eight-channel integrated optical add-drop multiplexer with cascaded parentsub microring resonators is experimentally demonstrated on a silicon-on-insulator (SOI) substrate. Through thermal tuning, each channel can be independently switched between the adding and dropping states. The measured thermal tuning efficiency is 0.15nm/mW. Typically, all eight channels can be multiplexed and de-multiplexed with a 2.6-dB drop loss, a 0.36-nm bandwidth (> 40 GHz), and a 20-dB channel crosstalk. Moreover, the scheme to increase the number of operating channels is also discussed. [05]

VI. CONCLUSION

In this paper discuss brief summery of optical add drop multiplexer (OADM) and its properties. OADM is important part WDM communication. OADM is importance is shown in the paper.

In future implement the OADM in the MATLAB software and test the characteristics of OADM. Analysis properties of OADM on the basic of different length of FBG.

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