



Broadband Wavelength Filter Device using Sidewall Grating for Filtering Optical Signals

IITM Technology Available for Licensing

Problem Statement

- Generally, the Silicon-on-Insulator waveguides has a compact design and prominent wavelength dependent characteristics with sub-wavelength grating which makes the SOI waveguides sought after in many applications.
- Further many SOI waveguides are used like multilayer interference filters. In conventional filters, the fundamental mode of the optical signal is passed along with the **unwanted** higher order modes, leading to **loss of power & causing signal interference**.
- In conventional DBR filters broad band pass wavelength response is not possible.
- Hence, there is a need to address above issues in efficient manner.

Technology Category/ Market

Technology: Broadband Wavelength Filter Device with grating structure;

Industry: Electronic Hardware, ICT, Photonics;

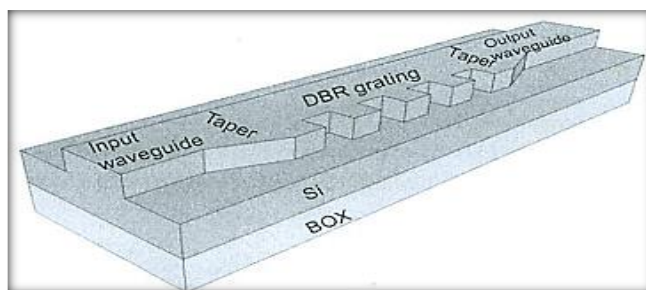
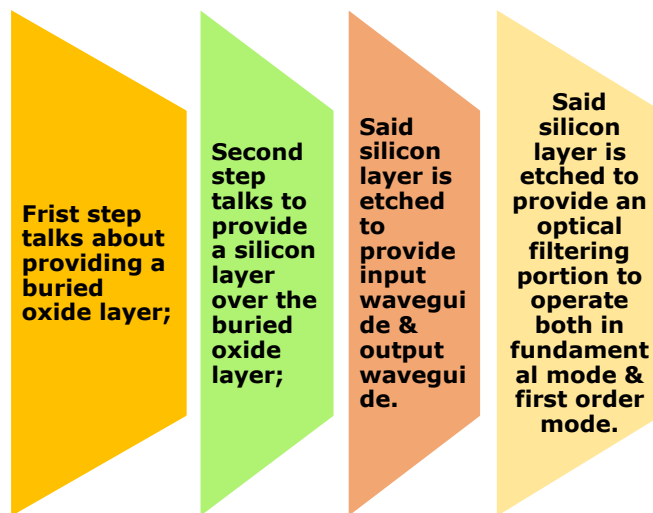
Application: Semiconductor, Optoelectronics;

Market: The global filter market by wavelength is projected to reach **\$158.76B** by **2030**, at a **CAGR** of **8.22%** during (2023-2030)

Technology

- Present invention describes a **Broadband wavelength filter device**, and a **method for fabricating** said broadband wavelength filter device for **filtering optical signals**.
- Said broadband wavelength filter device comprises a **buried oxide layer**, a **silicon layer over the buried oxide layer**;
- Moreover, said silicon layer comprises an **input & output waveguide** and an **optical filtering portion** and input & output taper region.
- Said Input waveguide and output waveguide is used to operate in a **fundamental mode of transverse electric** (TE) field.
- Further, the optical filtering portion is to operate in the fundamental mode and a first order mode.
- Input & output taper region filters out higher order leaky modes leading to remove **loss of power & signal interference**.

- The below smart chart along with figure describes the steps involved in the proposed method for **fabricating** a broadband wavelength filter device for filtering optical signals. (Refer Figs.2 & 3)



Intellectual Property

IITM IDF Ref. 1466; Patent No:410136; PCT Application No. PCT/IN2017/050403

TRL (Technology Readiness Level)

TRL-2/3, Proof of concept tested in Lab;

Research Lab

Prof. Bijoy Krishna Das,
Dept. of Electrical Engineering

CONTACT US

Dr. Dara Ajay, Head
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
<https://ipm.icsr.in/ipm/>

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

Key Features / Value Proposition

❖ Technical Perspective & Industrial Perspective:

- Provide a broadband wavelength filter device, & the waveguide structure over the buried oxide (SiO₂) is **unique** & it comprises multimode waveguide, wherein the distributed Bragg grating (DBR) structure describes the **optical filtering portion** which is **configured** in between **two** single mode **input, & output waveguides**. (Refer Fig. 1)
- Using **sidewall grating** for filtering optical signals.
- Provide an optical filtering portion in the broadband wavelength filter device, with periodic perturbations on one side such that the **optical filtering portion** supports at least **two modes** i.e., **a fundamental mode & a first order mode**, which couples back with **forward propagating fundamental mode thus resulting broadband filter response**. However, propagating further in **backward direction**, it travel through taper region followed by single mode input waveguide, hence **removing higher order leaky mode** which in turn remove interference & signal cluttering. Hence, facilitates said device **to filter higher order leaky modes**.
- Advantageous in **obtaining all the power in the fundamental mode** of the transverse electric mode & neglects the power in the first order mode.
- Applicable as a broad band pass wavelength filter in an **on chip optical WDM networking system/Raman spectroscopy**.

Image

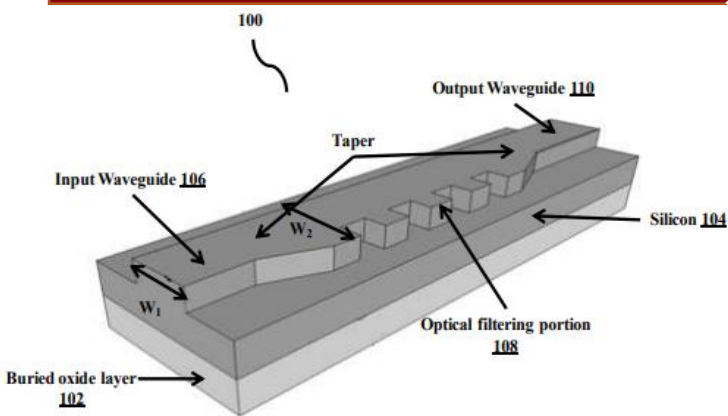


Fig. 1 : Illustrates a broadband wavelength filter device with reference;

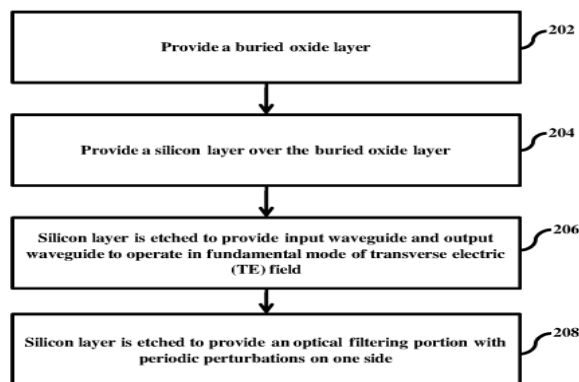


Fig. 2: depicts a flow chart illustrating a method for fabricating a broadband wavelength filter device;

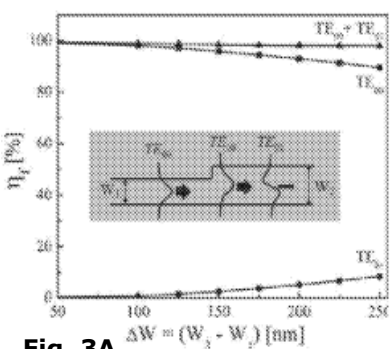


Fig. 3A

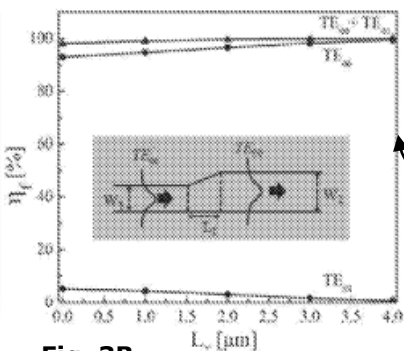


Fig. 3B

FIG. 3A & FIG. 3B (Left): Depict graph illustrating variations of power coupling efficiency of the forward propagating fundamental mode, the first order mode with respect to ΔW ; **Fig. 3b:** Depict graph illustrating variations of power coupling efficiency of the forward propagating fundamental mode, & the first order mode with respect to taper length L_T ;

CONTACT US

Dr. Dara Ajay, Head
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
<https://ipm.icsr.in/ipm/>

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719