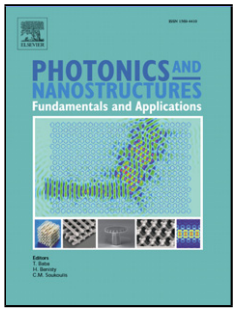

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Design of novel SOI 1x4 optical power splitter using seven horizontally slotted waveguides

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Highlights

- We demonstrate a compact silicon on insulator (SOI) 1x4 optical power splitter using seven horizontal slotted waveguides.
- The 1x4 splitter was designed by using full vectorial beam propagation method (FV-BPM) simulations.
- The energy of the optical signal at a 1.55µm can be split after a propagation length of 14.5µm with equal energy in each port.
- Numerical investigations show that this device can work across the whole C-band (1530 – 1565nm) with excess loss better than 0.23dB.

Abstract

In this paper, we demonstrate a compact silicon on insulator (SOI) 1x4 optical power splitter using seven horizontal slotted waveguides. Aluminum nitride (AIN) surrounded by silicon (Si) was used to confine the optical field in the slot region. All of the power analysis has been done in transverse magnetic (TM) polarization mode and a compact optical power splitter as short as 14.5µm was demonstrated. The splitter was designed by using full vectorial beam propagation method (FV-BPM) simulations. Numerical investigations show that this device can work across the whole C-band (1530 – 1565nm) with excess loss better than 0.23dB.

Keywords: Slot-waveguide; SOI; FV-BPM.

1. Introduction

Silicon (Si) photonics have become a significant subject of research and growth in the understanding of micrometer and nanometer scale optoelectronic devices. It allows low-cost optical devices by using common semiconductor fabrication techniques and their relatively simple integration with microelectronic chips [1]. Hence, control of light with Si-based photonic devices has been attracted much attention over the last years [2]. This remarkable advance in Si photonics will make it possible to design and fabricate new devices based on high index contrast material using silicon on insulator (SOI) technology [3, 4]. A very important feature of SOI devices is the capability to fabricate and the compatibility to the common complementary metal oxide semiconductor (CMOS) technology [5, 6].
Splitters are one of the most elementary building elements of photonic integrated circuits (PIC). Quality and compact optical power splitters are the key to implementation of an effectual PIC on optical chip. Diverse splitters based on multimode interference (MMI), Y-junction, photonic crystal and grating have been reported [7-13]. The unique structure of the slot waveguide received an increasing interest since it was