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Design of 1xN MMI power and wavelength splitters/couplers based on slot silicon waveguide structures

A slot-waveguide is a unique structure that enables light to be strongly confined and guided inside a narrow nanometer-scale region of low index material that is surrounded by two layers with high index material. Using this unique structure leads to a variety of advantages such as small beat length of the guided light and strong confinement in the slot region that results in extremely low losses. Choosing a slot material with lower-index value leads to a stronger confinement inside the slot region. However, a multimode interference (MMI) demultiplexer component with closer spacing between ports is very sensitive to the variation of the optical signals in the C-band (1530-1565 nm), which can influence the MMI coupler size and the performance. To overcome this problem, we choose Gallium nitride (GaN) as the slot material. GaN has a low-index value compared to Si material and is also high-index value compared to alumina or silica. Thus, the MMI demultiplexer component based silicon (Si)-GaN slot waveguide is not very sensitive to the variation of the effective refractive index that lead, the ability to separate closer wavelengths in the C-band inside the MMI coupler with good performances. We propose a novel 8-channel wavelength MMI demultiplexer in slot waveguide structures that operate at 1530 nm, 1535 nm, 1540 nm, 1545 nm, 1550 nm, 1555 nm, 1560 nm and 1565 nm. Gallium nitride (GaN) surrounded by silicon (Si) was found to be a suitable material for the slot-waveguide structures. The proposed device was designed by seven 1x2 MMI couplers, fourteen S-band and one input taper. Simulation results show that the proposed device can transmit 8-channel that works in the whole C-band (1530-1565 nm) with low crosstalk ((-19.97)-(-13.77) dB) and bandwidth (1.8-3.6 nm). Thus, the device can be very useful in optical networking systems that work on dense wavelength division multiplexing technology.

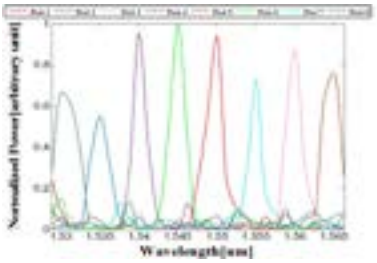

Figure1: Normalized power as function of the operated wavelengths.

Biography

Dror Malka received his BSc and MSc degrees in Electrical Engineering from Holon Institute of Technology (HIT), Israel in 2008 and 2010, respectively. He has also completed a BSc degree in Applied Mathematics at HIT in 2008 and received his PhD degree in Electrical Engineering from Bar-Ilan University (BIU) in 2015, Israel. Currently, he is a Lecturer in the Faculty of Engineering at HIT. His major fields of research are Nanophotonics, Super-resolution, Silicon Photonics and Fiber Optics. He has published around 21 refereed journal papers, 20 conference proceeding papers, and 2 book chapters.

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