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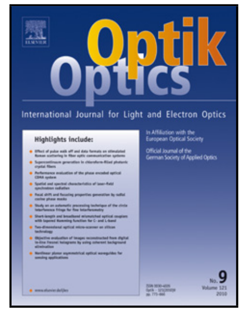

Title: Two-dimensional Photonic Crystal Slabs as a Tunable Polarization Mode Converter

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Two-dimensional Photonic Crystal Slabs as a Tunable Polarization Mode Converter

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Two dimensional photonic crystal slabs with elliptical holes exposed to the normal incident laser light are proposed and designed as a tunable broadband polarization rotator. The photonic crystal electric field mode due to the eccentricity and orientation of the holes will provide a mean to exchange power between two orthogonal polarization states. Around guided resonance wavelengths of photonic crystals with 45 degree oriented elliptical holes, 20% polarization mode conversion are achieved. By tuning of the difference of the two radii of the elliptical holes we are able to span a bandwidth of 130 nm and 70 nm around wavelengths of 1445 nm and 1650 nm. The unique properties of these devices such as ease of engineering and simplified light coupling scheme will make them a promising polarization mode converter in high speed polarization-multiplexed optical transmission systems.

Keywords: Integrated Optics, Photonic Crystals, Polarization

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Sending data using two orthogonal light polarizations of optical career through optical fiber links is a common method in high speed optical communication. Terabit/s class data transmission using polarization-multiplexed quadrature phase shift keying is becoming a common standard in recent years [1]. Usually polarization rotation of half of the output signal from the transmitter chip is conducted externally before combining the two orthogonally polarized signals to the fiber. Research and development on photonic integrated devices is an ongoing effort to miniaturize and bring more devices to the chip, and enhance the performance of these communication systems [2]. Two dimensional (2D) semiconductor photonic crystals (PCs) as a strong candidate are realized by creating nano-scale holes in periodic fashion on a semiconductor slab. These structures are widely studied and their applications range from optical imaging and nano-bio-sensing to optical communication [3-7]. Both planar and out-of-plane light coupling to these nano and micro-devices are widely studied and their usage for resonant cavities of tele-communication lasers, photonic crystal waveguides, optical filters and multiplexing systems are demonstrated [7]. Considering out-of-plane light coupling, the guided modes above the light line of the band structure for these devices can couple to radiation modes and possess a finite