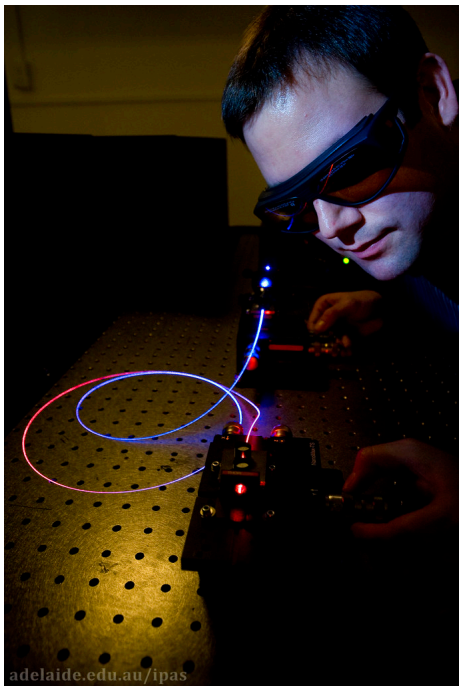
On-chip waveguide optical isolator

Unmet Need

Optical isolators are critically important in many applications in optical systems. Optical isolators are devices that transmit light in only one direction. They are used to avoid unwanted back-propagation of light, for example, to avoid destabilization of semiconductor lasers caused by reflected light coming back into the laser cavity. Conventional optical isolators are based on a Faraday rotator sandwiched between two polarizers. Because of the size of the Faraday rotator, this type of optical isolator is relatively large. It is also a challenge to build Faraday rotator-type isolator components in guided-optics format, i.e. to integrate them on a chip. In order to construct guided-wave optical isolators, an asymmetric Mach-Zehnder waveguide interferometer is commonly used. This optical isolator does not require polarizers, but instead uses high-precision interference for blocking back-propagating light involving two long waveguides hosting reciprocal and non-reciprocal phase shifters. Therefore there is a need for an improved single-waveguide optical polarizer design that is compatible with integrated nanoscale optical circuitry.

Technology

Duke researchers have designed a novel optical isolator constructed on a single-mode waveguide that uses magneto-optic materials to create a non-homogenous waveguide cross-section. The scheme of rejecting reverse-propagating waves is based on a direction-dependent waveguide cut-off frequency. The resulting optical isolator is compact and exhibits high reverse isolation in the bandwidth between the lowest forward- and backward- cutoff frequencies of the waveguide. The configuration of the magneto-optical medium distribution can also be optimized to the desired mode profile. Please also see the related technology



T-003887.

Advantages

- High level of optical isolation
- Single-mode waveguide design suitable for on-chip integrated optical circuits
- Simple low-cost design

Duke File (IDF) Number

IDF #:T-003063

Meet the Inventors

Yoshie, Tomoyuki
Drezdzon, Samuel
Tang, Lingling "Lingling"

Department

Electrical & Computer Engineering (ECE)

Publication(s)

...