

Invited paper

Optical Isolator for Silicon-on-Insulator Circuits

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Abstract

An optical isolator is fabricated for silicon-on-insulator circuits. The isolator, which employs a nonreciprocal phase shift in a Mach-Zehnder interferometer, is fabricated by directly bonding a magneto-optic garnet on a Si waveguide. A maximum isolation of 21 dB is obtained at 1559 nm.

Extended Abstract

An optical isolator plays an essential role in protecting optical active devices from unwanted reflections. The optical isolator compatible to silicon-on-insulator (SOI) circuits has never been realized. We fabricated the isolator on an SOI wafer for the application to silicon photonic circuits. The isolator employs a nonreciprocal phase shift in a Mach-Zehnder interferometer. The device is fabricated in a 300-nm-thick Si guiding layer with a rib waveguide structure. To provide the nonreciprocal function, a magneto-optic garnet, Ce:YIG, is directly bonded on the Si rib waveguide using a surface activated direct binding technique. It is important to conduct the process in a temperature as low as 250 oC for circumventing the problems associated with mismatch in thermal expansion between silicon and garnet. A maximum isolation of 21 dB is obtained for TM mode at 1559 nm.



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Tetsuya Mizumoto received the Dr.Eng. degree in electrical engineering from Tokyo Institute of Technology in 1984. He became a Research Associate, an Associate Professor, at Tokyo Institute of Technology, in 1984 and 1987, respectively. Currently, he is a Professor with Graduate School of Science and Engineering, Tokyo Institute of Technology. His research has been mainly concerned with waveguide optical devices, especially magneto-optic devices and all-optical switching devices based on the 3rd-order nonlinearity. Dr. Mizumoto received the Treatise Award in 1994, and the Best Letter Award of Electronics Society Transactions in 2007, from the Institute of Electronics, Information and Communication Engineers.