

Press Information

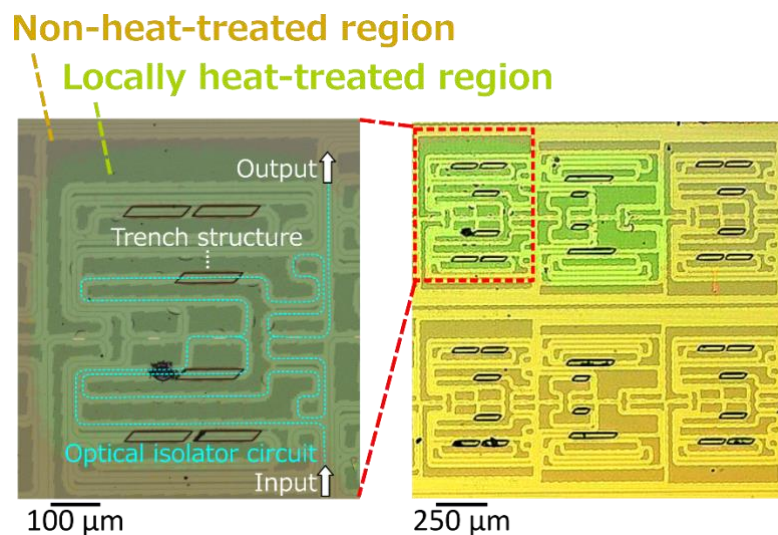
World's first: Kyocera and Tohoku University develop technology to integrate optical isolators directly onto silicon photonics chips

Isolator-integrated photonics chip reduces back-reflected light approximately 95%, enabling faster, energy-efficient AI data centres.

Kyoto/London, 8th October 2026. Kyocera Corporation and the Research Institute of Electrical Communication (RIEC), Tohoku University have developed a new technology¹ for integrating optical isolators onto silicon photonics chips using "laser annealing", a localized, laser-based heat-treatment method.

An optical isolator is a component that stabilizes optical communication by allowing optical signals to be transmitted in only one direction, reducing signal reflection.

A paper summarizing these results was published on 2 September, 2026, in "IEEE Access", an academic journal issued by the Institute of Electrical and Electronics Engineers (IEEE).



Microscopic image of the optical isolator fabricated and integrated onto a silicon photonics circuit by laser annealing

¹ For technology that integrates an optical isolator into a silicon photonics circuit using a laser annealing method; according to Kyocera research, July 2026.

Development background

As generative AI and related technologies place unprecedented demand on global data networks, silicon photonics² offers a solution for faster and more energy-efficient data centres. The expansion of silicon photonics is fuelling demand for technologies enabling Co-Packaged Optics (CPO), which integrate optical and electronic circuits within the same semiconductor package to minimize signal paths, signal loss and power consumption.

In optical circuits, light reflected back into the laser light source degrades performance. Optical isolators, which suppress reflected light, can overcome this challenge. The next generation of compact, integrated optical circuits incorporating CPO technology will require optical isolators that can be fabricated directly onto silicon photonics chips.

Optical isolators typically use a crystalline material known as “magneto-optical garnet”. To function as an optical isolator, this material requires heat treatment at approximately 600 °C or higher. However, heating the entire silicon photonics chip to this temperature can damage electrodes, wiring and other on-chip elements. Finding a way to selectively heat-treat only the magneto-optical garnet without overheating other areas of the chip has remained a significant challenge.

To address this challenge, Kyocera and Tohoku University developed a monolithic integration technology³ that directly fabricates optical isolators onto silicon photonics chips through a “laser annealing” process, in which a laser beam is applied locally to the areas of the chip requiring heat treatment. Kyocera and Tohoku University demonstrated the device’s operation.

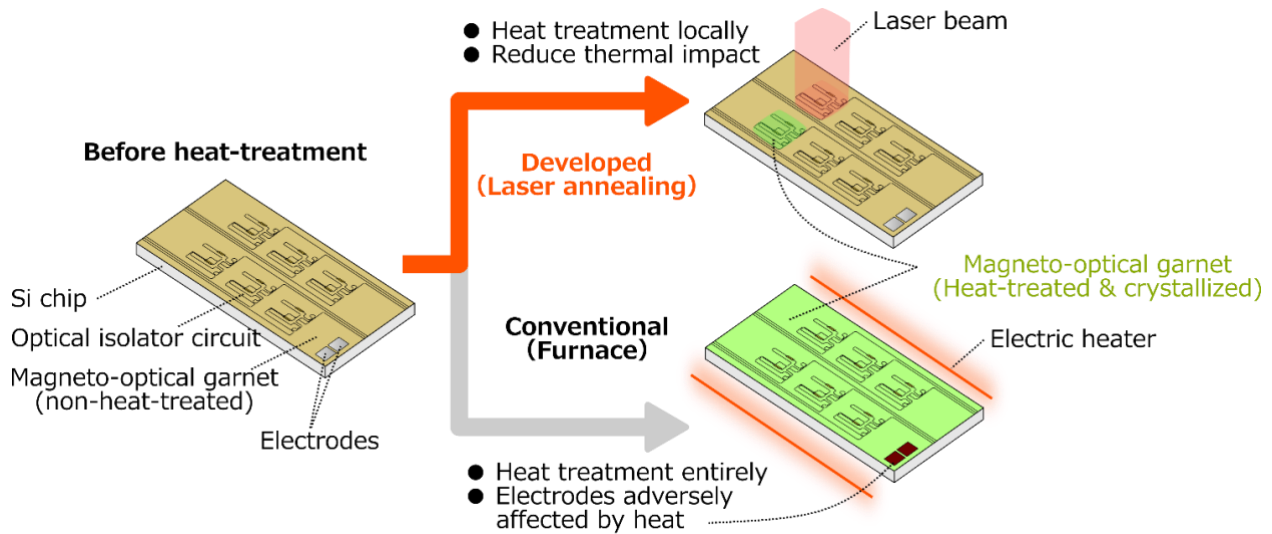
Features

1. Localized laser heating enables heat treatment of magneto-optical garnet without damaging the silicon photonics chip

A near-infrared laser beam is applied only to an optical isolator circuit region measuring approximately 700x700 microns (µm), where the magneto-optical garnet film has been deposited, causing it to crystallize with the properties needed to suppress reflected light. Unlike conventional methods that heat the entire chip in a furnace, this approach virtually eliminates thermal impact on the surrounding optical circuits and electrodes.

² Silicon photonics: A technology that forms optical circuits on silicon, a semiconductor material, and uses optical instead of electrical signals to transmit and process information.

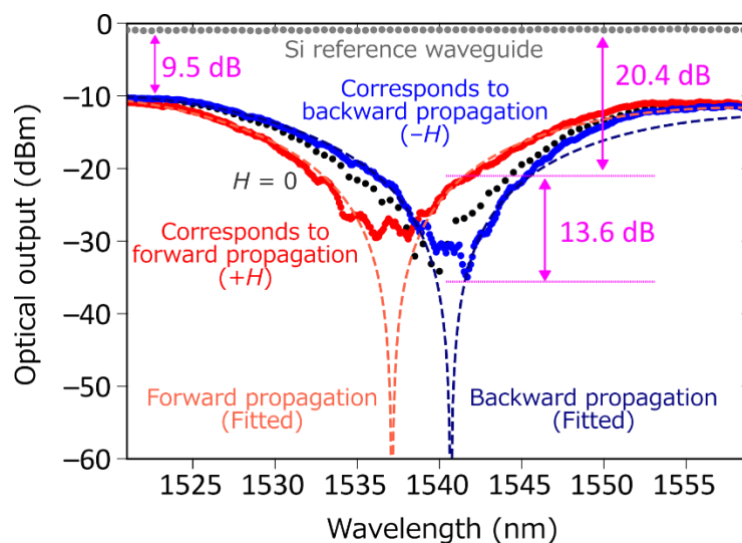
³ Monolithic integration technology: A technology that integrally forms multiple functional elements on the same substrate.



Features of the developed technology (laser annealing)

2. Optical isolator test on silicon photonics chip

Using this technology, the research team fabricated a device with a structure that utilizes light interference and experimentally demonstrated its operation as an optical isolator. In the experiment, the team compared the optical output corresponding to signal light, or forward propagation, with that corresponding to back-reflected light, or backward propagation. The results confirmed an isolation ratio of 13.6 dB in the optical communication wavelength range, reducing back-reflected light by approximately 95%. Electron microscopy also confirmed that the magneto-optical garnet in the laser-irradiated area had crystallized well on the silicon waveguide.



Optical isolator test results

Future development

Kyocera and Tohoku University have previously worked together to develop related optical isolator technologies that can be integrated onto optical circuits.⁴ To commercialize these technologies, the two organizations aim to achieve even lower loss, higher efficiency and improved productivity for mass production. They will continue to advance their collaboration and contribute to the development of an efficient and sustainable information society.

Paper information

Journal	IEEE ⁵ Access
Title	Monolithic magneto-optical Mach-Zehnder isolator using laser-annealed iron garnet on a silicon waveguide
Authors	Tomoya Sugita, Reona Motoji, Yuki Yoshihara, Dan Maeda, Hiroki Yamamoto, Hibiki Miyashita, Kazushi Ishiyama, Taichi Goto
DOI	10.1109/ACCESS.2026.3729586 (https://doi.org/10.1109/ACCESS.2026.3729586)

The press material is available for download via the following link:

<https://spgroup.box.com/s/8d6tgvpzndmxz2klt8arwxrof1h0v34d>

⁴ Prior joint research result (T. Sugita *et al.*, “Nanocomposite Garnet-Enabled Monolithically Integrated Magneto-Optical Isolator Using an Asymmetric Mach-Zehnder Interferometer,” *ACS Appl. Opt. Mater.*, vol. 4, no. 6, pp. 1813–1820, Jun. 2026, doi: [10.1021/acsaom.6c00176](https://doi.org/10.1021/acsaom.6c00176)).

⁵ IEEE is a registered trademark of The Institute of Electrical and Electronics Engineers, Incorporated.



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About Kyocera

Kyocera has been successful in Europe for over 50 years. From its European headquarters in Esslingen am Neckar, KYOCERA Europe GmbH operates 27 sites including manufacturing facilities, with products ranging from fine ceramics, automotive, semiconductor and optical components to components for medical products, industrial tools, LCDs, touch solutions, industrial printing components, and consumer goods such as kitchen and office products.

KYOCERA Europe GmbH is a company of the [KYOCERA Corporation](https://www.kyocera.com) headquartered in Kyoto/Japan, a renowned supplier in semiconductor, industrial and automotive components as well as electronic components, printing and multifunction systems, smart energy systems, and communications technology. Kyocera is one of the most experienced technology producers, with more than 65 years of industry expertise. The Kyocera Group comprises 279 subsidiaries (31 March 2026). With around 73,800 employees, Kyocera generated net annual sales of around EUR 11.83 billion in the 2025/2026 fiscal year.

Kyocera is ranked 1,123 on Forbes magazine's 'Global 2000' list for 2025 and ranked as 'The 100 Most Sustainably Managed Companies in the World' according to the Wall Street Journal. For the fourth time Kyocera has received an A ranking on the CDP A List for their performance on climate change. Kyocera has also received a silver rating in the EcoVadis Sustainability Survey and was acknowledged as a 'Top 100 Global Innovator 2026' for the tenth time by Clarivate, being one of the world's leading innovators.

Kyocera also takes an active interest in cultural affairs. The Kyoto Prize, a prominent international award, is presented each year by the Inamori Foundation – established by Kyocera founder Dr Kazuo Inamori – to individuals worldwide who have contributed significantly to the scientific, cultural, and spiritual betterment of humankind (equivalent to approximately €539,000 per prize category).

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