A Proposal for Technique of Light-Induced Self-Written Waveguide Formation Using a Lasing Mechanism

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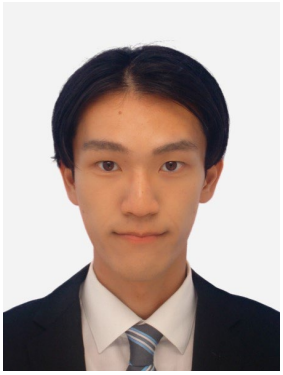
Optical connecting between a fiber and a semiconductor photonic device like a silicon photonics device requires super precise optical alignment, which makes the packaging cost of silicon photonics devices very expensive. We have been studying an automated optical connecting technique using a light-induced self-written waveguides which is formed using photo-curable resin. This technique gives high tolerance for optical axis misalignment and has a potential to omit an active alignment in the connecting process[1)].

In this paper, we propose a novel fabrication method for light-induced self-written waveguides which is based on a mechanism of laser oscillation. The fabrication system is comprised of a laser resonator, which is composed of a gain chip (active material whose one end is coated by high reflection coating) and a fiber loop mirror, and the optical connection point is placed inside the laser resonator. The waveguide is automatically started to form only when the optical alignment is ensured and the laser oscillation occurs. The proposed method can achieve a genuine passive optical alignment.

We experimentally demonstrated the proposed method in a fiber-to-fiber connection for the telecom wavelength (λ = 1600 nm). In the experiment, we continuously injected current to the gain chip, and we first confirmed that the light-induced self-written waveguide was not formed when the optical axes of the fibers were not matched due to the non-lasing condition. The optical output under the non-lasing condition was -15.5 dBm, which was lower than the threshold of the photo-curable resin. When the optical axes were matched and the lasing condition was ensured, the optical output was increased to -1.8 dBm and the waveguide was started to formed as we expected.

References 1) H. Terasawa et.al., Journal of Lightwave Technology, **39**, 7472 (2021).



Short biography:
Shun Watanabe graduated from the University of Tochigi in March 2024. He went on to pursue a master's degree at the same university. He is a member of JSAP. His research topic is SiPh.