

Research on 3D waveguide fabrication technology for connection with multi-core-arranged fiber

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Multi-core-arranged fiber (MCF) is highly researched and developed to increase the transmission capacity per optical fiber. The purpose of this work is to connect the MCF and the optical mode switch [1], that our laboratory is developing, and we propose a connection method using a 3D waveguide (Fig. 1).

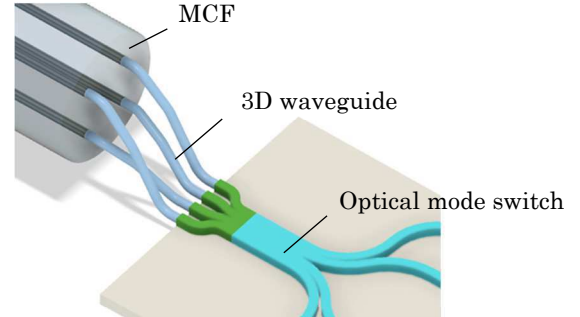


Fig.1 3D waveguide

The 3D waveguide means the waveguide where cores are freely arranged in a lateral and perpendicular direction, and this is the technology for connecting the outputs of multiple optical mode switches arranged in a lateral direction and the core position of the MCF directly. However, optical axis alignment is a problem in optical connection technology, and its accuracy is required to be 1 μm or less [2].

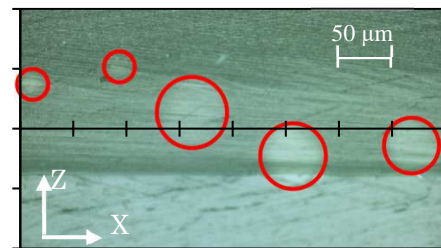


Fig.2 Cross section of the first waveguide

We have focused on the mosquito method as a fabrication method for 3D waveguide and developed 3D waveguide fabrication machine. The fabrication machine consists of a stepping motor and a reed screw, and the expected mechanical resolution is 0.78 μm .

However, there was a misalignment of about 26 μm in the X direction and about 32 μm in the Z direction on the cross section of the first prototype waveguide, and the misalignment of the waveguide was a problem (Fig.2).

To verify the reason, we improved the method of fixing the syringe and needle used to discharge the core monomer. As a result, it was clarified that the misalignment in the X direction was reduced by 18 μm (Fig.3).

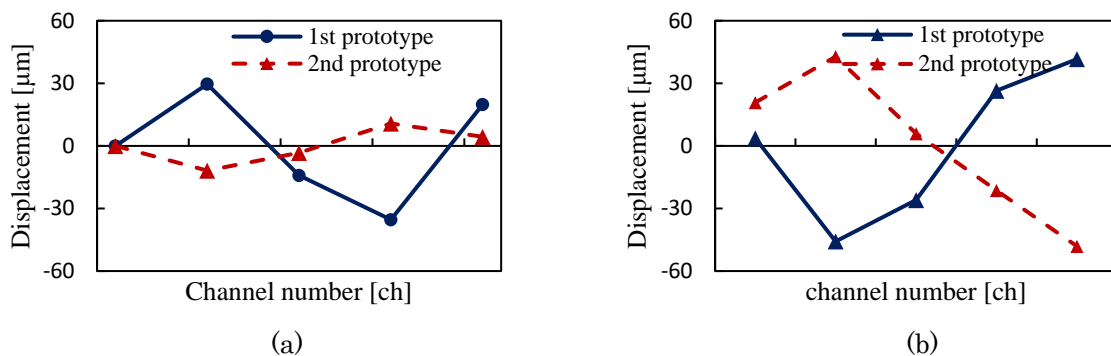


Fig.3 Displacement of core position. (a) X-direction (b) Z-direction

【References】

- [1] Kiichi Hamamoto et al, IEICE Elec., J100-C, 72 (2017).
- [2] J. R. Stern and R. B. Dyott, Electron. Lett., 7, 52 (1971).
- [3] K. Yasuhara et al, Optics Express, 25, 8524 (2017).