

2D Fiber Arrays

— W O P —

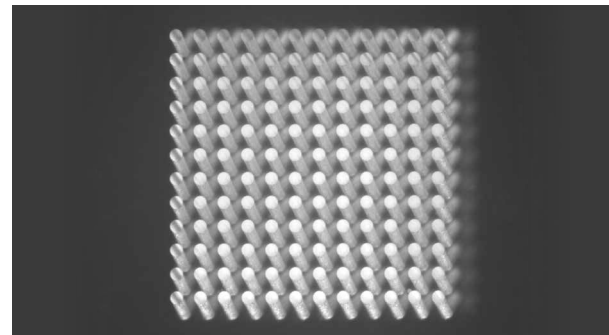
- Tight tolerances
- Tight positional accuracies
- Well-controlled alignment

Technological achievements in optical fiber alignment arrays

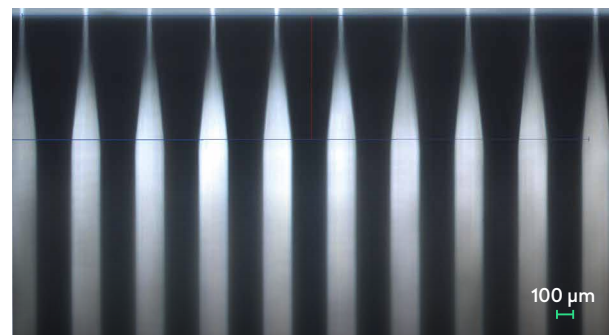
The demand for fiber alignment structures is steadily increasing due to the growing need for high-speed and reliable optical communications systems.

The most common application of fiber alignment arrays includes Co-Packaged Optics (CPO) and other optical communications systems addressing growing challenges around bandwidth density, communication latency, and speed.

The WOP solution enables reaching excellent precision in the fabrication of 2D fiber arrays, resulting in low-loss, high-speed, large-capacity communication.



144 channel fiber alignment plate



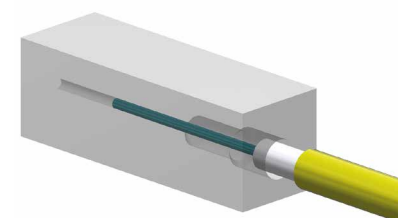
2D optical fiber arrays

Laser technology for ultra-fast communication

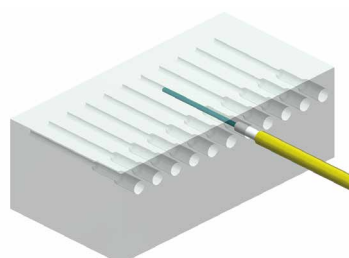
While there are one-dimensional (1D) and two-dimensional (2D) arrays, the need for speed and the growing volume of data drive demand for 2D fiber arrays.

The main reasons are:

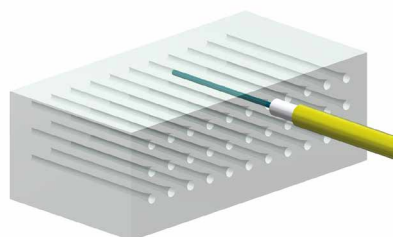
- 2D fiber arrays hold fibers in a matrix arrangement (rows × columns), unlike conventional 1D fiber arrays (fibers in a single row, e.g., 12 or 16 channels).
- Allows hundreds of fibers to be packed in a dense footprint, as they are precision glass plates with micron-scale holes or grooves, drilled and etched in 2D.
- Made from fused silica or high-purity borosilicate glass, due to its low CTE and dimensional stability.



One hole example with SMF fiber



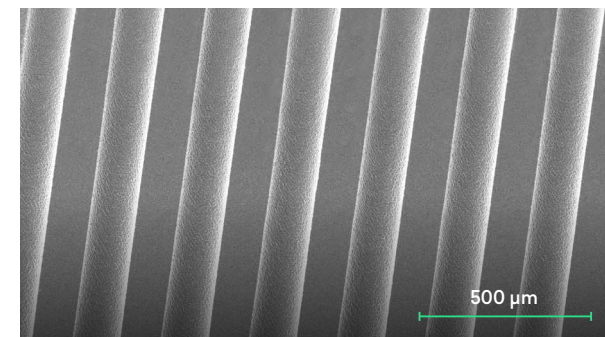
1D Alignment array with SMF fiber



2D Alignment array with SMF fiber

The production process of 2D optical fiber arrays is more complex than that of 1D arrays.

While 2D arrays can be fabricated using diverse techniques, WOP utilizes femtosecond laser micromachining, followed by selective laser-induced etching (SLE), which demonstrates definite advantages in precision, consistency, speed, material versatility, and cost-effectiveness.

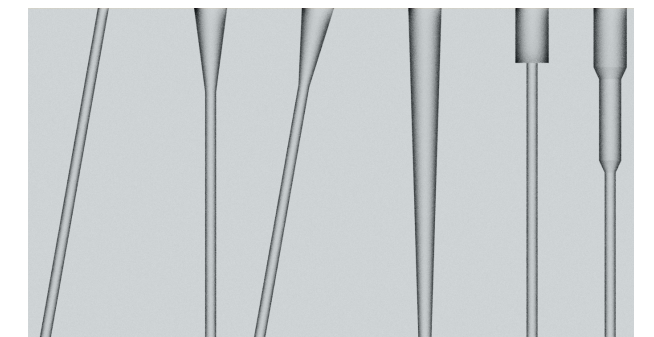


2D fiber arrays, 8° angle, side view

Using this laser micromachining method, critical features such as tight tolerances, tight positional accuracies, also hole diameter, within the tolerance of $\pm 0.5 \mu\text{m}$, can be achieved.

This tight control of metrics ensures well-controlled alignment, thus reducing insertion loss and providing good repeatability.

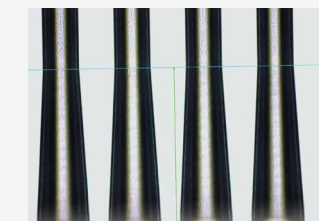
Moreover, this method enables shaping the hole entrance as a funnel, step profile, or with a conical taper for easy fiber insertion. The channels can be straight or angled (like 8°).



Possible holes entrances and angles

The advantages:

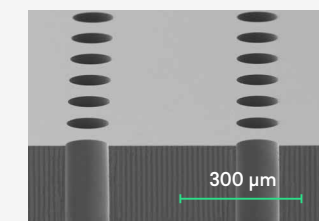
- Designed for standard SMF fibers, diameter 125/250 μm , also reduced clad fiber 80 μm (not limited to it).
- Ultra-high precision & quality results
- Tight tolerances within $\pm 0.5 \mu\text{m}$
- Straight, flared, or with a cone for easier fiber insertion
- High density, standard 0,25 mm pitch
- Straight or angled holes
- Ultrafast direct laser writing speed, suitable for high-scale production



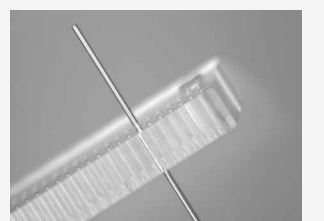
2D fiber arrays, flared



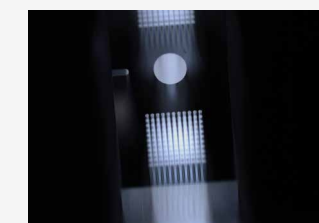
2D fiber arrays



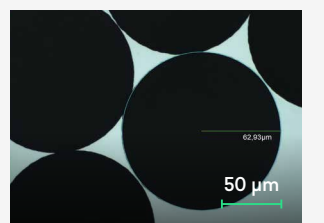
2D fiber arrays, cross-section



2D arrays with testing pin



High density 2D optical fiber arrays



2D fiber arrays, 127 μm

Flexible designs are available, with customizable hole sizes and pitch dimensions according to customer requirements.