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Pioneering 3D photonic integrated circuits

ENABLING HIGH-DENSITY OPTICAL SWITCHING

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With ever-increasing fiber density presenting challenges for optical switching manufacturers, novel fiber alignment solutions are needed to avoid optical losses without costs spiralling.

Offering the dynamic reallocation of bandwidth between dedicated devices at the physical layer, optical switching is key to ensuring flexible networking to meet today's high, disparate and fluctuating traffic demands. Yet high-performance switching is predicated on high-precision fiber alignment – a task made difficult when fibers and channels are necessarily becoming so densely packed.

Optical switching technologies, such as wavelength selective switches (WSS) and optical cross connect (OXC) modules, are regarded by the industry as key enabling technologies for next-generation high-capacity fiber-optic communication networks. For this reason, the optical switching market is booming, growing at a 10% CAGR and projected to exceed $10 billion by 2023.

Part of what is motivating this growth is the need for network flexibility in the face of the coming 5G revolution. 5G promises to change the way we live our lives, underpinning new services and user experiences like autonomous cars, mobile AR/VR and countless IOT applications. But it can only deliver on these promises with an underlying connectivity infrastructure capable of handling demands like massive machine connectivity, ultra -low latency and hyper-flexible bandwidth.

5G-enabling fiber

Playing a vital role in this will be photonic technologies. Optical fiber will be pervasive in 5G networks, transporting data to and from the masts directly, as well as handling the backhaul to the rest of the communications network. 5G networks require a substantially tighter mesh of radio base stations, with more cells resulting in a denser communications network. As a result, 5G will require increasing port densities and large-scale deployment of new high-speed optics.

Among many other challenges, this proliferation of 5G-enabling fiber demands more optical switching. Optical switches will act as aggregation points between the fronthaul and backhaul networks, helping to facilitate the adoption of software defined networks, allowing network service providers and data center operators to access and optimize all the systems within their optical transport networks, and dynamically reallocate bandwidth between dedicated devices at the physical layer to meet real-time demand.

This presents the industry with the tough task of developing even higher density devices than those used today. In OXC, for example, channel counts are already in the 1000+ range. And in WSS, relatively complex modules are being developed that go beyond conventional 1D (1 x N) arrays enabling more complex switching configurations.

Design freedom, cost, and performance

Avoiding losses in both of these high-density scenarios requires best-in-class precision fiber alignment. Fortunately, there is a new 2D hole array fabrication technique that provides such precision, while also solving a number of other challenges for optical switch manufacturers.

Optoscribe's laser-induced selective etching method is a two-stage microstructuring process, wherein subsurface 3D shapes can be rapidly patterned and then preferentially etched.

With this high-speed, high-precision, and highly scalable technique, high-density glass 2D hole arrays can be produced with tight control over positional accuracy of the fiber hole center (<0.5µm tolerances) and hole diameter, reducing losses.

What is more, the technique provides optical switch manufacturers with unprecedented design freedom in terms of the geometry of the fiber arrays. For example, 2D hole array thickness can be chosen depending on individual requirements, meaning arrays can be built from a single glass substrate, reducing assembly costs. And freeform 3D control means the hole shape and angle throughout the volume of the substrate can be modified to the needs of a given optical switch, even down to making fiber insertion easier by changing the shape and taper of the hole entrance.

Optoscribe has named the 2D glass precision fiber alignment structures resulting from its laser-induced selective etching method OptoArray™. At a time when innovative new high-density OXC and WSS designs are needed to meet industry and consumer demands for greater bandwidth, the combination of design freedom, reduced cost and improved performance makes OptoArray™ a key product to enable both today's evergrowing optical infrastructure, and that of the future.

About Optoscribe Ltd

Formed in 2010, Optoscribe uses its innovative laser direct write technology to manufacture glass-based photonic components primarily for the telecommunications and data communications markets. Optoscribe's technology allows for 3D waveguide formation and 3D laser induced selective etching with unprecedented design freedom.

Optoscribe's Precision Fiber Alignment Structures (OptoArray™) are capable of solving many of the challenges with the drive for high density optical connections.

The company is located in Livingston, UK, where it has a state-of-the-art manufacturing facility.

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For further information please contact us, details below

Optoscribe Limited
Rosebank Technology Park
Rosebank Road
Livingston
EH54 7EJ
United Kingdom

T: +44 (0) 1506 536000
E: sales@optoscribe.com
W: www.optoscribe.com