OPTOSCRIBE

Pioneering 3D photonic integrated circuits

THE DRIVE FOR LOW COST SINGLE MODE TRANSCEIVERS

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Data center operators are pushing transceiver manufacturers to deliver ever increasing performance levels at lower costs, targeting 400Gb/s optical transceivers at a sale price of $1 per Gb/s by 2019. To meet this challenge, significant innovation is needed in integrated design, assembly and packaging of optical interconnects, particularly in single mode transceivers which are becoming more common as datacenter operators adopt more unified architectures.

Manufacturers are competing to streamline cost bases of complex transceiver assemblies, and in the process aim to bring electronics style manufacturing methods to the 'artisan craft' of optics assembly. Yet challenges remain in delivering market-ready products and scaling production of these complex solutions to meet the ever-increasing demands from data center operators.

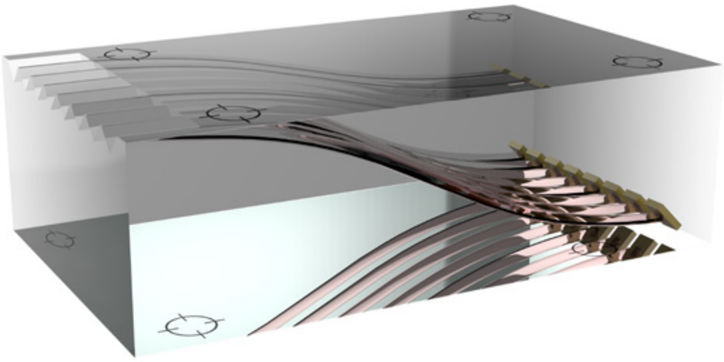
Not least of these challenges is making the transceiver's optical interface assembly less complicated and faster, which in turn will reduce overall module costs and drive adoption.

Optical interposers in transceiver packages

Using optical interposers inside transceivers offers a way to mitigate some of the alignment challenges of interconnecting between the optical signals from the fibers to the active elements such as Silicon Photonic PICs or discrete lasers/detectors. By embedding componentry that facilitates simple coupling to or from these structures using machine vision or passive placement, an interposer can eliminate more costly and time consuming assembly procedures.

Glasses are well established as substrate materials within transceiver packages, and interposers offer robust thermal performance, close CTE matching to semiconductors, and good optical transmissivity. Glasses are also able to be processed to contain a wide range of integrated optical components such as waveguide circuits and micro-optics using industry standard photolithographic techniques.

Ultrashort pulse laser irradiation offers the ability to produce 3D waveguides below the surface of glass substrates, a process allowing arbitrary routing of waveguides with high precision within the bulk of the material. The same ultrashort laser pulses can also be used to enhance the etch rate of a glass by more than 1000 times, allowing precise 3D micromachining of the glass substrate to produce complex microstructures defined by the laser irradiation pattern.



Example of glass chip for SiPh platform with grating couplers
not to scale, representative only

With micro-machined "V" grooves integrated into the glass chip with sub-micron precision, single mode transceiver manufacturers can make use of passive alignment between waveguides and the fiber. Furthermore, with the inclusion of laser etched precision fiducial markers on the surfaces of the glass chip, the interposer can be aligned using machine-vision alone.

A monolithic photonic integrated circuit of this nature would enable automated assembly processes to facilitate scaling production, reducing overall module costs and to meet high volume product ramps.

Increase performance

Although assembly is a core issue in optical transceivers, it is not the only one. The demand for bandwidths of 400Gb/s and beyond has led researchers to utilise various transmission formats alongside varied and complex fiber arrangements for data communications speed improvements. This requires manufacturers to design a rich variety of transceiver architectures and configurations, requiring increasingly complex optical photonic platforms.

A monolithic, glass-based interposer approach is well suited to such a diversified picture, allowing 'pick and place' assembly and the creation of passive custom fiber coupling and attaching solutions intended to specifically address the challenges of individual transceiver designs and packaging.

Different types of photonic platforms can be incorporated into a wide range of transceivers including silicon photonics (SiPh), vertical-cavity surface-emitting laser (VCSEL) and distributed feedback laser (DFB) based designs and coupling to a wide variety of standard fiber architectures including single mode fiber (SMF) and multimode fiber (MMF).

Additionally, when ultrashort pulse laser direct writing is used, the 3D nature of such a photonic platform lends itself to interfacing multicore fiber (MCF) to address fiber density issues as speed (bandwidth) moves from 400Gb/s to 800Gb/s and beyond.

About Optoscribe

Formed in 2010, Optoscribe uses its innovative laser direct write technology to manufacture 3D glass-based integrated photonic circuits for the telecommunications and data communications markets. These monolithic optical products are primarily used by high volume optical transceiver manufacturers. Optoscribe photonic integrated circuits are helping transceiver manufacturers cost reduce and automate their existing transceiver products as well as simplifying the move to SiPh platforms.

The company is located in Livingston, UK and recently opened 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
F: +44 (0) 1506 691280
E: sales@optoscribe.com
W: www.optoscribe.com