

Innovation, optimisation and cost-efficiency: VTEC in the FLEXIT project

FLEXIT

The high volume production line for Integrated Photonics

Photonic integrated circuits (PICs) play an essential role in finding and developing solutions to many of the world's critical problems, such as reducing energy consumption, improving healthcare, fighting food waste and meeting our continuous hunger for information. However, a generic solution for the assembly and packaging of photonic chips does not currently exist. The FLEXIT project, which runs from January 2022 to December 2023, therefore sees an opportunity to unite high-tech companies in the Netherlands and push forward this highly promising domain.

The FLEXIT project will enable this through the further development of the FLEXIT method to process photonic chips at an industrial level. Through a design tool for product development and the mapping of the entire digital chain, the project will also optimise all production processes in the supply chain. Ultimately, two demo products will be selected to test the supply chain according to a new FLEXIT product standard for mass production, through which manufacturing yield will rise, costs will be reduced and delivery reliability can be maintained for the foreseeable future.



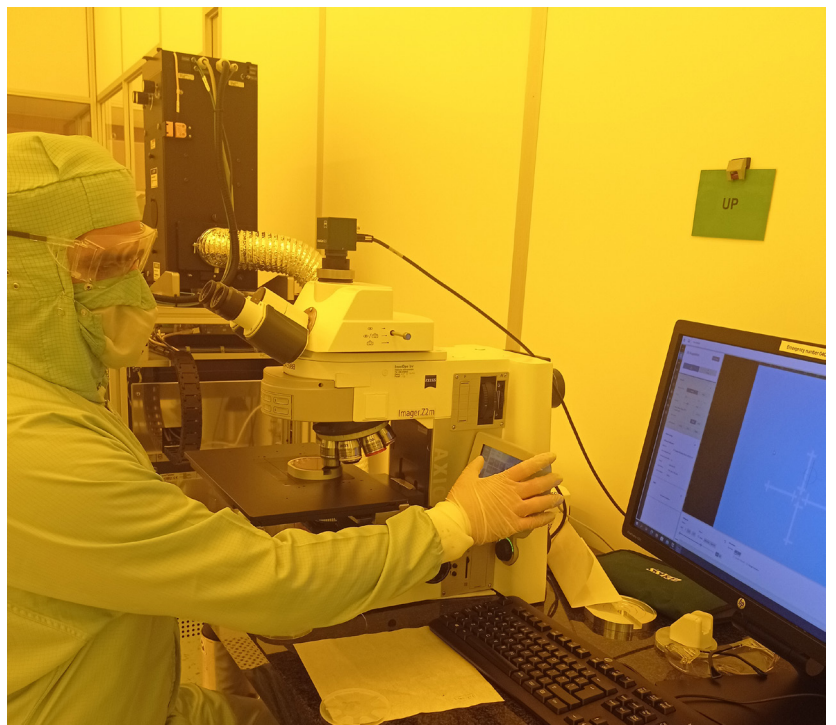
EUROPEAN UNION

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European Regional Development Fund

To the FLEXIT project, VTEC Lasers & Sensors is bringing its expertise in the design, creation and testing of photonic applications and its deep knowledge of indium phosphide for the production of InP chips. Thanks to its experience developing the building blocks for multi-project wafers in the datacom and sensing domains, VTEC also has a strong awareness of how to get the best out of collaboration with diverse partners, making it a perfect addition to the FLEXIT ecosystem.



Technological opportunities

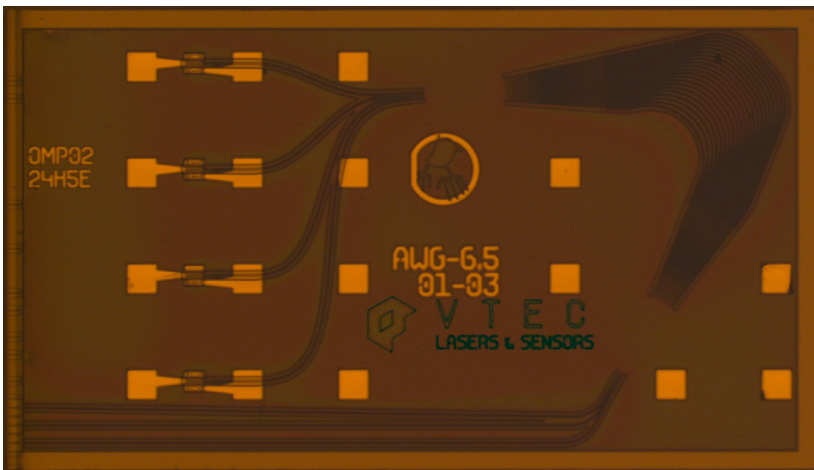
The goal in the FLEXIT project is the mass production of a compact, co-packaged transmitter for the O-band with a very high speed and low power consumption, as this market shows a lot of untapped potential. VTEC is at the processing stage, working on the fabrication of a Mach-Zehnder Modulator (MZM) with over 80 GHz of bandwidth and a half-wave voltage (VPI) of 2 V. This will enable 112 Gb/s non-return-to-zero (NRZ) transmission for data centres without any high-level modulation schemes. VTEC will also deliver a 60 GHz silicon-germanium (SiGe) MZM driver and a receiver with a demultiplexer.

In doing so, VTEC has the opportunity to develop a demo product that will challenge the planned assembly methods in the FLEXIT project: a 100 Gb/s NRZ MZM and a SiGe driver to build an optical engine that matches the requirements for co-packaged optics devices for data centres. The VTEC design of the MZM will enable much lower power consumption than silicon photonics-based devices.

A combination of skills

FLEXIT isn't VTEC's first rodeo: they were among the earliest of 66 members to join PhotonDelta, which serves as a European hub for the integrated photonics industry from design and fabrication to packaging and testing. The experience gained here and elsewhere has helped them build up a varied portfolio of qualities and skills, including:

- **Innovativeness.** VTEC delivers the highest speed (112 GB/s) with thermal and mechanical stability (a position change of <5 micron). They also boast more than a decade of experience in leveraging indium phosphide for the design of photonic components.
- **Cost-efficiency.** VTEC has all of the required capabilities in-house, enabling short communication lines.
- **Optimisation.** VTEC is in control of the design and processing of all building blocks of their devices, enabling optimised solutions at the product level.
- **Vertical integration.** This unique vertically integrated capability allows VTEC to bring all of the aforementioned benefits together in the design and production of high-quality devices.



None of this would be possible without a strong team. VTEC's involvement in FLEXIT has therefore been entrusted in the skilled hands of Ankit Soni (Photonics Design and Test Engineer), Alexander Iatropoulos (Photonics Design and Process Engineer), Selma Henader (Photonics Design and Process Engineer) and Arun Ramachandran (Project Manager), as well as a number of supporting team members.

Proof positive

As for the work in FLEXIT so far, the challenges for the assembly methods lie in fibre coupling using flexible fingers, radio frequency (RF) connections and flip-chip mounting of the MZM and the SiGe high-speed driver. Going forward, project partner PHIX will co-package the modulator and driver on silicon (SI) substrate using flexible fingers, creating a complete and compact product. The reliability of this product and its packaging will be tested at VTEC and will offer the possibility of an efficient, high-speed transceiver and an active optical cable when packaged with a high-speed avalanche photodiode that will be custom-designed by VTEC.

Ultimately, VTEC expects to get a design and chips for both the MZM and the driver. These chips will serve as the basis for a unique product – one which has been proven possible to assemble all thanks to FLEXIT's innovative equipment and processes.

FLEXIT project partners

Chilas

Development and production of semiconductor lasers based on several materials with high power in combination with integrated technology.

IMS

Development of production and assembly lines for hybrid microsystems with added value like lenses for smart phones, medical implants and microsystems.

LioniX International

Develops and commercialises on silicium-nitride (SiN)-based waveguide technology (TriPlex) for a variety of applications and is leading the photonic sector.

PHIX

World-leading packaging and assembly foundry for Photonic Integrated Circuits (PICs), building optoelectronic modules based on all major PIC technology platforms in scalable manufacturing volumes.

Salland Engineering

World-leading in test technology and engineering, specialised in solutions and services to improve efficiency and quality testing at semiconductor manufacturers.

SMART Photonics

The first "pure-play foundry" in the area of InP PIC production and on the verge of scale up.

Synopsys

Supports the project with design software and tools for the development of photonic ICs.

VTEC

Development and realisation of lasers and sensors for various photonic platforms. Assembly and packaging is taken care of including fibre connections.

Workfloor

Supplier of factory data collection systems.

High Tech NL

The national branch association for the Dutch high-tech industry. Its Semiconductors cluster is fully focused on the vast and strong semicon industry, operating as a 'single point of contact' in all steps of the value chain, driving and stimulating (international) cooperation, and initiating and facilitating (international) innovation and crossover projects.

Berenschot

A consultancy company that supports High Tech NL with grant proposal writing and project management and facilitates cooperation between companies and the growth of ecosystems.