

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

European Regional Development Fund.
Funded as part of the Union's response to the COVID-19 pandemic



European Regional Development Fund

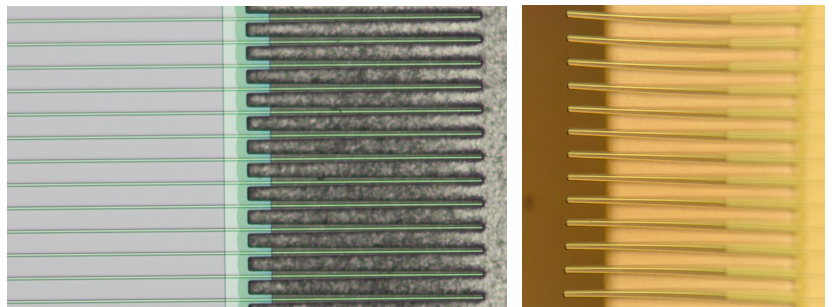
LioniX International contributes decades of PIC/MEMS experience to FLEXIT

Since 2001, LioniX International has been driving technological and commercial developments in their specialist fields of photonic integrated circuits (PICs) and micro-electromechanical systems (MEMS), ultimately becoming a leading provider of customised microsystem solutions globally. As a vertically integrated company, they work across all stages of the production process, from design to the delivery of a finished module. Their world-class fabrication facilities also allow them to scale production volumes as customer requirements grow. These are just some of the skills and assets that they are now applying to the FLEXIT project.

Communicative, cross-discipline collaboration

Besides the high-quality services that they provide, the strength of LioniX International lies in the creativity of their problem solving. By building multidisciplinary project teams together with customers and by asking the right questions at the right time, they deliver solutions that not only answer problems but also boost their customers' business. This makes them an ideal partner for FLEXIT, which brings together 11 organisations that span the entire ecosystem of Dutch integrated photonics and requires a communicative, cross-discipline approach to collaboration.

Within this, LioniX International is providing Si₃N₄-based chips using their proprietary and patented TriPleX® platform in two use-cases: hybrid tunable lasers and 100 Gb/s transceivers. LioniX International has developed a robust method to fabricate flexible TriPleX® fingers in which the amount of out-of-plane bending can be accurately engineered by choosing the right finger length, stress pad geometry and shape. These flexible fingers are currently under fabrication in two runs in which they are being incorporated in tunable laser cavity designs in the C-band and transceivers in the O-band on behalf of project partners Chilas and VTEC respectively.

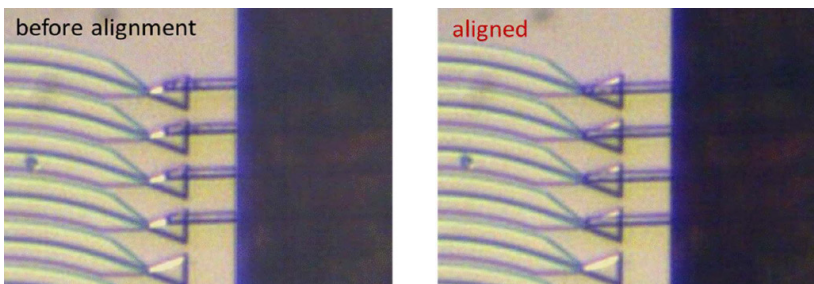


Beyond the standard

In FLEXIT, facet structures are being provided by Smart Photonics as part of their indium phosphide (InP) integrated chips. These facets are special structures on the chip, comparable to a lock, that allow for direct on-wafer coupling to the light in the photonic chips and their

output. Standard chips do not have a facet and access to the light and output is only possible after the complete fabrication of the wafer and upon the finalisation of the individual dies. To make the next step in low-cost wafer level testing and hybrid assembly, LioniX International has therefore developed a special etching procedure to generate flexible waveguide structures – ‘waveguide fingers’ comparable to a door key – that enable passive alignment to other technology platforms.

The focus of FLEXIT is on interfacing the TriPlex® waveguides to the active InP platform of Smart Photonics. LioniX International and Smart Photonics are therefore working in close collaboration to make sure that the flexible waveguides fit exactly into the etched ‘locks’ in the InP chips. This has proven the case thanks to FLEXIT’s self-aligned assembly process, which has led to passive alignment.



The future of scalability

This improved assembly strategy, based on TriPlex® flexible fingers and InP pockets, is the primary advantage of the FLEXIT project as it strongly reduces time-consuming hybrid PIC assembly. Instead, fully automatic assembly is now possible using industrial pick and place equipment which is already available. And, with the process developments and wafer-level optical probing functionalities found within FLEXIT, LioniX International is able to increase assembly yield and lower their total assembly costs. This will further enhance the company’s vertically integrated mindset and pave the way to the scalable hybrid integration of complementary PIC platforms.

To continue generating innovations in the future, LioniX International draws on its past: a proven track record in the field of integrated optics and MEMS processing going back more than 20 years. Having served hundreds of customers worldwide, LioniX International has experience in an endless list of applications and therefore understands what is needed for the near future when it comes to scalability. Aspects such as testing and assembly are vitally important to the entire supply chain and LioniX International provides a unique approach to each thanks to its vertical integration approach, playing a key role in securing the goals of the FLEXIT project.

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 silicon-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.