Fraunhofer IZM

Fraunhofer Institute for Reliability and Microintegration IZM

Laserstructured and metallized thin glass interposers for biomedical and telecom application (unpopulated).

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Wafer-level metallization, structuring, and joining of glass

Thin-glass Packaging for Photonic Chip Integration

European Project PhotonicLEAP

PhotonicLEAP

In this project, Fraunhofer IZM processed 200 mm laser-structured glass wafers to create finest pitch thermal and electrical connectivity in glass interposers, which are the most complex part of the PhotonicLeap package. This process involved applying and structuring thin-film metallized redistribution layers on glass and fully metallizing through glass vias (TGVs). After populating the glass interposer with photonic and electronic components, the package can be hermetically closed by adding laser-structured and -sealed caps.

Project Applications

Photonic integrated circuit (PIC) technologies are being rapidly deployed in communications, medical, sensing, and quantum and AI applications. However, existing PIC packaging and testing processes are difficult to automate, have limited throughput, and account for 75% of the overall PIC module manufacturing cost. To address this challenge, PhotonicLEAP has developed disruptive wafer-level PIC module integration, packaging, and test technologies that can significantly reduce PIC packaging costs.

PhotonicLEAP packages are hermetic and solderable, allowing them to be placed like thin surface-mount technology devices. They use standardized ball grid arrays on the bottom of the package for thermal and DC/high-RF electrical contacting. The top of the package serves as a large optical interface for either emitting free space beams or coupling to optical fibers.

In this project, Fraunhofer IZM made full use of its state-of-the-art laser direct imaging and wafer processing line to create all electrical and thermal connections on the base of the PhotonicLEAP package, a laser-structured and -etched glass interposer. Fraunhofer IZM also demonstrated laser sealing of fully assembled packages to make them hermetic and machine-placeable.

Project partners

- Tyndall National Institute
- Fraunhofer HHI
- LPKF Laser & Electronic
- ficonTEC Ireland
- SUSS MicroOptics/Focuslight
- Bosch
- TU Eindhoven
- IMEC

Website

- www.photonicleap.com

Volume

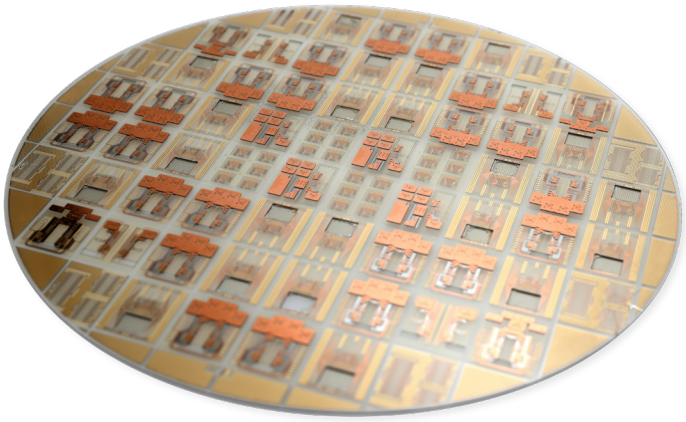
- €5.95 Million

Runtime

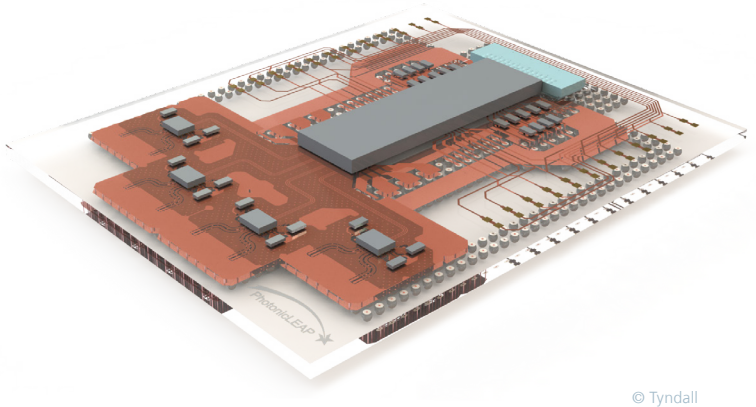
- 01/01/2021 - 30/09/2025

Funding reference

- EU Horizon 2020/ Photonics21
- Grant Agreement 101016738



200 mm interposer wafer with metallization by IZM: Filled TGVs, four redistribution layers on top and one balling layer on bottom (unpopulated).



CAD drawing of populated glass interposer with [18 x 22] mm footprint, including an InP-modulator-chip with integrated laser sources.

IZM Project Contributions

- Filling of 80 µm glass interposer vias
- Creation of fine-pitch redistribution layers
- Laser sealing of the package with a frame and lid
- Singulation into 18 mm x 22 mm packages

Advantages of Using Thin Glass as a Packaging Material

- Transparent with low RF-line losses
- Easily adaptable by using laser processing
- Structuring in 3D with µm resolution
- Scalable to large wafers and panels
- Optical waveguides can be included

Future Applications Addressed:

- Optical processing applications (AI)
- Quantum optical packaging
- Optical chiplet platforms

Fraunhofer IZM is expanding its glass panel/wafer processing line to accommodate larger packaging formats, such as 500 mm x 500 mm panels or 300 mm wafers, for photonic packaging like that in PhotonicLEAP.

PHOTONICS 21

PHOTONICS PUBLIC PRIVATE PARTNERSHIP

Fast Facts

1. Novel glass-packaging approach for photonic and quantum chips – used in telecom and AI
2. Highly adaptable using laser structuring and maskless metallizationon large wafers/panels
3. Glass interposer containing thermal, electrical and high-RF through glass-vias on bottom
4. Interposer after population is capped: Package top serves as designable optical interface
5. Closed package is thin and can after balling get mounted/soldered with SMT

More information

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