Fraunhofer IZM

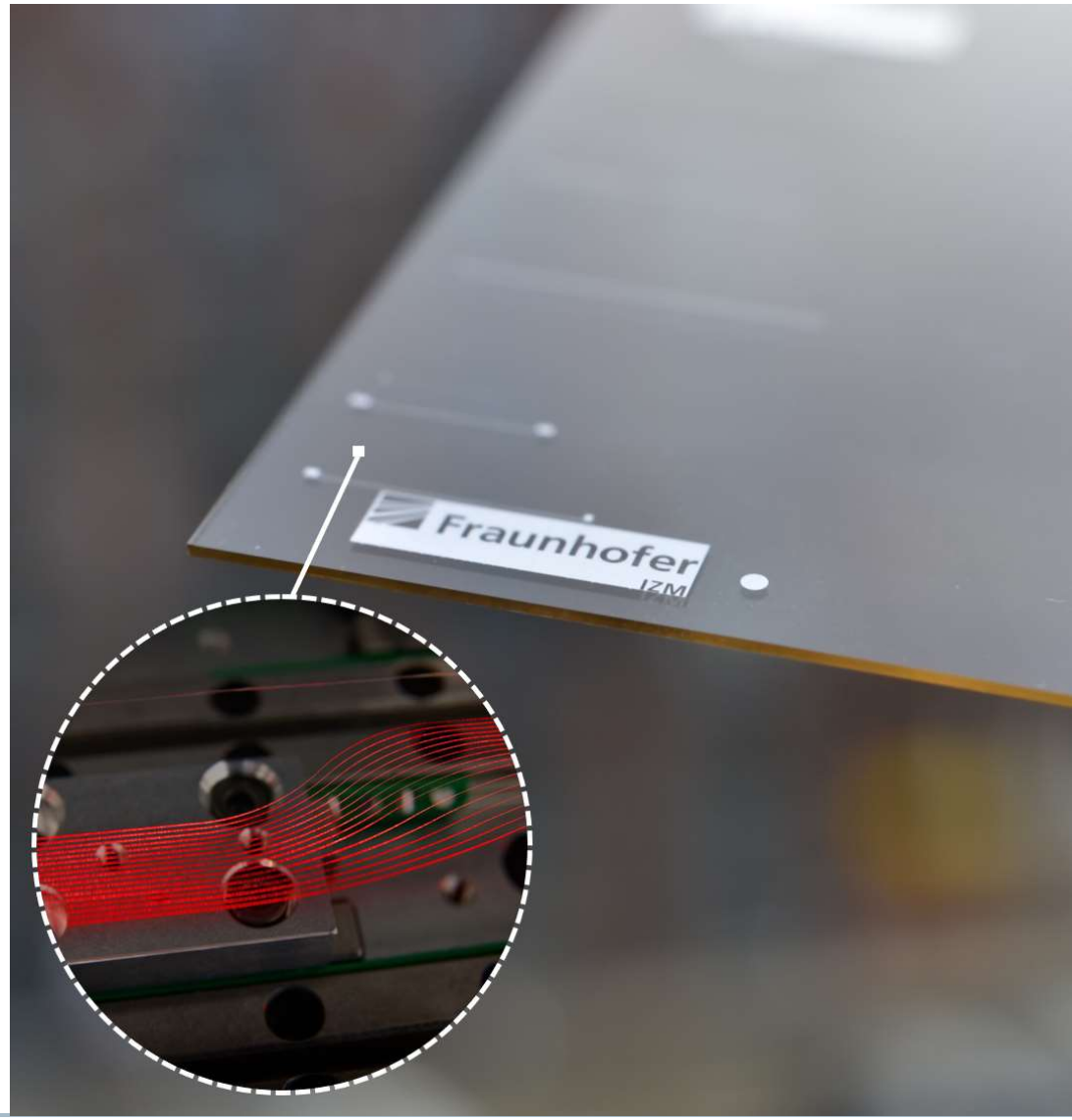
Fraunhofer Institute for Reliability and Microintegration IZM

Working in Photonics in Berlin / June 27th 2022 / Julian Schwietering

Working with the fascinating combination of Photonics and Glass

Outline

- My personal way to “working in photonics in Berlin”
- The institute – focus on electronics
- The group – focus on optics
- Combination of glass and photonics
- Process development on industrial equipment
- Electrical optical circuit board as an example



My personal way to “working in photonics in Berlin”

From solid-state physics to optics in glass

TECHNISCHE UNIVERSITÄT ILMENAU

Bachelor
Technical Physics

Micro Systems Technology

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Bachelor thesis
Ion-Exchange in Glass

Glass

TECHNISCHE UNIVERSITÄT ILMENAU

Fraunhofer IOF

Master
Technical Physics

Glass

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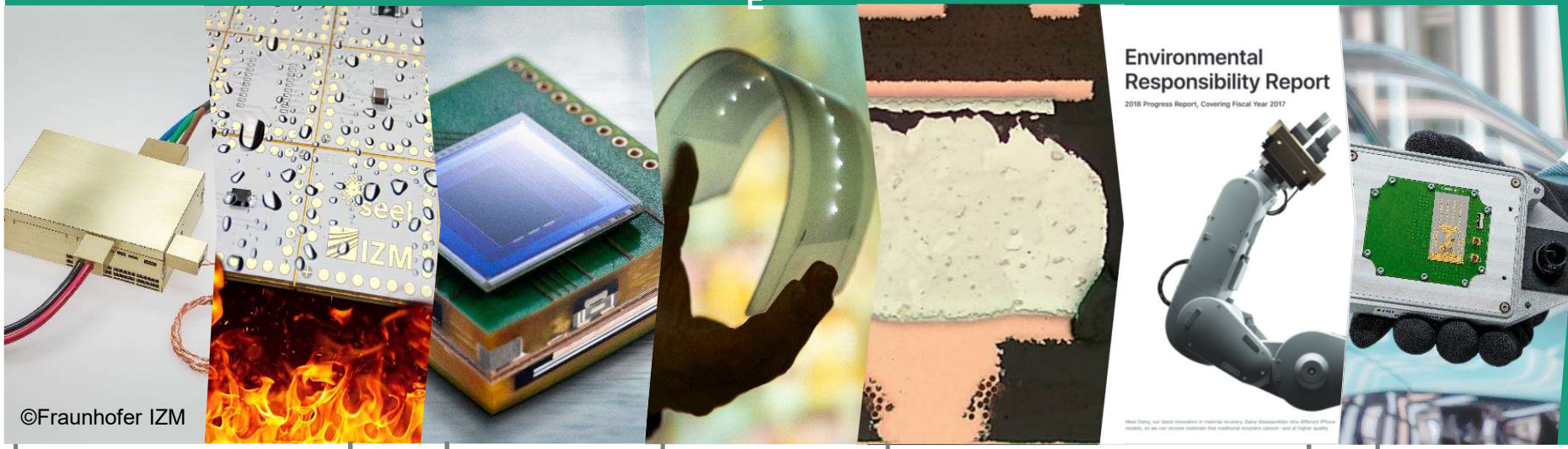
Master thesis
Optical Waveguides
in Glass

Glass + Optics

The main focus of Fraunhofer IZM is on electronics

SMALLER	RESISTANT	MORE FUNCTIONAL	FLEXIBLE OR STRETCHABLE	MORE RELIABLE	MORE SUSTAINABLE	MORE COST-EFFECTIVE	UNIQUE



What special properties does your electronics need?

- Ultra-miniaturized power packaging
- Sensor development and integration for harsh environments
- Modular 3D integration for high-speed systems
- Textile and conformable electronics
- Electrochemical/ electrical degradation, process-related failures and thermo-mechanical stress
- Carbon footprint documentation
- Camera radar system for autonomous driving

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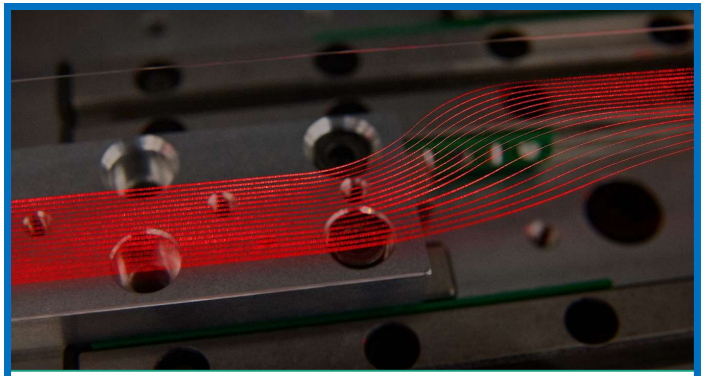
…but there is also a photonics group

Group leader: Dr. Henning Schröder

Thin glass (2D)



Integration of waveguides into glass

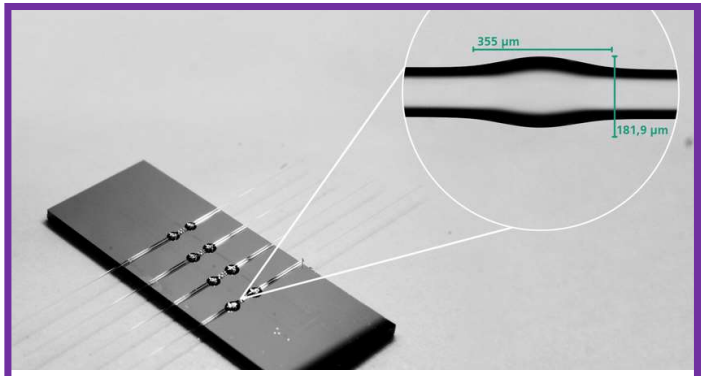
- Electro-optical circuit board
- Lab-on-a-Chip made of glass
- Integrated optics for quantum packaging

Glass components (3D)

High-precision assembly on glass

- Photonic systems with high dimensional stability
- Free beam forming

Glass fibers (1D)



Optical fiber processing

- Optical sensing
- Thinning of fibers
- Fiber-Chip coupling

Ion-Exchange | Laser cutting | Simulation | Laser structuring | Etching in molten salts | Laser welding

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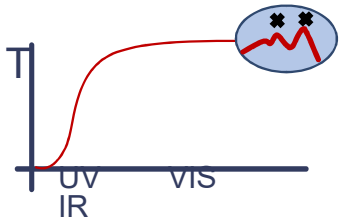
1) Combination of Glass and Photonics

Glass has outstanding properties

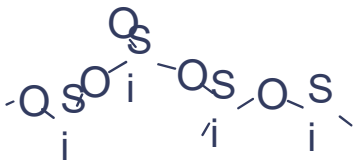
Optical transparency



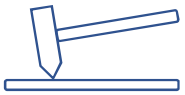
1310nm,
1550nm

High stability in dimension

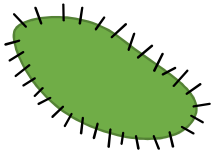
High chemical resistance



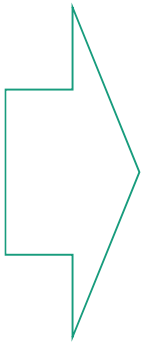
Strong and low cost commercial display glass



Biocompatibility



Good electrical properties (HF)



Display technology

Optical lenses

Quantum packaging

Photonic lab on a chip

Glass fibers for data communication

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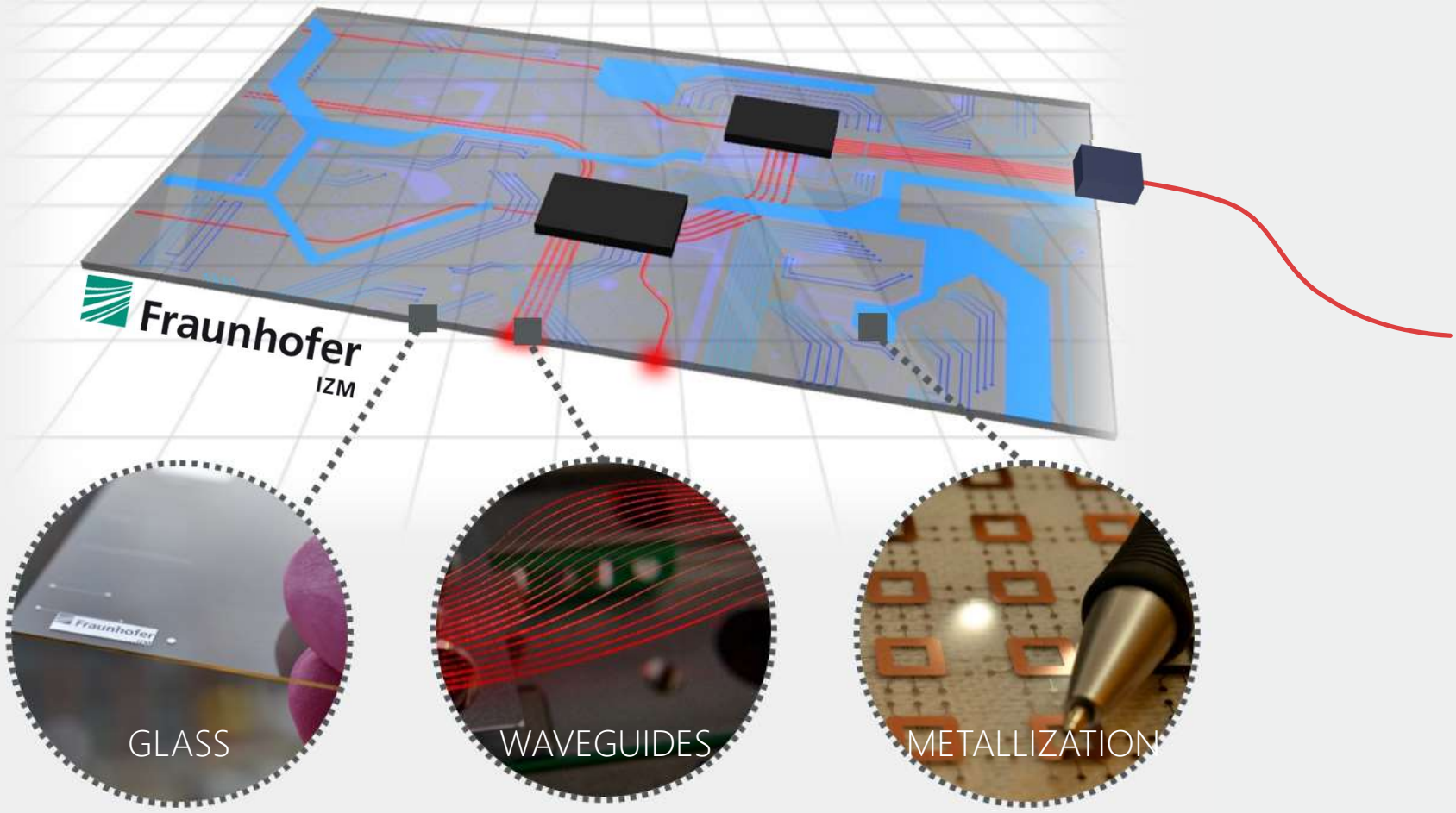
2) Fraunhofer is the link between universities and industry

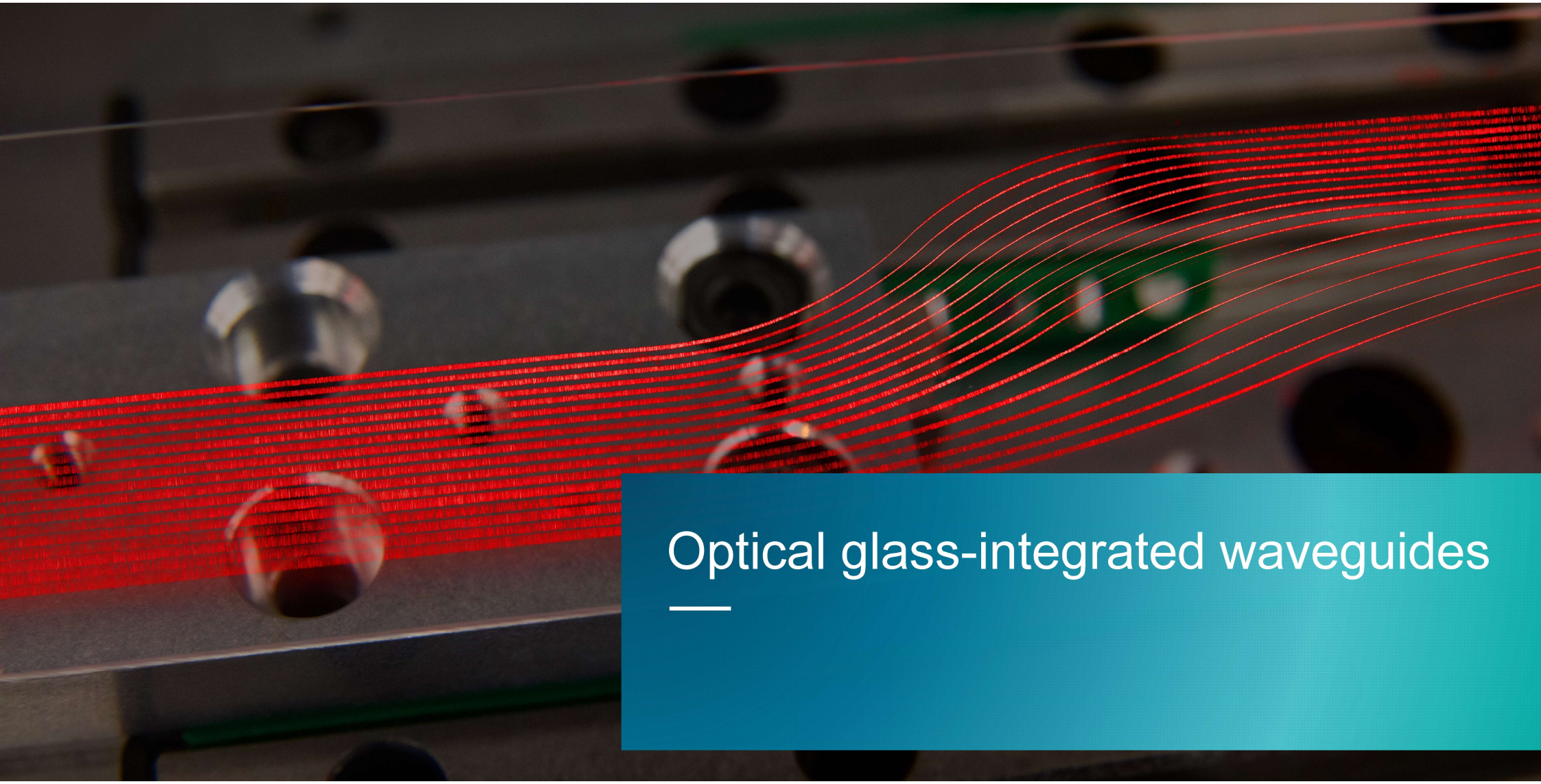
Universities ⟷ Fraunhofer IZM ⟷ Industry

Main consequence:

“Process development is done on and for industrial equipment.”

EOCB – Electrical Optical Circuit Board





Optical glass-integrated waveguides

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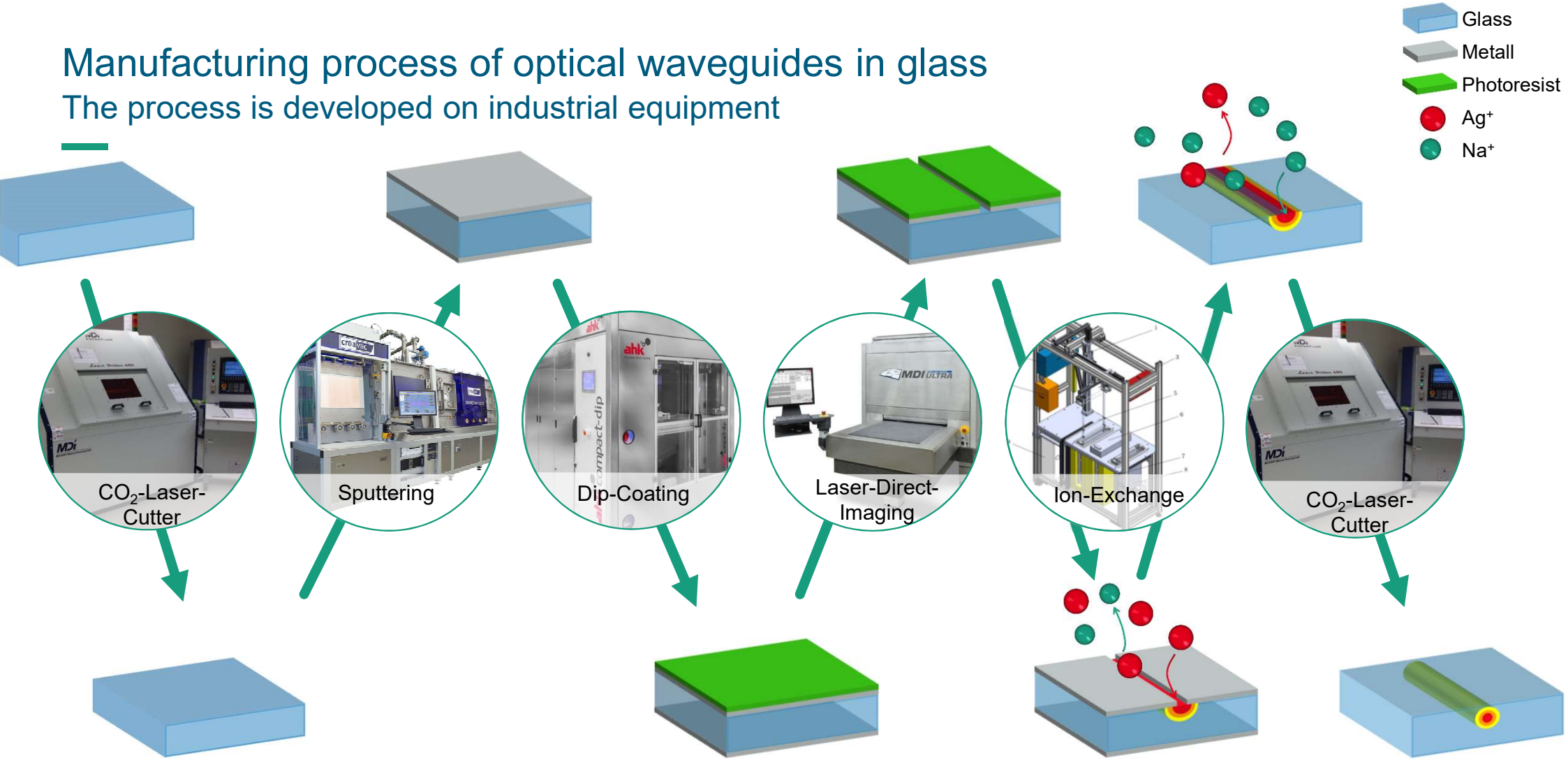
Manufacturing process of optical waveguides in glass

The process is developed on industrial equipment



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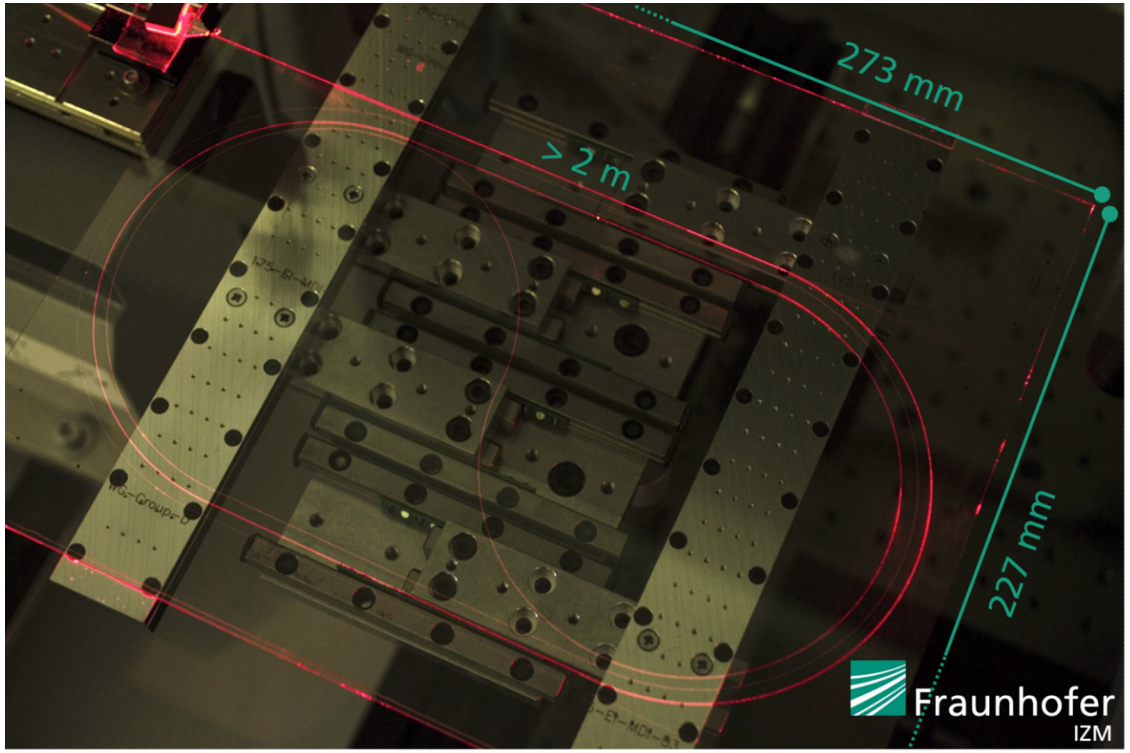
Properties of optical waveguides in glass

These waveguides have excellent properties



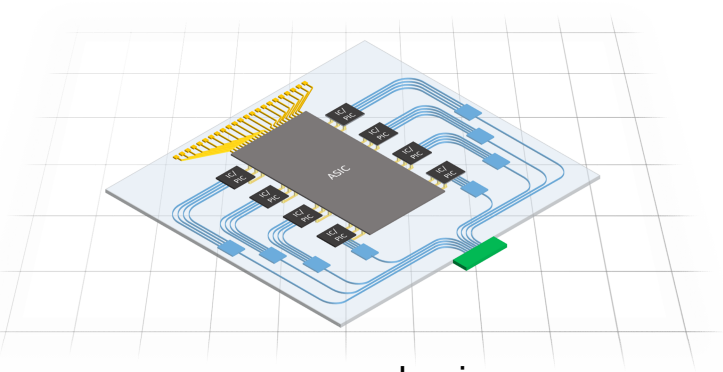
Properties

- Single-mode and multi-mode
- α < 0.06dB/cm @ 1310nm & 1550nm
- Thin glass down to 300µm thickness and up to 440x305mm^2
- Can be integrated into standard circuit boards
- Mode field can be adjusted to optical fibers

Application fields

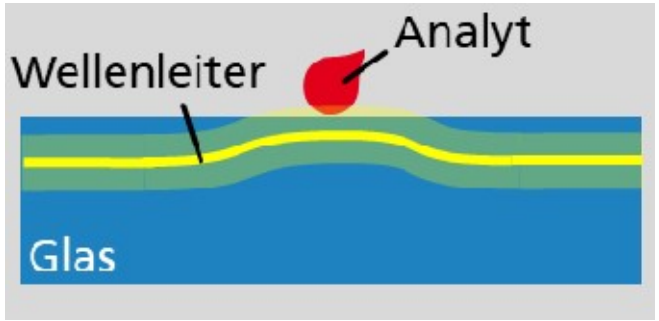
The glass integrates waveguides have mainly three fields of application

Communication



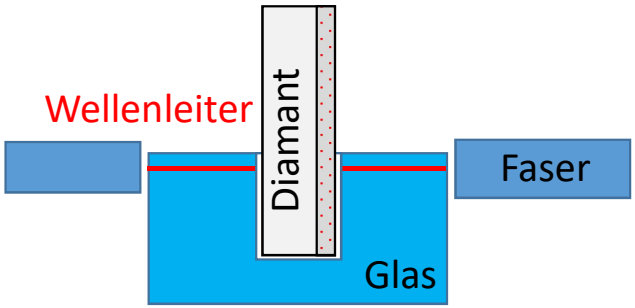
e.g. co-packaging

Sensing



e.g. sensing in the evanescent field

Quantum Packaging



e.g. manipulation of vacancy centers

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We are hiring!

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Postgraduates, Professionals, Students, Apprenticeships and Internships

- Various backgrounds: physics, photonics, physical engineering, micro systems technology, …
- Process development on multiple processes
  - ion-exchange
  - selective laser etching
  - two photon polymerization
  - lithography
  - system assembly
- Simulation of optics and of ion-exchange
  - Lumerical
  - COMSOL
  - self build up Python scripts

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Feel free to get in touch with us

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Contact

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