HYBRID PICs – BEST OF ALL WORLDS

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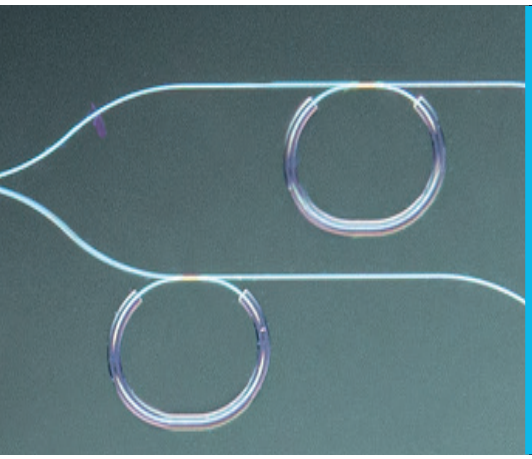
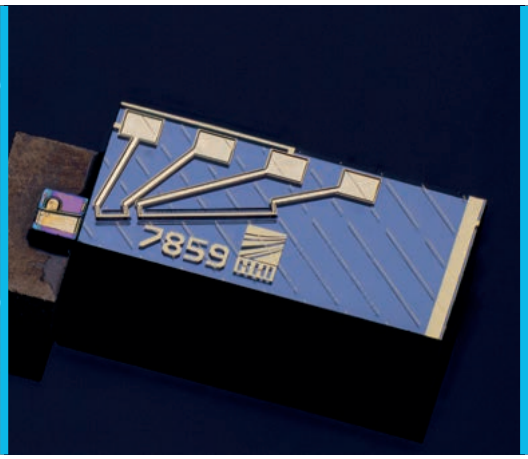
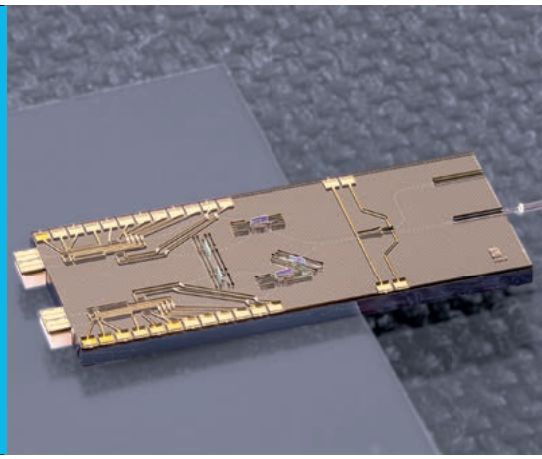


microring waveguide for sensing



tunable laser with InP gain chip



micro optical bench

AT A GLANCE

We enable the hybrid integration of complex photonic components with our PolyBoard and silicon nitride platforms.

Features

- Modular tool box
- Rapid prototyping
- Short iteration cycles
- Low upfront development effort

Applications

- Telecom and datacom
- Sensing and spectroscopy
- Microwave photonics and 5G networks
- Quantum technology

Hybrid PICs

We develop photonic components and integrated circuits based on InP, polymer, graphene, and SiN material systems according to customer needs and specifications. Our PolyBoard technology platform allows for rapid prototyping, short iteration cycles and low upfront development effort.

Contact us with your ideas and make use of our expertise in design and simulation, CAD, technology development, wafer fabrication, device manufacturing, and chip characterisation, incl. qualification tests.

Bundesministerium für Bildung und Forschung

WACHSTUMSKERNE UNTERNEHMEN REGION

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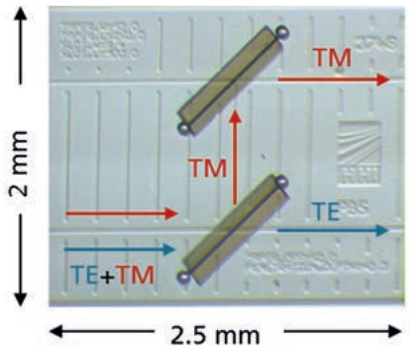
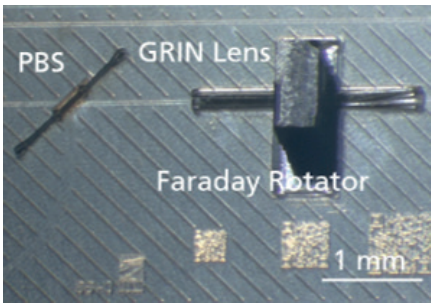
References

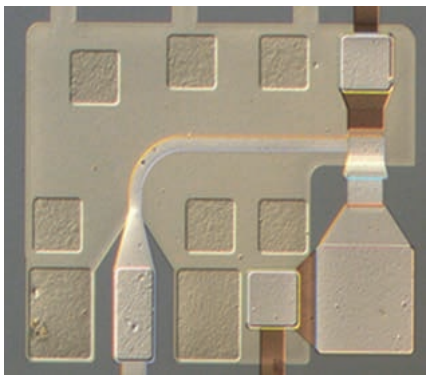
- International R&D projects HAMLET, 3PEAT, UNIQORN, TERIPHIC, ACTPHAST-4R (funded by EU commission)
- Innovative Regional Growth Core POLYPHOTONICS BERLIN and R&D Project PHONO-GRAPH (funded by BMBF)



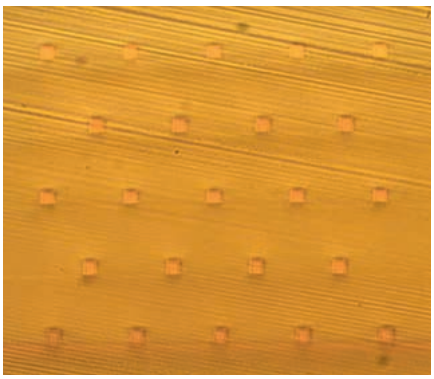
Low footprint thin-film-based elements (for polarization handling and filtering)



Micro-optical bench: optical isolator



Graphene-based Gb/s modulators



3D photonic integration

Our hybrid integration platform comprises:

- Thin film elements for polarization beam splitting, polarization beam rotation and optical filtering
- U-grooves for adjustment-free fiber-chip and GRIN lens coupling
- Micro-optical bench: wavelength lockers and meters, optical isolators and circulators
- Passive components: splitters, couplers, gratings, MMIs, AWGs, 90° hybrids
- Micro-mechanical structures: mirrors, slots, grooves, trenches
- Efficient thermo-optic functionalities: VOAs, switches, tunable filters, tunable lasers, phase shifters
- InP actives: gain elements, photo diodes /arrays, DFB lasers /arrays
- Graphene-based Gb/s modulators
- Flexible high-frequency and optical interconnects (FlexLines)
- 3D photonic integration: multi-layer waveguides, vertical MMIs
- SiN: grating couplers, MMIs, microring resonators

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COMPONENTS FOR HYBRID INTEGRATION

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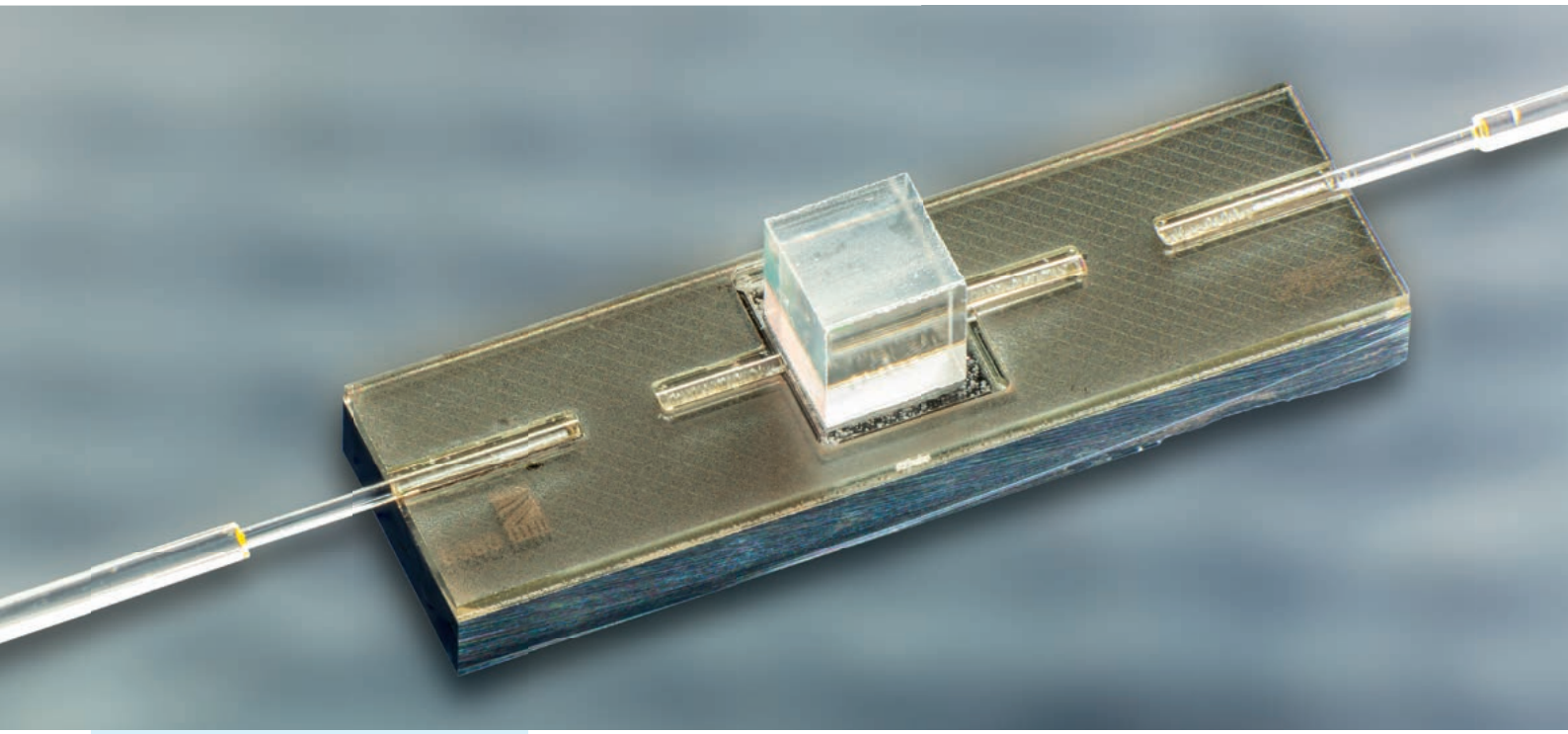

AT A GLANCE

Hybrid photonic integration offers a large variety of peripheral optical components. Not only in integrated circuits, but also available as separate units, customized to specific needs.

Features

- Fiber arrays with adjustable pitch and low insertion loss
- Small footprint optical isolators and circulators
- Customizable GRIN lenses
- Thin-film filters for polarization and wavelength handling
- Automatized assembly of all components

Applications examples

- U-groove technology enables low-loss fiber arrays with adjustable pitches down to a few micrometers
- Free-space optical isolators available as stand alone building blocks or GRIN lens and waveguide integrated via the PolyBoard integration platform
- 1064 nm tunable DBR lasers
- Photo diode to single mode fiber coupling via PolyBoard interposer

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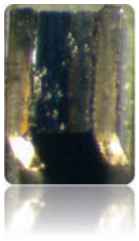
Performance

- Thin-film elements for polarization and wavelength handling with high extinction ratios >50 dB (peak) and low insertion loss down to 0.5 dB.
- Low-loss free-space isolators with <0.3 dB insertion loss and >40 dB (peak) isolation.
- Customizable low-loss GRIN lenses with adjustable pitch, numerical aperture, diameter and coatings.
- Tunable DBR lasers at 1064 nm with 10 nm tuning range and up to 30 mW output power. Other wavelengths on request.

Customizable optical components

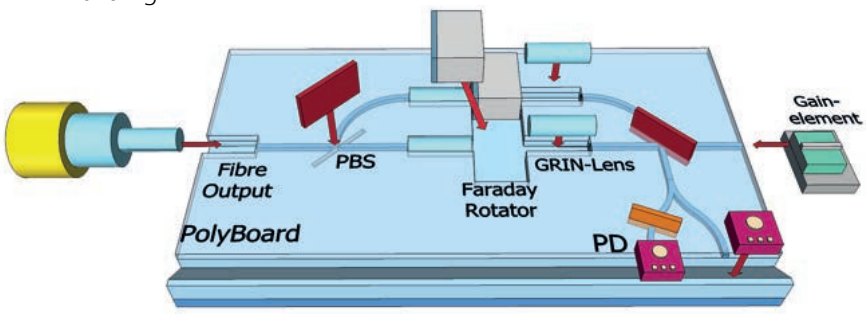
Thin-film elements for optical filtering and polarization handling



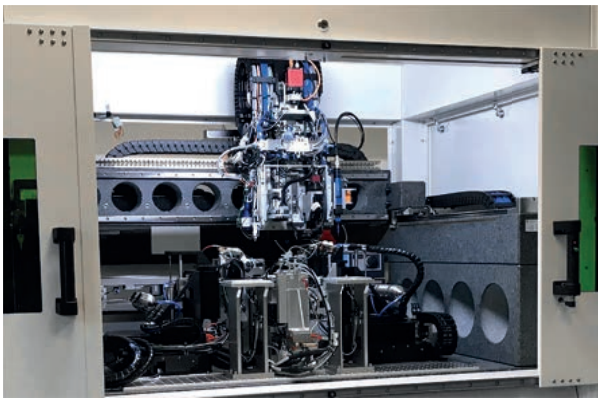
Optical isolators

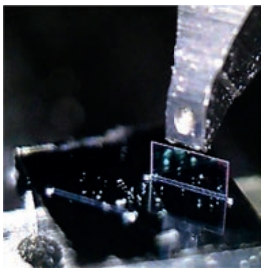
GRIN lenses

Photo diodes and gain elements



Automated assembly of photonic components





Automatized assembly for all components available

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MICRO-OPTICAL BENCH

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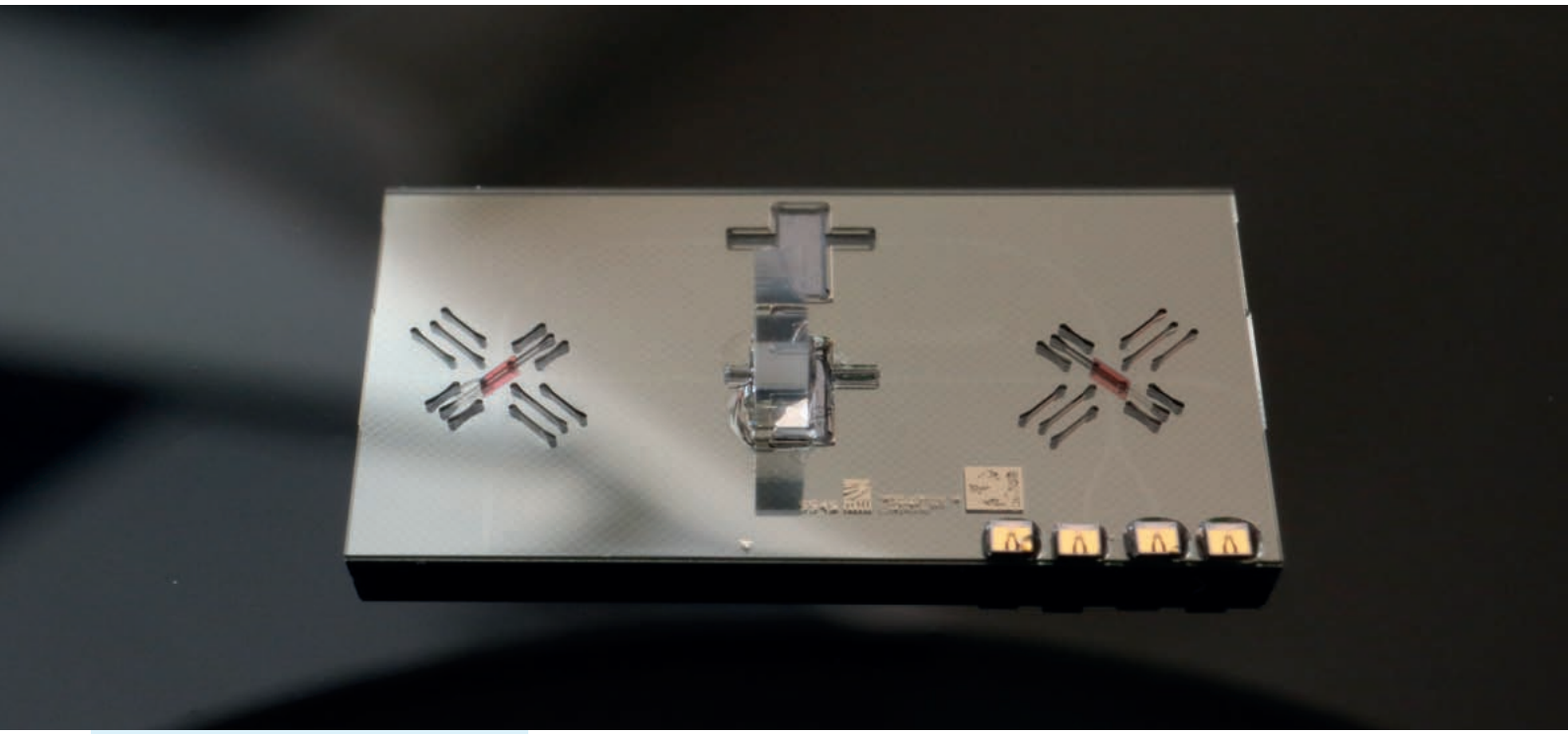

AT A GLANCE

PolyBoard enables the integration of low loss free-space sections into photonic integrated circuits via Micro-Optical Benches

Features

- Integrated free-space sections with < 1 dB on-chip losses
- Integration of bulk optical crystals (e.g. magneto optic materials, BBO, KTP, LiNbO3, etc.)
- Chip-integrated free-space etalons

Applications

- Optical isolators
- Optical circulators
- Wavelength lockers
- Quantum technology

Micro-Optical Bench

PolyBoard's Micro-Optical Bench demonstrates the capability and flexibility of hybrid photonic integration. Using two GRIN-lenses, an on-chip free-space collimated beam section is created allowing for the low-loss insertion of bulk materials. These include Faraday rotators for optical isolators and circulators as well as nonlinear optical crystals for quantum technology applications.

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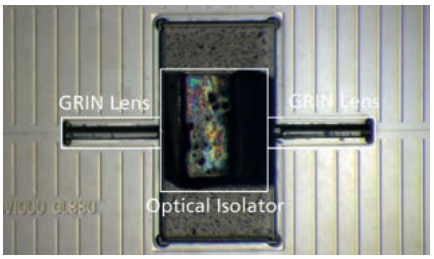
Performance

- 20 dB isolation over 150 nm bandwidth
- 30 dB peak isolation
- <1.4 dB on-chip loss

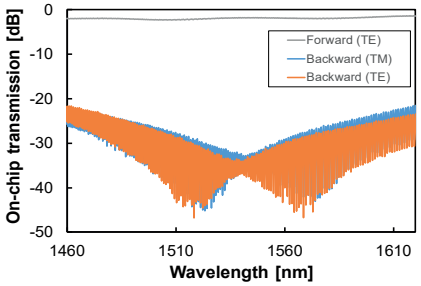
References

- International R&D projects 3PEAT and UNIQORN (funded by EU commission)
- Innovative Regional Growth Core PolyPhotonics Berlin (funded by BMBF)

Optical Isolator

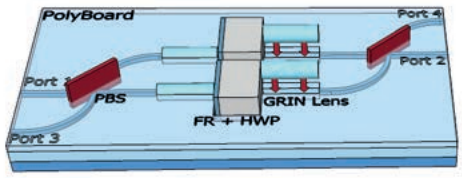


Integrated free-space isolator

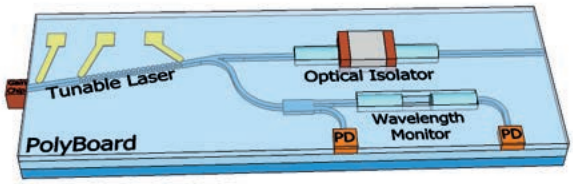


Spectrum of optical isolation

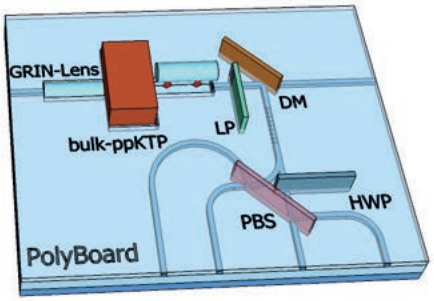
Further Applications



Optical circulator



Tunable laser with integrated isolator and wavelength locker



Entangled photon source

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FLEXIBLE INTERCONNECTS

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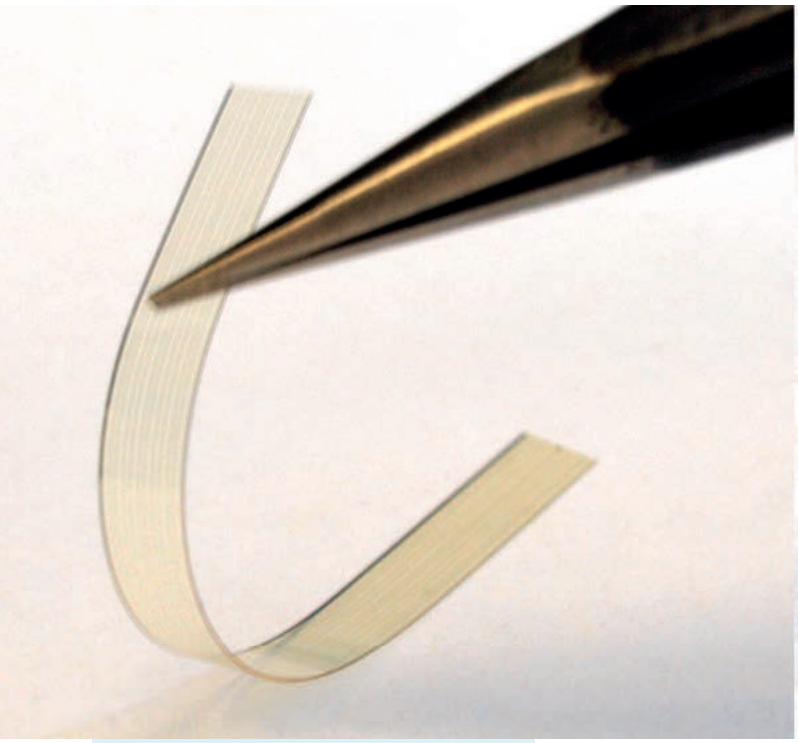

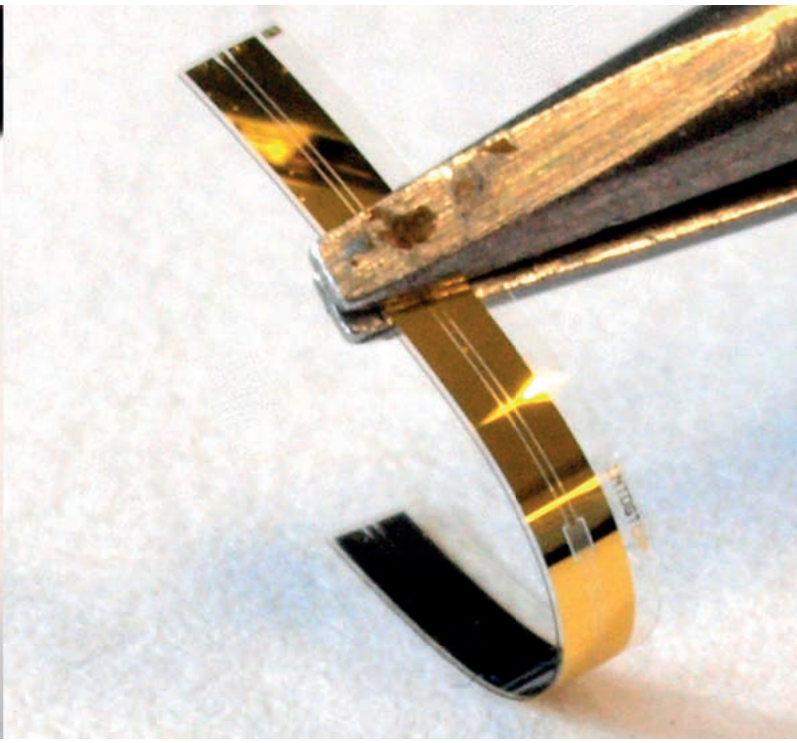

AT A GLANCE

Optical and high-frequency flexible interconnects for optoelectronic packaging and wearables

Features

- Optical single mode waveguides with additive functions
- Electrical coplanar waveguides with bandwidths >100 GHz.
- Customized designs

Applications

- Flexible optical interconnects (chip-to-chip or chip-to-PIC)
- Flexible electrical interconnects (LD-to-driver or PD-to-TIA)
- 3D optoelectronic packaging
- Wearable sensors

Technical Background

Optical FlexLines offer simple and cost-effective solutions for the interconnection of photonic integrated circuits (PICs) from diverse technology platforms featuring customized taper structures for low loss coupling and the integration of optical functions such as AWGs, wavelength filters or polarization handling.

Electrical FlexLines provide an ultra-fast and flexible electrical connection of active optical devices such as laser diodes and photo detectors to their electrical drivers or TIAs exceeding bandwidths >100 GHz.

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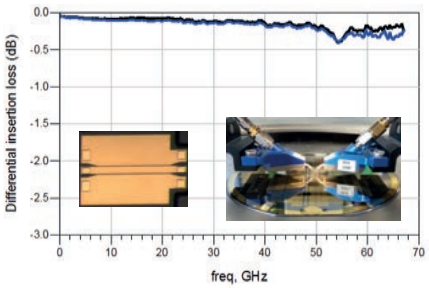
References

- International R&D projects 3PEAT and TERIPHIC (funded by EU commission)
- Innovative Regional Growth Core PolyPhotonics Berlin (funded by BMBF)

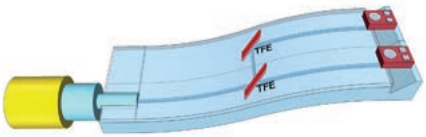
Characteristics

Optical FlexLine: Optical ribbon cable

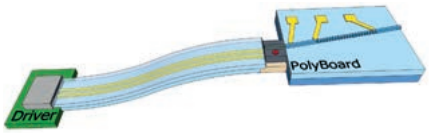


Electrical FlexLine: Bandwidth >100 GHz

Applications



Optical FlexLine as PBS interconnect to SMF



Electrical FlexLine as laser driver interconnect

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