Towards Smart Integrated Photonic Building Blocks

Meint Smit
Generic Integration Philosophy

- Transistor
- Resistor
- Capacitor
- Optical Amplifier
- Phase Modulator
- Polarisation Converter
- Waveguide

Electronic integration

Photonic integration

A SOA (gain section) Phase modulator Shallow etched waveguide
Deep etched waveguide Polarisation rotation section

A φ WGs P

Institute for Photonic Integration

SMART Photonic Building Blocks München Tue 12 Nov 2018
What can you make with these Basic Building Blocks?
All kinds of passive devices ...

- MMI-couplers and filters
- MMI-reflectors
- AWG-demux
- Ring filters
- Polarisation splitters
- Polarisation combiners
- Polarisation independent differential delay lines
switches and modulators …

- Phase modulator
- Amplitude modulator
- Fast space switch
- Polarisation independent 2x2 switch
- Ultrafast switch
- WDM crossconnect
- WDM add-drop
All kinds of lasers ...

- Fabry-Perot lasers
- Tunable DBR lasers
- Multiwavelength lasers
- Picosecond pulse laser
- Ring lasers
And many other components ...
Examples of Photonic ICs (PICs)

More than 400 PICs fabricated in JePPIX foundries

- **THz and RF circuits**
- **Optical data handling**
- **Optical switching**
- **Variety of Lasers**
- **Medical and bio-imaging**
- **Sensor readout units**
- **Microwave photonics beam-former**
- **Fibre to the home**
Many different application fields

Telecommunication, datacommunication, precision metrology, automotive, medical diagnostics, crop monitoring, …
100G optical ‘system-on-chip’ transmitter

- 10x DWDM DBR tunable lasers
  - >10 mW output power
- 10x Mach-Zehnder Modulators
  - >25 GHz bandwidth
  - Suitable for 50 Gb/s PAM-4
- 100GHz AWG
- Booster SOA
- Monitor Photodetectors for on-chip wavelength locking
- 4 x 6 mm chip
- Customized generic process technology

80 km Mach-Zehnder Tx PIC
CFP2 transceiver product
Example Photonic Integrated Circuit

111 components on one cm² chip

(de)multiplexers \times 11
PIN \times 100
and routing

6 mm \times 8 mm
FBG sensor unit
Distributed temperature and strain measurement with embedded fibers + PIC readouts

Wider possibilities for structural health monitoring
Technobis experiences very strong growth, already outgrowing their new facilities

Newsletter introduction

from CEO Pim Kat

In 2013, we started thinking about building a new facility for Technobis Group. At that time we were a company of 27 people and thought it would be a good idea to build a new facility that could accommodate 50 staff in offices, labs and an assembly area.

The new building was inaugurated by our Minister of Commerce, Henk Kamp, and we moved in on 1 May 2014.

Now, only two and a half years later, we have already outgrown our new premises. Was it bad planning, just luck, or coincidence?

None of the above, actually, as we started developing optical instruments based on optical chips (ASICs, Application Specific Photonic ICs) some five years ago. This was completely new technology, mainly being tested in universities by PhD students and focusing on telecom/Datacom.
Pilot Photonics becomes award winner at the EPVF and raises 1M € VC funding
Building Blocks like lasers and modulators need dedicated electronic drivers and controllers

Next step: integration of photonic and electronic ICs in combined Photonic Electronic Building Blocks

Examples
- Lasers with electronic drivers and controllers
- Modulators with electronic drivers and controller
- Detectors with amplifier
- Filters with tuning control

Available in PDK
Integrating InP PICs with Silicon electronics

Project designed PICs

Project designed drivers and receiver electronics

Wafer scale bonding technology

Wafer scale interconnection processes
Thermal, mechanical, electronic and optical codesign
Heterogeneous integration process
An attractive PIC prototype trial for SMEs

- EU ACTPHAST project supports short (6 months) prototype development projects for EU SMEs. They develop a prototype for you.

- Quick procedure, high acceptance chance.

- Cost for SMEs:
  - **FREE** up to 30 k€ project cost
  - 25% contribution for costs in excess of 30 k€

Interested? Contact coordinator@jeppix.eu