Green ICT @ IZM
Photonics FOR TOMORROW’S PRODUCTS

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FRAUNHOFER IZM AT A GLANCE

Founded in 1993

37.6 million € turnover in 2020

440 employees (incl. students and trainees)

Long-term contract with
- Technical University of Berlin
- Technical University of Dresden
- Brandenburg University of Technology

Turnover 2020

- Basic funding: 24%
- Direct contracts with industry: 38%
- Mainly covered by NDA: 38%

Funded projects by …

Confidential
FRAUNHOFER IZM – BRINGING R&D INTO APPLICATION

TECHNOLOGICAL RESEARCH & DEVELOPMENT
DIN EN ISO 9001:2015 @ Dept. WLSI

BASIC RESEARCH | TECHNOLOGY READINESS LEVEL | MASS PRODUCTION

PROOF OF CONCEPT | PILOT LINE

APPLICATIONS

MEDICAL ENGINEERING

INDUSTRIAL ELECTRONICS

ICT

MOBILITY

SEMI-CONDUCTORS

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FRAUNHOFER IZM – A WORLD-CLASS HIGH-TECH ENVIRONMENT

approx. 5,100 m² laboratory space

66 labs & measurement rooms

Wafer Level System Integration

Panel Level System Integration

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FRAUNHOFER IZM – MERGING OF WAFER- AND PANEL-LEVEL TECHNOLOGIES

- Based on standard PCB materials & equipment
- 3D and double sided routing are standard features for PCBs
- Line/space down to (2/2 µm)
- Full format/large area is standard 500x515, 600x600, 24”x18”

- Based on standard thin film technology equipment
- Tightest tolerances for fine pitch line/space (0.5/5 µm)
- Currently running up to 300 mm

Wafer- and Panel-Level Technologies

- PWB (organic substrate)
- Lowest cost

- CMOS (Si-based wafers)
- Highest cost

MERGING IS THE KEY TO THE FUTURE SUCCESS OF HETEROGENEOUS INTEGRATION
OPTICAL INTERCONNECTION TECHNOLOGIES
– A PHOTONICS GROUP WITHIN AN ELECTRONICS INSTITUTE

Head: Henning Schröder
Ind. Relations Manager: Gunnar Böttger

Photonic System Assembly
- precise structuring of glass
- customized holders for micro-optics
- 1D and 2D optical micro-benches
- automated assembly, pick-and-place
- shrinkage compensated and shrinkage-free adhesive bonding

Fiber Optical Interconnects and sensors
- optimized fiber-to-chip coupling
- custom fiber splicing
- structuring glass fiber tips
- fusing fibers/capillaries to glass chips

Electro-Optical Circuit Board
- In-glass embedded optical waveguides:
  - single-mode VIS-IR,
  - low loss: <0.1 dB/cm
  - lithographic precision, fine pitch,
  - planar structures: couplers, splitters, resonators
  - controlled depth of the waveguide
- structured metallization of glass
Product Lifecycle Assessment (LCA) is an essential tool to Green ICT
IZM reviews all of Apple’s product LCAs since 2007
Demand for LCA-type eco assessment is growing (EU policy)

Need for action along the industrial value chain

- **Production Phase**
  - Reporting:
    - Energy efficiency KPIs
    - Full LCA (various impacts)
    - Product Carbon Footprints
    - Component level carbon footprints (IC & PCB manufacturing)
    - CRM (critical raw materials)
    - Eco-design measures (benchmarks)

- **Use Phase**

- **End-of-Life Phase**
  - Reporting:
    - Energy efficiency KPIs
    - Full LCA (various impacts)
    - Product Carbon Footprints
    - Component level carbon footprints (IC & PCB manufacturing)
    - CRM (critical raw materials)
    - Eco-design measures (benchmarks)

- **Regulation:**
  - ErP -Eco-Design Directive / ESPR Sustainable Product Regulation
  - PEF Product Environmental Footprint / Eco Declaration
  - Circular economy (repair)

- **Public awareness:**
  - Carbon neutral reporting (ISO 14068)
  - EPEAT Label / Eco Labels
  - Global Reporting Initiative
The relative and absolute environmental impact needs to be understood.
Effectiveness develops strategies and Efficiency the technical solutions.

Peter F. Drucker once said:
"**Effectiveness** is doing the right things,
**Efficiency** is doing things right."

Peter F. Drucker (1909-2005)
economist and management consultant

**Absolute environmental impact**
(on a market scale)

**Relative environmental impact**
(on a product scale)

**Strategic level** (target setting)
- Environmental assessments needed

**Operational level** (technical solutions)
- Eco-design methods needed
# Methodical approach to Lifecycle Inventory Models and Carbon Footprints

**5C-Methode (UTAMO Project, BMBF Green ICT Begleitforschung)**

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Carbon Footprint of electronic components

ICs have the highest environmental impact (more LCA data sets are needed)

Analysis of an exemplary electronic device

10% of component types contribute to 90% of the carbon footprint

60% of components are not relevant

Capacitors
Semiconductors (IC)

c. 180 Component types

Beitrag einzelner Komponententypen zum Carbon Footprint einer Baugruppe
Recycling of polymers from electrical and electronic equipment
IZM develops eco-design guidelines

EU-Project PolyCE (Post-consumer high-tech recycled polymers for a circular economy)

33 Recommendations for “Design For and From Recycling” at product and component level

Handover of the 1st Design Guidelines book to EC Vice President Frans Timmermans

Workshops with leading manufacturers and designers of EEE (250 participants)

Demonstration of the usability of > 80% PCR plastics in 7 product demonstrators, 4 of them TRL 9

2 awards at Plastics Recycling Awards Europe

KunststoffWeb raw materials exchange for PCR plastics

Consumer awareness campaigns across the EU