Fraunhofer IZM

Annual Report 2025 / 2026

Electronic Packaging for High-Performance Systems

Fraunhofer
IZM

Annual Report 2025/2026

Electronic Packaging for High-Performance Systems

“Packaging is our DNA. With our world-class facilities, we contribute to Europe’s technological sovereignty in microelectronics.”

Prof. Ulrike Ganesh
Director of Fraunhofer IZM

Content

Preface **4**

Fraunhofer IZM
- Departments 6
- Core Competencies 8
- Highlight: The Future of Chip Integration in Saxony 10
- Highlight: APECS – Europe's Integration Engine for Microelectronics 12
- Fraunhofer – a Strong Network 14
- Business Units & Industry Sectors 16
- Labs and Services 26

Events & Promoting Young Talent **28**

Facts & Figures **36**
- Fraunhofer IZM in Facts and Figures 37
- Awards 38
- Dissertations, Editorials 40
- Lectures 41
- Cooperations with Universities 42
- Cooperations with Industry 43
- Memberships 44
- Publications 44
- Patents & Inventions 48
- Advisory Board 49

Contact **50**

Imprint **52**

Preface

The profound changes currently taking place in the economy, technology, and the global landscape call for clarity, determination, and a willingness to break new ground. Collaborations, strategic initiatives, and numerous technological advances impressively demonstrate our institute's high potential for innovation. Fraunhofer IZM has set an important strategic course for the coming years and significantly strengthened its role as a driver of innovation. A milestone in this regard was the intensive strategic development carried out as part of a comprehensive strategy audit. The focus was on refining the content of our research portfolio. In addition, the role and development of the APECS pilot line were defined in concrete terms – a large-scale European initiative that offers a unique opportunity for Fraunhofer IZM.

At the »Electronic Packaging Days 2025«, it became clear what an important role the pilot line will play as the centerpiece of the future European packaging infrastructure. The event was a special highlight last year and brought together numerous guests from industry and research. The conference program on current topics such as chiplets, photonic integration, quantum computing, power, and sustainability, along with lab tours in twelve departments and topic-specific expert sessions, impressively demonstrated the connection between technological innovation, industrial application, and European strategy at Fraunhofer IZM.

We were able to successfully expand our research activities. Several projects in various application fields serve as examples of this:

- The »QuoGkA« project is dedicated to the miniaturization of quantum sensor technology, in which key optical components are embedded in a photonic glass platform with integrated waveguides to enable compact, precise measurements for gravimetry. An absolute novelty is an optical fiber with a target wavelength of 780 nm.

- In the »SUSTRONICS« project, ten pilot products were developed that are geared toward the circular economy and use sustainable materials and technologies for their manufacture.

- In addition, the institute supported the European Commission in revising regulatory frameworks, particularly in the area of energy-efficient and sustainable products. This included the further development of ecodesign requirements as well as the introduction of transparent evaluation criteria for the energy efficiency and repairability of desktop computers and laptops.

In June, the 15th anniversary of the institute's branch in Dresden-Moritzburg was celebrated during a ceremony featuring a technical symposium. Since its founding in 2010, Fraunhofer IZM-ASSID has evolved into a globally recognized innovation driver for 3D system integration and wafer-level packaging and has since played a key role in the European technology ecosystem. At the same time, the strategic development of the site has been further advanced: As part of CEASAX (short for »Center for Advanced CMOS & Heterointegration Saxony«), the expansion to ASSID 2.0 is underway. The planned expansion into a state-of-the-art 300 mm competence platform creates the conditions to address key future technologies even more effectively. In close collaboration with Fraunhofer IPMS-CNT, a high-performance competence center is thus being created that will sustainably strengthen competitiveness.

We are also looking forward to the development of the iCampµs project at our Cottbus site. There, Fraunhofer IZM is working together with university and non-university partners to strengthen the innovation and competitiveness of small and medium-sized enterprises in the Brandenburg region.

A central component of our strategic development is our participation in the European pilot line for »Advanced Packaging and Heterogeneous Integration for Electronic Components and Systems« (APECS for short). The initiative is coordinated by the Fraunhofer Society and implemented within the framework of the Research Fab Microelectronics Germany (FMD). The goal is to sustainably expand European semiconductor expertise and competitiveness by establishing state-of-the-art infrastructure for wafer- and substrate-based high-density integration. Fraunhofer IZM is actively involved in the development of the pilot line. A particular focus is on the integration of around 40 state-of-the-art systems that set new standards in system integration.

Here you will find an overview of the key figures for the year 2025: The number of employees has risen again and is approaching the 300 full-time equivalent mark. The operating budget has also increased and now stands at over 47 million euros. Operating income amounted to more than 17 million euros.

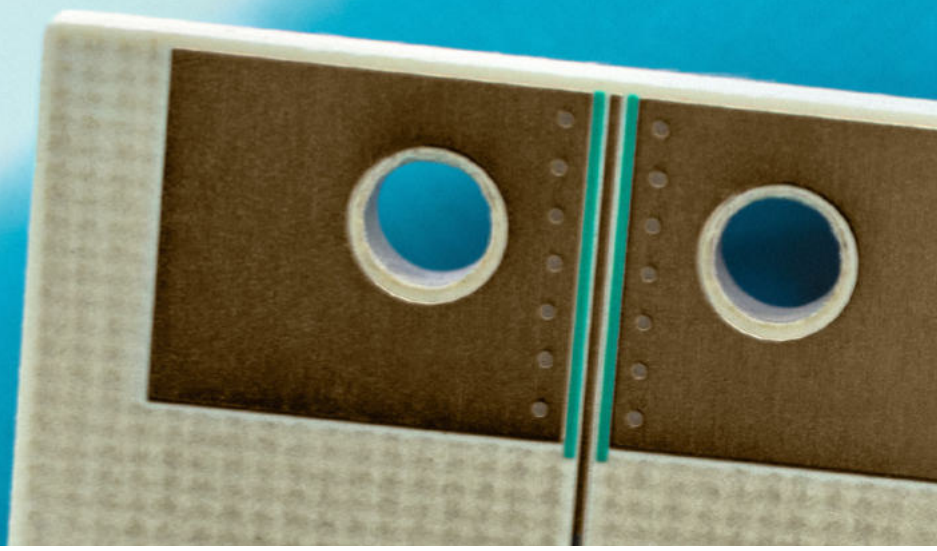
These successes are due in particular to the commitment and expertise of our employees. I would like to express my special thanks to them for their outstanding work, their innovative spirit, and their tireless dedication.

I would also like to thank our partners from industry, academia, and politics, as well as all funding bodies at the EU, federal, and state levels, for their trusting cooperation and continuous support.

These are just a few selected insights into an eventful year. I cordially invite you to learn more about our activities and developments on the following pages – and I look to the future with confidence and curiosity.

Warm regards,
Ulrike Ganesh

Departments



Head:
Dr. Tanja Braun

Head:
Dr. Andreas Ostmann

System Integration & Interconnection Technologies

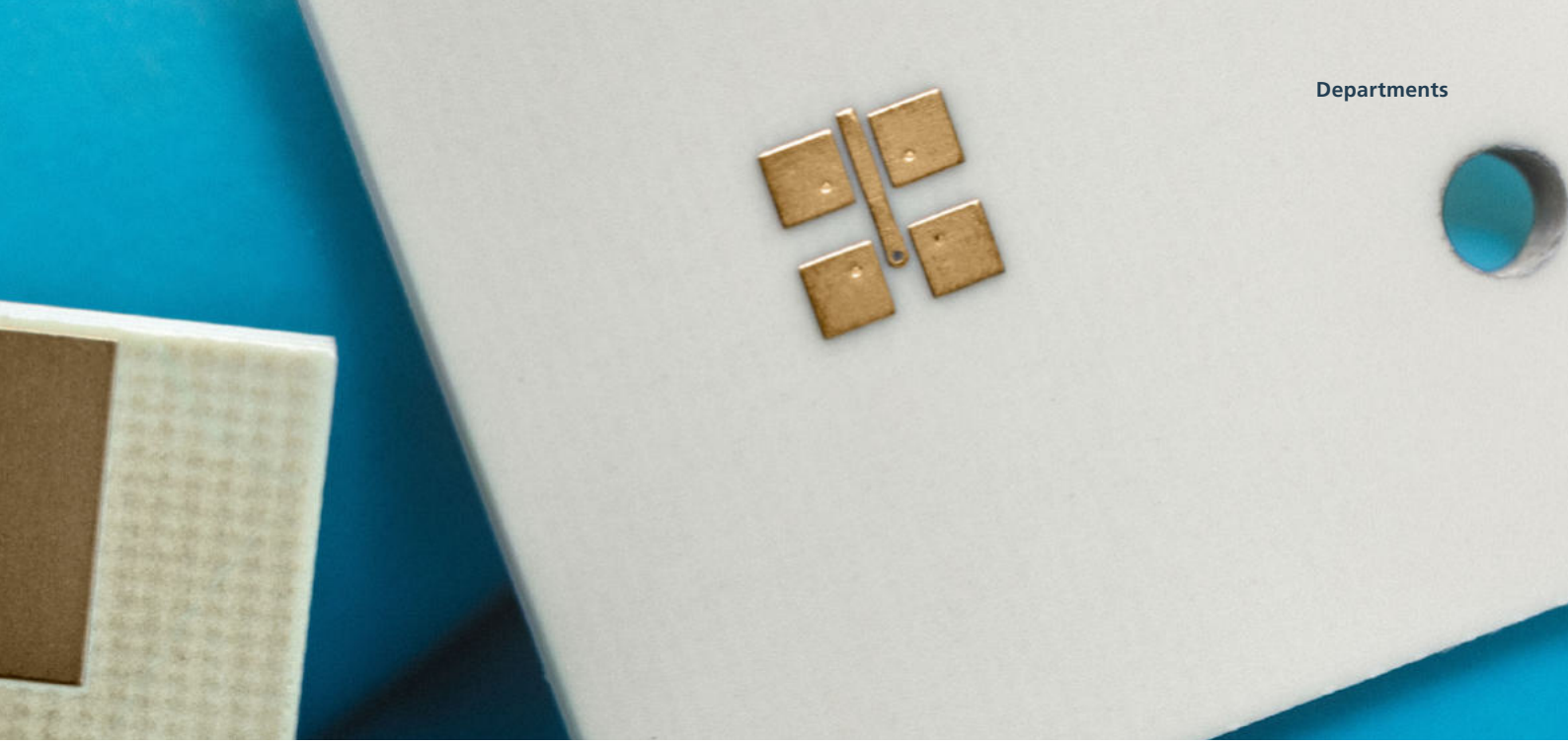
With over 100 employees, we research and develop processes, materials, and technologies for interconnection techniques at board, module, and package levels. Our focus is on integrating electrical, optical, and power electronic components into complete high-performance systems.

Head:
Dr. Manuela Junghähnel

Head:
Dr. Michael Schiffer

Wafer Level System Integration

The department develops technologies for advanced packaging and system integration at wafer level (up to 300 mm). The focus is on customer-specific solutions for microelectronic smart systems. Approximately 100 employees at the Berlin and Dresden-Moritzburg (ASSID) locations work on highly integrated, scalable, and industrially viable concepts.



Head:
Dr. Nils F. Nissen

Environmental and Reliability Engineering

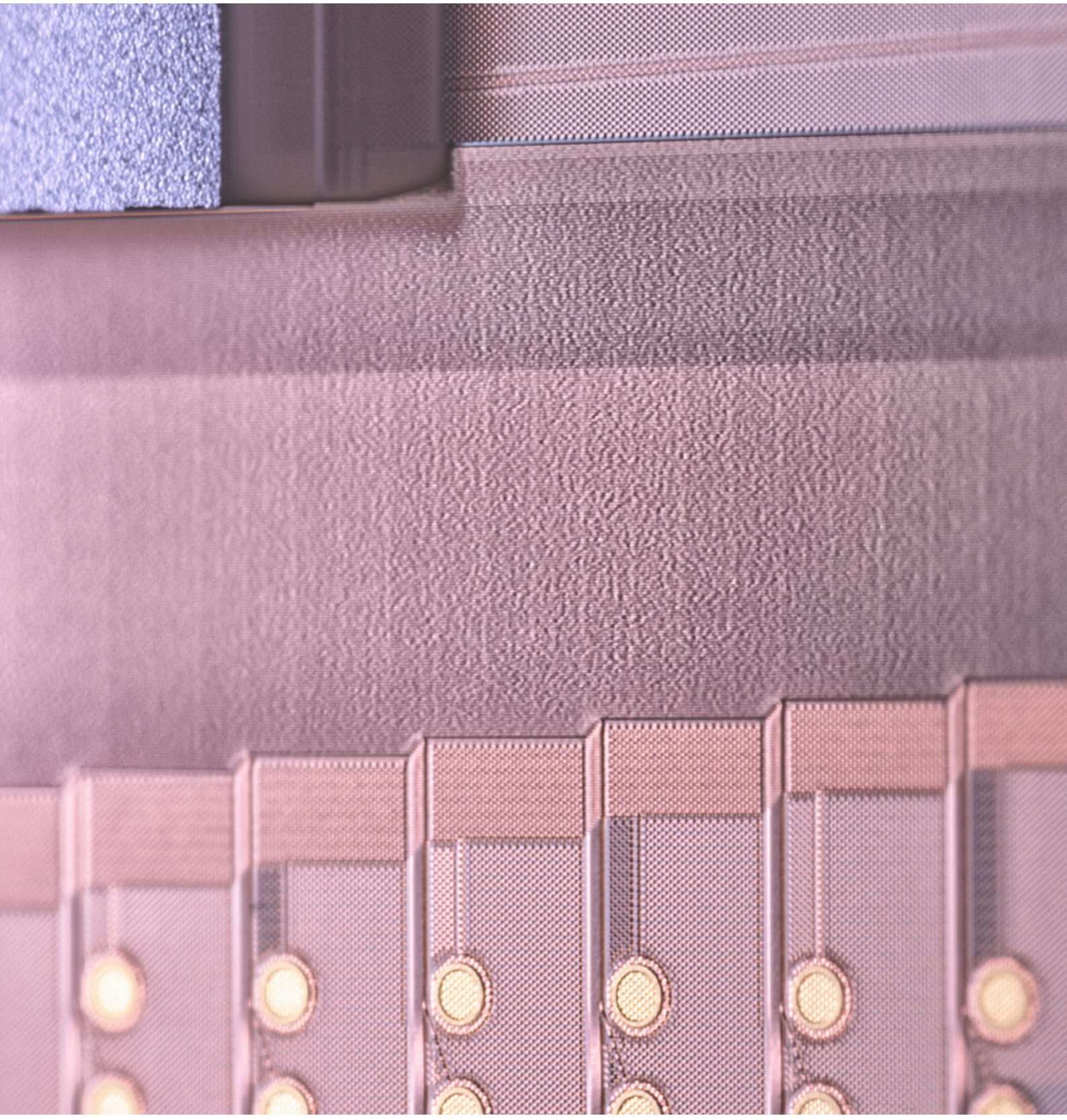
We support technological developments through to market readiness with comprehensive environmental and reliability analyses. The spectrum ranges from nano-characterization to system evaluation. The department combines reliability and sustainability, thereby creating a holistic foundation for robust, long-lasting technologies.

Head:
Harald Pötter

Head:
Prof. Ivan Ndip

RF & Smart Sensor Systems

The department develops application-specific wireless sensor nodes, radar and communication systems, as well as HPC modules. Additionally, we characterize assembly and interconnection technologies, and implement innovative designs for RF, millimeter-wave, and terahertz packaging to enable high-performance and networked systems.



Flip-chip-mounted photonic integrated circuit (PIC) on a silicon interposer (ALLEGRO project)

Core Competencies

High-End Performance Packaging from Wafer to System

Smart electronic systems – available everywhere! To make this possible, their components must possess exceptional properties. Depending on the application, they must be resistant to high temperatures, exceptionally durable, extremely miniaturized, custom-shaped, or even stretchable. Fraunhofer IZM supports companies worldwide in developing, building, and integrating robust and reliable electronics - even under extreme conditions - into their specific applications.

To this end, the institute, with over 460 employees, develops customized system integration technologies at the wafer, chip, and board levels. Research at Fraunhofer IZM means making electronics more reliable and providing reliable predictions about their durability.

Collaboration with Fraunhofer IZM

Fraunhofer IZM's research results are of exceptional interest to user industries such as the automotive industry, medical technology, and industrial electronics, as well as the lighting and textile industries.

Opportunities are open to semiconductor companies and suppliers of relevant materials, machinery, and equipment, as well as small businesses and startups: ranging from readily available standard technology to disruptive high-end development. As partners, customers benefit from the advantages of contract research: they can exclusively bring a product innovation to market, improve a process, or have a process tested and certified.

Heterogeneous integration

High-performance systems at lower costs – that is the promise of heterogeneous integration solutions and technologies such as chiplet architectures. Fraunhofer IZM sees itself as a link between manufacturers of materials, machines, and components and specialists in assembly and interconnection technology. In the implementation of the European Chips Act (EuCA), the institute is engaged as a partner for integration innovations.

Trending topics

Trending topics include chiplet assembly, hybrid bonding, silicon interposer technologies, fan-out wafer-level packaging, cryo-packaging, quantum electronics, the integration of high-bandwidth memory (HBMs), RF characterization, and packaging for 5G/6G applications are just a few of the technologies and examples in this portfolio designed to address the key trends of the future.

Highlight

The Future of Chip Integration in Saxony

Manuela Junghähnel and Kathrin Reinhardt

As a central pillar of the APECS pilot line, CEASAX is driving the development of 300 mm advanced packaging

With the Center for Advanced CMOS & Heterointegration (CEASAX), Fraunhofer IZM-ASSID is undertaking a technological expansion of central importance for the institute's future role in European advanced packaging. The project aims to expand the existing 300 mm research infrastructure in Dresden and Moritzburg. This will create the conditions necessary to sustainably meet the requirements of the EU Chips Act and the joint APECS pilot line.

Image on the right: Cleanroom at Fraunhofer IZM-ASSID

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CEASAX is a comprehensive project that goes far beyond the aspects of construction and equipment. It serves as a structural development tool that significantly strengthens IZM's research depth, process breadth, and international competitiveness in the field of 300 mm wafer-level system integration.

At its core, CEASAX aims to expand and modernize the cleanroom facilities in Dresden (ASSID 2, An der Bartlake) as well as the adjacent areas at the Center for Nanoelectronic Technologies (CNT) of Fraunhofer IPMS. In total, approximately 1,300 m² of cleanroom space will be technically upgraded and prepared for new 300 mm systems. This includes, among other things, the media supply, cleanroom climate control, and the infrastructural integration of additional process modules. At the same time, the existing equipment from ASSID 1 will be transferred to the new ASSID 2 area. The goal is to bundle and consolidate capacities and process availability at the 300 mm level.

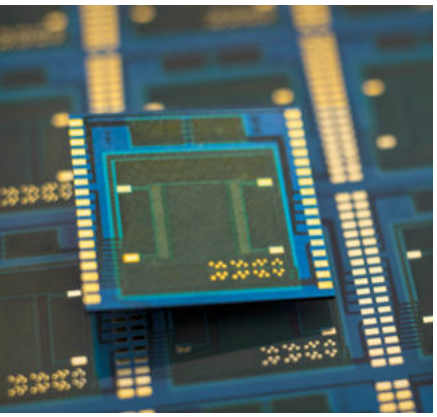
CEASAX's equipment includes a range of modern, fully automated systems. These include, among others, a 300 mm hybrid bonding tool, BEoL layer transfer systems, a 300 mm CVD cluster, large-area lithography systems, and automated cleaning and plating modules. The infrastructure is complemented by plasma and PECVD process modules, as well as additional equipment for plasma dicing, dry-film lamination, resist ashing, and thermal post-processing. This creates a seamless 300 mm process chain for heterogeneous integration. CEASAX covers core technologies that are indispensable for next-generation packaging roadmaps; these include 3D integration, hybrid bonding, back-end metallization, and large-format patterning steps.

For Fraunhofer IZM, CEASAX is key to further sharpening its profile in the international arena. The new facilities enable the establishment of fully industry-compatible 300 mm process chains, which represents a decisive advantage for partners in the fields of microelectronics, optics, sensor technology, and power electronics. The institute thereby increases its attractiveness for European and global R&D collaborations and positions itself even more clearly as an implementation partner in the field of advanced packaging. The close integration with the CNT at Fraunhofer IPMS also strengthens cross-institute collaboration and visibly and strategically bundles regional expertise in Saxony.

CEASAX contributes to increasing Fraunhofer IZM's internal innovative capacity. New process modules can accelerate developments in areas such as 3D stacking, ultra-fine-pitch bonding, or functional multilayer metallization. The cross-site implementation also strengthens the institute's organizational capability to plan, manage, and integrate complex large-scale projects into existing structures. CEASAX creates an infrastructure that enables Fraunhofer IZM to meet industrial and scientific requirements at the highest technological level in the long term. Expanding the scope of manufacturing strengthens the institute's strategic role as a European leader in advanced packaging. With regard to the APECS pilot line, CEASAX makes a decisive contribution to securing European semiconductor value creation and positions Fraunhofer IZM as an active shaper of this future.

Highlight
APECS – Europe's Integration Engine for Microelectronics

Rolf Aschenbrenner and Erik Jung



Pilot lines aim to bring the European chip sector back to the global forefront

In its strategic analysis, the European Commission noted that the European Union has lost considerable ground in semiconductor technology and currently accounts for only 8 percent of global value creation. The goal is to increase this share to 20 percent in the coming years.

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APECS is co-funded as part of the "Chips for Europe" initiative by the Chips Joint Undertaking as well as by the national funding agencies of Austria, Belgium, Finland, France, Germany, Greece, Portugal, and Spain.

Thanks to extensive funding from the Federal Ministry of Research, Technology, and Space (BMFTR) as well as the federal states of Saxony, Berlin, Bavaria, Schleswig-Holstein, Baden-Württemberg, North Rhine-Westphalia, Brandenburg, and Saxony-Anhalt, it will be possible to further expand the R&D infrastructure in the coming years as part of the APECS pilot line.

The key instrument for this is the European Chips Act, introduced in 2021, which has three pillars:

- Strengthening Europe's innovation capacity to world-class standards
- Building and modernizing manufacturing capacities for state-of-the-art semiconductor products
- Mechanisms for early response to market shifts, such as raw material shortages

Under the first pillar, leading EU research institutes will be equipped with state-of-the-art, production-oriented facilities to work on innovative processes. The goal is to bring innovations to market faster and to integrate science and industry more closely. Another focus is on supporting early-career researchers and establishing links to the manufacturing sector.

Five pilot lines address key technology areas:

- NanoIC-PL: smallest feature sizes (<2 nm)
- WBG-PL: new material systems for power semiconductors
- FAMES-PL: extremely power-efficient processors based on FDSOI
- PIXEUROPE-PL: photonic systems
- and APECS as the connecting element.

As an integration platform for heterogeneous systems, APECS plays a key role and consistently advances the »More than Moore« concept.

The Research Factory for Microelectronics Germany (FMD) was selected as the »hosting entity« in collaboration with partners such as CEA-Leti (France), imec (Belgium), and institutions from 13 other countries. As the operator of the APECS pilot line, FMD will become the European hub for system integration and a bridge between the pilot lines.

The focus is on the integration of advanced nodes, semiconductors, and energy-efficient processors into chiplet architectures using advanced packaging technologies. This is followed by validation of process and functional reliability.

To achieve this, progress is needed in:

- Interposer and assembly technology at the chip and wafer level
- Printed circuit board technology
- System integration
- Testing, characterization, quality assurance, and functional safety

The goal is a holistic design approach (System Technology Co-Optimization, STCO) that overcomes the previous boundaries between semiconductor manufacturing and backend processes.

The financial resources are substantial: the EU and its member states are providing 11 billion euros specifically for Pillar 1. It is expected that, through the involvement of private actors and other incentive measures, a total of up to 100 billion euros will flow into the microelectronics sector in Europe.

Within APECS, Fraunhofer IZM plays a central role as an innovation driver for heterointegration and as an interface between technology development and industrial implementation. The pilot line itself is being established with 730 million euros. At Fraunhofer IZM, the spectrum ranges from chiplets to panel stacks.

Key technological areas include:

- Miniaturization of through-silicon vias by a factor of 10 while maintaining extreme aspect ratios of 20
- Development of sub-micrometer-scale metal layers for the feed and interconnection of chiplets
- Use of glass alongside silicon to combine electrical and optical signal routing in the smallest possible space
- Further development of hybrid bonding toward micron-scale contacts for future HPC applications

Another focus is on integrating semiconductor-level subsystems into the finished system. State-of-the-art substrate technologies enable integration into rigid and flexible designs, thereby ensuring continuity from the component to the system.

Over the next three years, Fraunhofer IZM will invest approximately 90 million euros in equipment for the development of technologies and feature sizes below one micrometer for 2D and 3D integration concepts. Four specialized departments cover the entire chain from technology development to quality assurance.

Through integration into the FMD and access via the »FMD-OSSO«, companies, startups, and universities also benefit from these technologies.

Global Leader in Applied Research

A Strong Network

The Fraunhofer-Gesellschaft

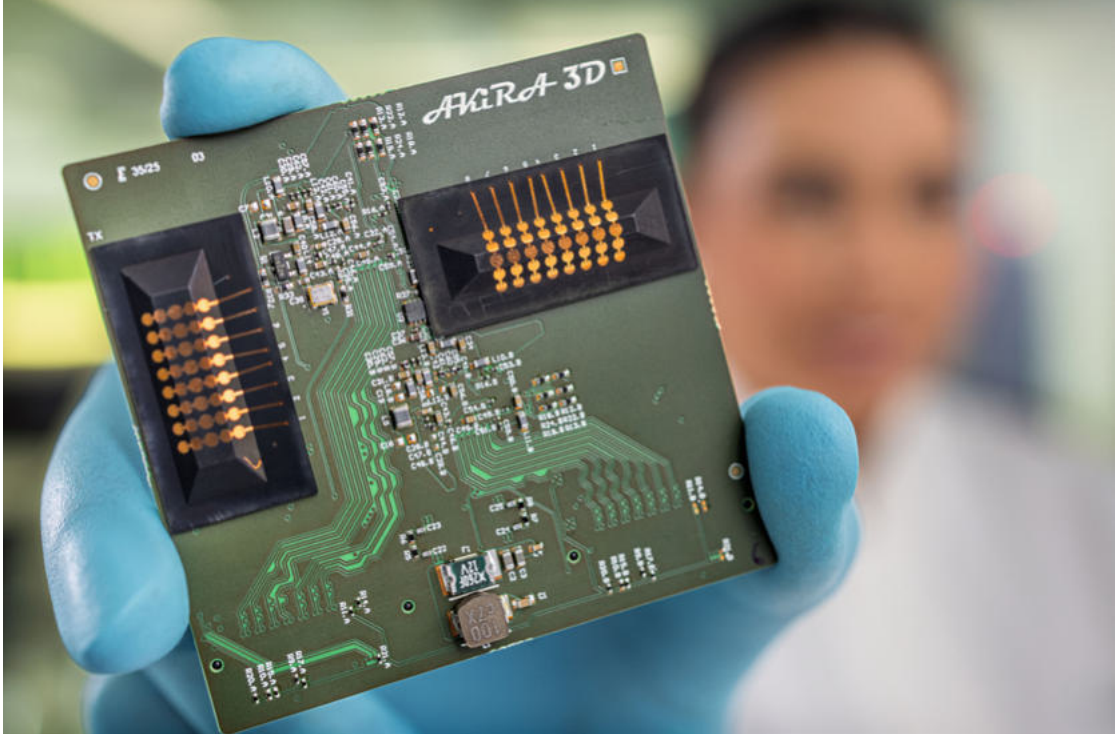
The Fraunhofer Gesellschaft, headquartered in Germany, is the world's leading organization for applied research. With its focus on key technologies relevant to the future and on the commercialization of research results in business and industry, it plays a central role in the innovation process. Founded in 1949, the organization currently operates 75 institutes and research facilities in Germany. Nearly 32,000 employees, most of whom have backgrounds in the natural sciences or engineering, generate an annual research volume of approximately 3.6 billion euros. Of this, 3.1 billion euros are allocated to contract research.

Research Fab Microelectronics Germany – One-Stop Shop for Microelectronics

Last year, the Research Fab Microelectronics Germany (FMD) further expanded its role as a central, cross-site and cross-organizational point of contact for micro- and nanoelectronic research and development in Germany and Europe. As a collaboration between 13 Fraunhofer Institutes and the Leibniz Institutes FBH and IHP, the FMD brings together application-oriented expertise across the entire microelectronics value chain. It exemplifies how Europe's technological independence is fostered where a nationally distributed research landscape operates in a unified, coordinated, and cross-technological manner.

Through the targeted development of strategic research and transfer infrastructures, the close integration of science and industry, and active participation in European initiatives such as the EU Chips Act, the FMD makes a significant contribution to Europe's technological resilience. At the same time, it sustainably strengthens the innovation and competitiveness of the European semiconductor ecosystem. Fraunhofer IZM is one of the institutes collaborating within the FMD and contributes its unique packaging expertise.

Heterogeneous integration and advanced packaging: Establishment of the APECS Pilot Line
Since late 2024, the institutes collaborating within the FMD have been working together with other European partners to establish the pilot line for »Advanced Packaging and Heterogeneous Integration for Electronic Components and Systems« (APECS). By the end of 2025, the procurement of more than 50 percent of the required equipment had been initiated; key work packages were successfully launched.



79 GHz MIMO radar sensor with 3D antennas and an optimized field of view for drone detection applications

National interface to European design and manufacturing pilot lines: G3C
Launched in October 2025, the »German Chips Competence Centre« (G3C) supports companies, startups, and research institutions in translating semiconductor ideas into concrete development projects. As an independent advisory body, the G3C assesses technical and economic feasibility and identifies suitable development and implementation partners.

The Europe-wide establishment of national Chip Competence Centers is a core component of the Chips Act and complements European research and technology transfer structures in the field of microelectronics.

Networking chip design expertise: Chipdesign Germany
As one of four partners, FMD is involved in the »Chipdesign Germany« (CDG) network, which strengthens pre-competitive exchange and the networking of existing chip design expertise in Germany. Together with edacentrum GmbH, Leibniz University Hannover, and the Rhineland-Palatinate Technical University of Kaiserslautern-Landau, a central platform for research, industry, and the promotion of young talent is being established.

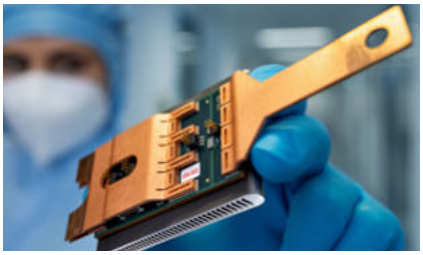
FMD's research expertise has been strategically expanded over the past three and a half years Through two large-scale cross-organizational projects, FMD has strategically expanded its portfolio of expertise in recent years, particularly in the areas of quantum and neuromorphic computing as well as environmentally sustainable information and communication technology (ICT).

As part of the »FMD-QNC«, a national research infrastructure for hardware development in the field of novel computing technologies was established. A large part of this expanded research infrastructure is being continued, for example, within the APECS pilot line. In parallel, the »Green ICT @ FMD« competence center was established as a platform that brings together research and development across institutes to reduce the energy and resource consumption of digital technologies. Fraunhofer IZM plays a key role in both projects.

Competence Centers

The Center of Excellence »Function Integration for Micro-/Nanoelectronics« brings together the expertise of the four Fraunhofer Institutes/Branch Offices - IPMS, ENAS, IIS-EAS, and IZM-ASSID as well as the universities TU Dresden, TU Chemnitz, and HTW Dresden, which are positioned along the value chain for microelectronics and microsystems technology products. The Competence Center is embedded in Saxony's microelectronics cluster. The »Digital Networking« Competence Center is a collaboration among the four Berlin-based Fraunhofer Institutes FOKUS, HHI, IPK, and IZM. Its work focuses on technologies and solutions that address the increasing digitalization and networking of all areas of life.

Business Units & Industry Sectors



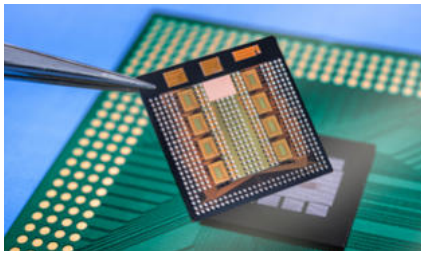
Automotive and Transportation

Modern traffic systems have to be safe, environmentally friendly and cost-efficient. High-performance, reliable and, in some cases, highly miniaturized systems are key goals for developers creating innovative forms of transport and traffic systems for road, rail, sea and air. Transportation has been a key priority and competence area across Fraunhofer IZM departments since the institute's very beginning. The institute helps OEMs, Tier1 companies and particularly their suppliers integrate the latest electronics into vehicles quickly and efficiently. We develop future-proof, reliable solutions, including prototypes, which improve the safety and comfort of conventional, hybrid and electric engines and systems.

Information and Communication

The new era of increasing connectivity and digitalization creates new challenges for the design and assembly of ICT systems: The efficient sharing and storing of data needs ever larger data centers and the means to transmit electric and optical signals. Digitalization itself brings its own challenges: There is increasing demand for highly dynamic networks that can transport, process, and analyze data. Fraunhofer IZM offers comprehensive solutions for these challenges with more than two decades of experience in the field of system integration.

Complex project initiatives move across the boundaries of disciplines and competencies. They benefit from the business expertise of Fraunhofer IZM's dedicated Business Development Team that represents the industry's specific needs in all functional areas of the institute and coordinates the work on innovative solutions. We are here to assist you in the strategic development of innovative areas with complex and groundbreaking technologies.



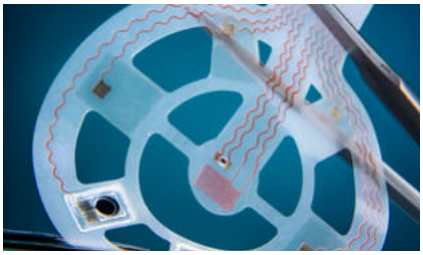
Semiconductors

This business unit specializes in the integration of semiconductor elements and the production of sensors for the assembly of complex heterogeneous system-in-package (SiP) solutions.

Fraunhofer IZM offers its clients holistic services – from developing the original concepts and designing the processes to characterizing and testing the reliability of the finished systems. The institute's facilities cover all relevant processes for manufacturing sensors and wafer-level packages, allowing the production of hermetically sealed sensor packages and even entire 3D systems.

Industrial Electronics

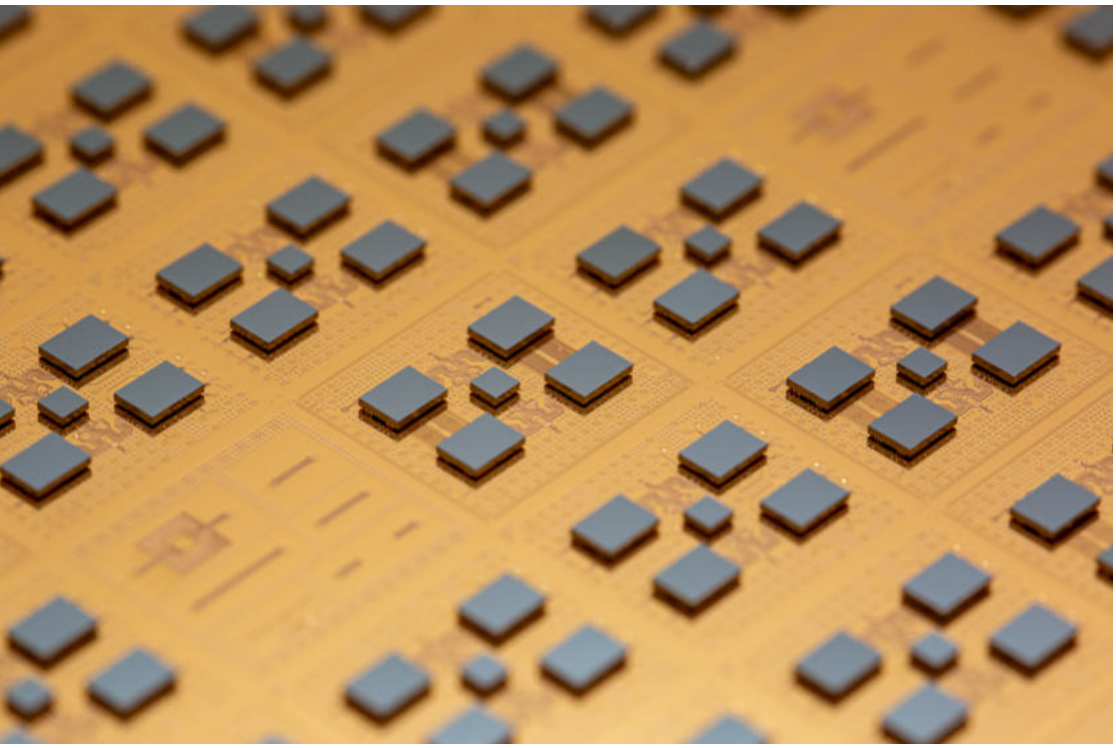
In recent years Fraunhofer IZM's industrial electronics specialists have concentrated on the visionary concept of Industry 4.0. Particular emphasis was placed on the work on cyber physical systems (CPS) and autonomous, specifically high-reliability radio sensors that record and process the relevant monitoring and/or video data on site and distribute it via standard interfaces when and where the user needs it. Industry 4.0 means much more than CPS integration: Flexible access to monitoring data is particularly vital both for location-bound controlling and management processes and ERP systems, and for on-demand access via mobile devices in inspection, maintenance, or repair scenarios.



Medical Engineering

Over the past years, the innovation potential of microelectronics has led to considerable progress in medical technology.

Fraunhofer IZM has been front and center in this development process for 20 years. Our know-how in microtechnology and innovative integration processes helps manufacturers realize innovative new medical engineering products that meet all legal requirements. Of course, Fraunhofer IZM also performs customized reliability analyses, bio-compatibility assessments, as well as the risk assessment according to ISO 14971 standards, which is required for the development of new products.



REWAL Package: RDL-First FOWLP with assembled chiplets

Multi-chiplet integration for 77 GHz automotive radar

The BMFTR-funded »REWAL« project addresses the growing demand for high-performance and reliable 77 GHz automotive radar systems. To this end, it relies on a so-called heterogeneous chiplet approach based on FOWLP (RDL-First Fan-out Wafer-level Packaging) technology. This technology enables high-density integration of multiple RF chiplets with short, low-loss interconnects.

Fraunhofer IZM implemented the entire development chain – from process development and material evaluation to simulation and reliability testing. The successful functional testing of the 4×4 MIMO radar system was carried out by an external partner. A comparison with eWLB technology shows that RDL-First FOWLP is well-suited for future mmWave and automotive applications.

Green ICT – Sustainability for competitive microelectronics

With the »GreenICT@FMD« project funded by the BMFTR, a competence center for sustainable information and communication technology (ICT) was established for the entire FMD under the technical guidance of Fraunhofer IZM. It brings together Fraunhofer expertise in the development of energy- and resource-efficient microelectronics, photonics, and wireless technology. The project, which will be completed in early 2026, is one of the largest initiatives for sustainable ICT and represents a milestone for Fraunhofer IZM and the Fraunhofer Society. The »Environmental & Reliability Engineering« Department at Fraunhofer IZM took on the technical leadership in the Green ICT sector and supported the development of expertise among all project partners.

A particular focus was placed on life cycle assessment for ICT. Training sessions conveyed the fundamentals of life cycle analysis to a broad audience. In integrated projects, the environmental improvements of new technical solutions were validated using simplified life cycle assessments. A highlight is the study »Development of Electricity Demand and Carbon Footprints of ICT in Germany«, published by Fraunhofer IZM in 2025, which maps economic and technical trends for the first time in a new life cycle inventory model. The project clearly demonstrates that Green ICT is central to a high-performing and competitive ICT industry. In addition to the efficient use of energy and raw materials, it addresses resilient supply chains, design for and from recycling, and the substitution of critical substances. Green ICT strengthens the prospects for producing microelectronics and photonics systems competitively in Germany again in the future.

Green ICT will continue even after the project ends and stands for efficient use of energy and resources, circular device design, and a resilient microelectronics and ICT economy.

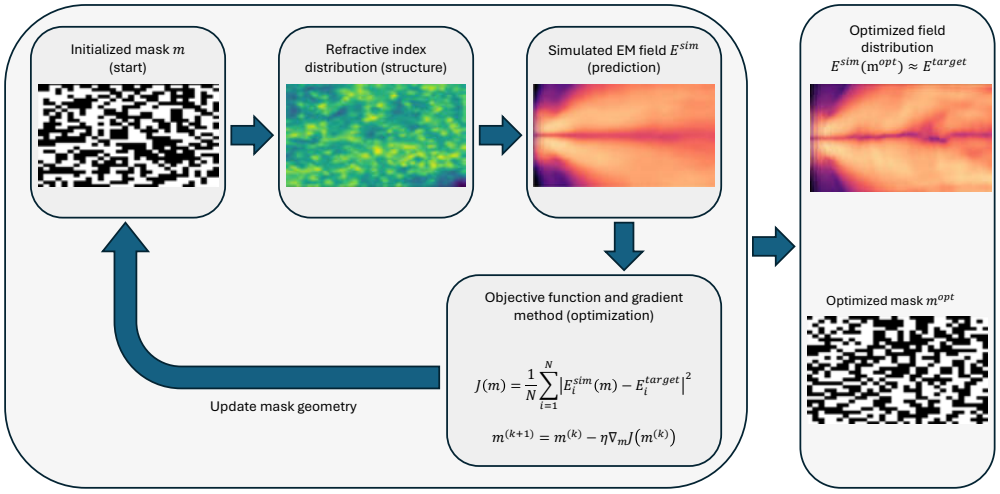
»All2GaN« – Innovative packaging solutions for GaN power electronics

The »All2GaN« project, funded under the Chips Joint Undertaking, aims to develop the next generation of energy-efficient power electronics based on gallium nitride (GaN). Through new integration and packaging concepts, GaN devices are set to fully realize their potential in applications such as electric mobility, industry, data centers, and renewable energy. Thanks to high switching speeds, low losses, and compact designs, GaN systems contribute significantly to reducing energy consumption and CO_2 emissions.

Fraunhofer IZM plays a central role in the project within the Advanced Packaging division. The WLSI department develops innovative bonding technologies for the direct assembly of GaN bare chips onto printed circuit boards. The focus is on nanoporous gold (NPG) for fine-pitch applications to significantly reduce feature sizes, increase integration densities, and reduce parasitic effects. This results in compact, high-performance modules.

NPG enables a solder-free joining technology at low temperatures for direct chip bonding on organic printed circuit boards. It offers high electrical and thermal conductivity as well as excellent temperature and aging resistance. Due to its porous microstructure, it is highly deformable: under moderate pressure, it compensates for surface roughness and, thanks to its large specific surface area, enables material-bonded connections at comparatively low temperatures. This reduces thermal stress on the components to be joined and improves process compatibility. The goal is scalable, robust processes for highly integrated fine-pitch GaN modules.

GaN-SMPT test chip with nanoporous gold for flip-chip mounting on a PCB test board



3DGlassGuard: Schematic flow of Inverse Photonic Design (IPD) for field shaping

»3DGlassGuard«: AI-optimized glass photonics for robust sensor technology

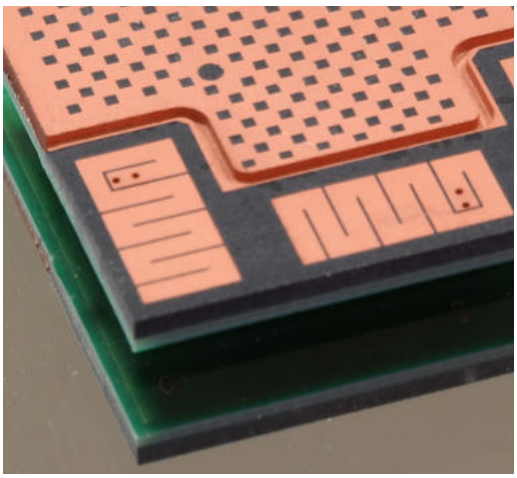
In the BMFTR-funded »3DGlassGuard« project, Fraunhofer IZM is developing integrated photonics in glass that enables sensor technology even under harsh conditions, for example in power electronics or environmental analytics. The core idea is the three-dimensional integration of photonic functions into thin glass substrates: optical waveguides, couplers, and functional structures are realized directly in the glass and then transferred into hybrid assemblies using assembly and interconnection technology (AVT). Glass offers chemical stability, temperature resistance, and electrical insulation, as well as the basis for optical components that can be directly embedded into this substrate.

Technologically, »3DGlassGuard« combines femtosecond laser structuring for 3D waveguides with the ion exchange process (IOX) to create low-loss, reproducible, and large-area-processable photonic components. The IOX process enables the fabrication of photonic components such as intensity splitters. For the design of these components, Fraunhofer IZM relies on Inverse Photonic Design (IPD) to create unprecedented structures. To implement this approach, the project is developing AI-supported surrogate models that accelerate simulations and significantly shorten the path to a production-ready layout. These surrogate models are used to algorithmically optimize the geometry and process parameters. The results are incorporated into glass-integrated demonstrators for optical current sensing as well as into integrated sensor modules for water analysis.

AI-supported quality assessment in electronics manufacturing

In the BMFTR-funded project »AdaPEdge« (Edge Computing Module for Resilient Electronics Manufacturing with Adaptive Process Optimization), industrial manufacturing processes are to be made more robust, efficient, and consistent in quality through AI-supported edge computing solutions. Process and environmental data are collected and preprocessed decentrally close to the source, enabling rapid responses, reduced data loads, and stable operation even in the event of disruptions or process fluctuations. At the core of the approach is adaptive process optimization based on end-to-end data flows and scalable integration concepts.

Package with integrated sensors, a robust wireless interface (BLE), and an I²C interface for connecting additional sensors



As a manufacturing partner, Fraunhofer IZM provides a real-world high-mix/ low-volume manufacturing environment. The institute's own production line serves as a test bed for the time-correlated collection and evaluation of process and state data such as solder paste volume, placement force, soldering temperature, solder joint geometry, as well as the geometry and position of EMC pastes during compression molding. In addition, temperature, humidity, and acceleration data are recorded and stored. This data enables a holistic assessment of production that goes beyond traditional metrics such as yield. A key project outcome is the condition-level concept for the early derivation of countermeasures.

Networked sensor systems form a key data source in this context. The developed Smart Secure Sub-Edge Modules (S3EM) are modular, industrial-grade sensor nodes with robust wireless connectivity. Their SiP-based integration concept combines PCB technologies, molded encapsulation, EM shielding, and 3D antennas. This ensures reliable, interference-resistant communication even under demanding industrial conditions. In this way, Fraunhofer IZM systematically connects the physical manufacturing world with the data and AI levels, creating transferable foundations for the digital transformation of industrial production processes.

Wafer-based integration for minimally invasive neuroimplants

In the EU-funded »MINIGRAPH« project, Fraunhofer IZM is developing wafer-based processes for the fabrication of highly integrated, flexible neuroimplants for adaptive brain stimulation. The core contribution is the integration of an ASIC and high-density circuit traces into biocompatible polymer carriers with reliable thin-film encapsulation. The developed technologies enable large-area, scalable implants with high signal integrity, low invasiveness, and the potential for future closed-loop therapies for neurological diseases.

Flexible thin-film-based substrate for epi- and subcortical applications

Miniaturized quantum gravimeter on a photonic glass bench

In the EU-funded »QuoGkA« project, Fraunhofer IZM and Nomad Atomics are developing the next generation of quantum gravimeters: high-precision gravity sensors based on cold atoms, whose core component is a novel, micro-integrated laser system on a photonic glass bench. The key innovations include polarization-maintaining waveguides at 780 nm, integrated electro-optical switches, and a micro-fabricated rubidium glass cell. All of this is built on and within a glass bench measuring just a few centimeters.

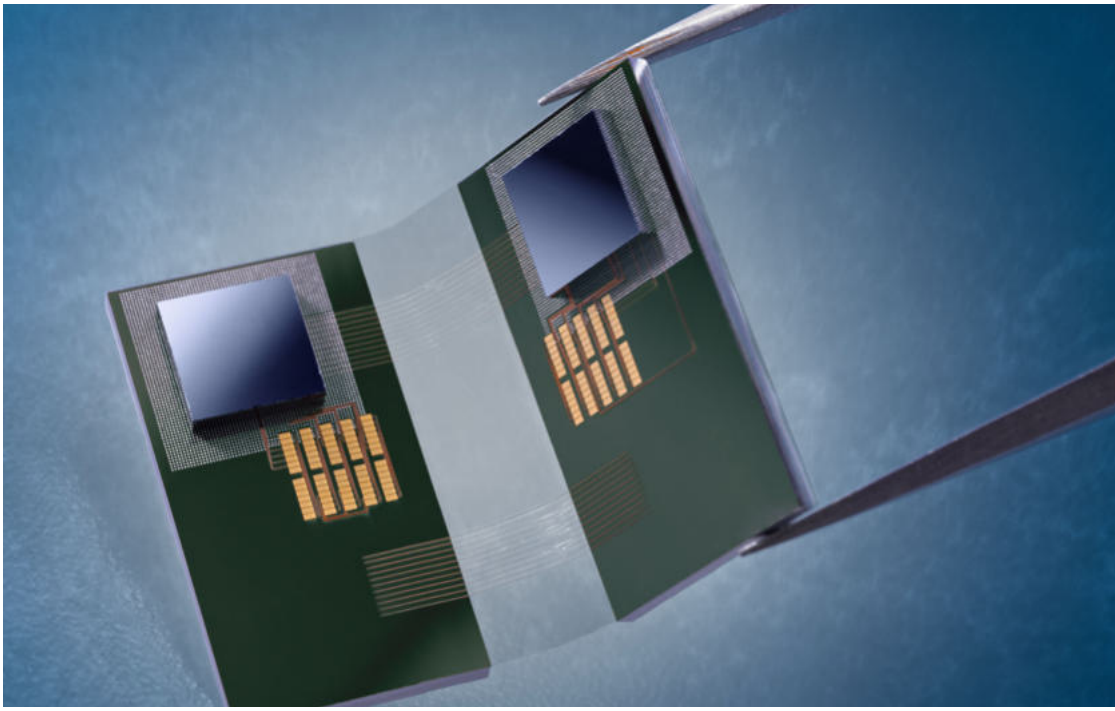
Nomad Atomics integrates this glass bench into a compact atomic interferometer, which will first be tested in the laboratory and subsequently on a drone. This creates one of the world's first drone-based quantum gravimeters. Compared to conventional gravimeters, quantum sensors enable drift-free, absolute measurements with high spatial resolution – crucial for the precise detection of minute density differences in the subsurface.

»QuoGkA« addresses several business sectors:

- Mining: more efficient exploration of ore and other deposits
- Oil and gas exploration: improved structural mapping and risk minimization
- Environmental and water management: monitoring of groundwater recharge and leaks in water infrastructure
- Engineering: condition assessment of tunnels, mine fields, and critical infrastructure

As part of the Berlin Quantum Alliance, »QuoGkA« strengthens Berlin's role as a hub for application-oriented quantum technologies while simultaneously laying the groundwork for future products in the field of quantum-based navigation and inertial sensors.

Using a photonic glass platform developed at Fraunhofer IZM, the institute and Nomad Atomics are miniaturizing complex quantum gravimeters for use in drones



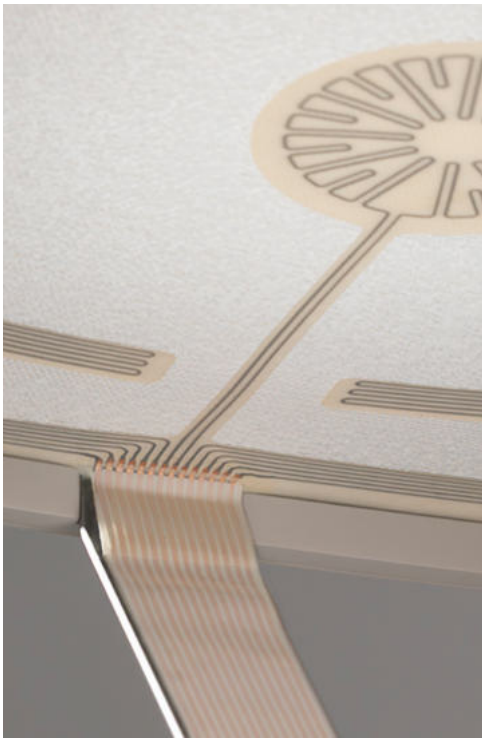
Project »QSolid«: Rigid-flex interposer with a polyimide bridge and superconducting TiN connections for high-density, thermally decoupled integration of QPU and QCI in cryogenic quantum computing

Semiconductor-based assembly and interconnection technology for scalable quantum computers

The BMFTR-funded »QSolid« (Quantum Computer in the Solid State) project aims to develop the first fault-tolerant quantum computer in Germany. This is intended to establish Germany as a leader in the field of quantum technologies. The QSolid consortium includes 26 institutions from academia and industry. Together, they are working to establish a comprehensive ecosystem for quantum computing. This ecosystem is to be integrated into the JUNIQ supercomputer environment at Forschungszentrum Jülich (FZJ) and made accessible to external users as well.

In the work package »Technologies for Hardware Integration«, Fraunhofer IZM-ASSID is leveraging its expertise in 300 mm wafer-level packaging to develop pioneering concepts for the scalability of the assembly and interconnection technology of the quantum processor (QPU, Quantum Processing Unit) based on semiconductor technologies. The key challenge of scalable interconnection technology lies in the fact that the quantum processor must be highly densely connected to control and readout electronic components at operating temperatures below 1 K, while at the same time being thermally isolated from them.

In close collaboration with Fraunhofer IPMS, Fraunhofer IZM-ASSID is further developing its rigid-flex interposer solutions for these new application environments. Fundamental, manufacturing-technologically demanding steps include the deposition and patterning of superconducting materials, the fabrication of ultrathin seed layers for bumping, and ensuring the thermomechanical reliability of the interposer.



Soft Interfaces: Textile-integrated, tactile light control using printable liquid metal ink

Development of flexible, textile interfaces with printable liquid metal structures

The »Soft Interfaces« project by Fraunhofer IZM and the WINT Design Lab, funded as part of the Fraunhofer »Science, Art & Design« network, demonstrates how textile surfaces can be transformed into interactive control elements. At its core is a newly developed, printable liquid metal ink based on Galinstan, which is integrated into elastic textiles. This creates flexible, stretchable, and aesthetic interfaces that respond to touch. One demonstrator is a lamp with a knitted shade that can be turned on, off, and dimmed by touch. The technology opens up new possibilities for smart home textiles, wearables, and innovative human-machine interfaces.

New wafer-to-wafer bonding process for ultra-thin hybrid pixel detectors

As part of the EU-funded project »Advancement and Innovation for Detectors at Accelerators« (AIDAinnova), Fraunhofer IZM has developed a polymer-metal hybrid bonding technology that represents an important step toward the realization of ultra-thin hybrid pixel detectors with reduced chip weight. The process development is based on wafers with daisy-chain test structures. The top and bottom wafers are bonded together using planarized, low-profile Cu-Sn pillar bumps and a structured polymer bonding layer. The electrical characterization of the daisy chains and the resistance of the individual bump connections show promising results for the transfer of the wafer-to-wafer bonding technology to the production of functional hybrid pixel detectors based on TIMEPIX3 readout chips.

Reliable real-time touch detection

In the »NeuroTouch – Neural Touch Detection on Large-Area Displays« project, Fraunhofer IZM is collaborating with interactive scape GmbH to develop technologies designed to revolutionize interaction with large displays. Using artificial intelligence and modern neural networks, the goal is to detect touches on large display systems more precisely, reliably, and in real time.

The intuitive and flexible operation of multi-touch displays via multiple touch points simultaneously remains a challenge for touch technology pioneers such as interactive scape GmbH. Together with Fraunhofer IZM, they are therefore developing innovative modules that, in combination with AI algorithms, offer unprecedented accuracy and versatility. The modules must also be robust against environmental influences and interference so that they function reliably in a wide variety of application scenarios.

To this end, Fraunhofer IZM implements reliable technologies specifically tailored to large-area touch systems in displays.

Thanks to its expertise in microintegration, the institute optimizes the processing so that the hardware interacts precisely and quickly with the AI evaluation algorithms. This ensures that the captured touch signals are recorded and processed with the highest precision and speed. In addition, the intelligent software integrates seamlessly, and the developed solutions remain modular and scalable thanks to innovative system integration.

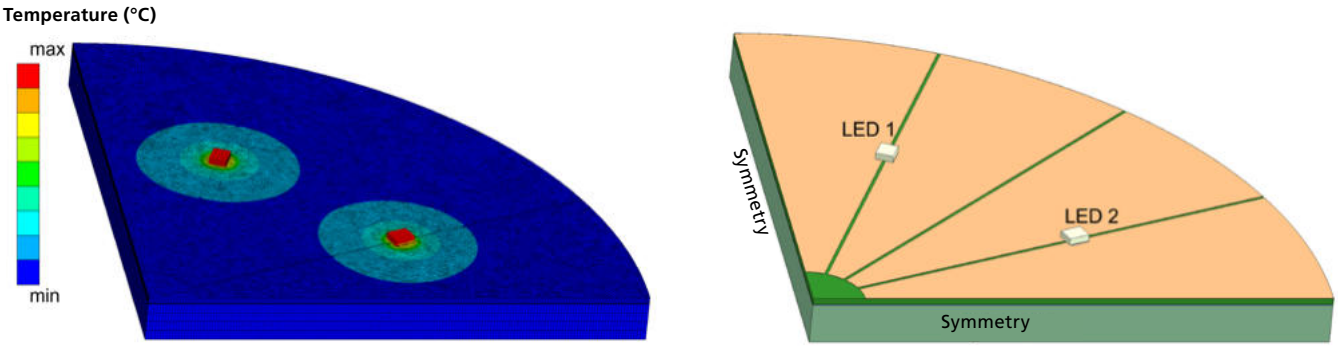
COMSBlue – Innovative thermal management for LEDs in mobile therapy devices

COMSBlue utilizes a novel, antibiotic-independent mechanism of action for the treatment and prevention of chronic and acute wound infections. In the project funded by Innosuisse and the BMFTR, Fraunhofer IZM contributes its expertise in LED thermal management and integrates an innovative heat buffer into a mobile therapy device. An integrated approach combining simulation, technology development, prototyping, testing, and analysis yields insights for further application areas and strengthens Fraunhofer IZM's position in the field of electronic packaging.

Standardization of Product Carbon Footprints in the semiconductor value chain

In collaboration with the SEMI Semiconductor Climate Consortium, Fraunhofer IZM is providing important impetus for a climate-transparent semiconductor and IT industry. The researchers are developing a strategic roadmap for the Product Carbon Footprint (PCF) that enables a practical and comparable assessment of greenhouse gas (GHG) emissions along the entire value chain – from semiconductor manufacturing to end devices.

Through in-depth industry analyses and discussions with numerous companies, the institute is documenting the growing need for reliable and standardized PCF data. This work lays the foundation for uniform methods, transparent data structures, and standardized exchange formats, which are considered key to effective GHG reduction in IT hardware.



Thermal modeling results for feasibility analysis and design optimization of a portable medical lighting system

Labs & Services

System Integration

Wafer-Level Packaging Line

Fraunhofer IZM operates two process lines (cleanroom class 10 – 1000) in Berlin (975 m²) and Dresden (ASSID, 1000 m²), that offer our customers various wafer-level packaging services from development stage to prototyping and small volume production. Different substrate materials (e.g. silicon, III/V, ceramic and glass) and wafer sizes (4"–12") can be processed. Project and process work on both lines is executed in compliance with ISO 9001:2015 management standards.

Process Modules (up to 12")

- Cu-TSV integration (via-middle and via-last-processes)
- Silicon and SiC plasma etching – DRIE (TSV, cavities)
- Multilayer thin-film deposition (PVD, CVD, ECD, lithography (resolution up to 0.5 µm), mask aligner, reactive ion beam etcher)
- PECVD process chamber (200/300 mm) for the deposition of TEOS oxide, Silane oxide and Silane nitride
- High-density thin-film multilayer (Cu/polymer RDL, Cu-Demascene)
- Wafer-level bumping (Cu-Pillar, SnAg, Ni, Au, In, InSn, AuSn, Cu-nano interconnects, nanoporous Au)
- Wafer thinning und thin wafer dicing (blade, laser grooving and stealth dicing)
- Wafer bonding – permanent and temporary
- Wafer-level assembly up to 300 mm (D2W)
- Automatic inline wafer metrology for layer thickness, topographies, roughness as well as TTV / warpage / bow
- Fully automated electric wafer measurement system (8" / 12")

Substrate Line

Our R&D line offers fully flexible processing of large-format substrates up to 610 × 456 mm² and 510 × 515 mm², enabling rapid adaptation of designs, materials, and process parameters. The complete process chain for PCBs, HDI boards, and IC substrates is available, including subtractive, mSAP, and SAP manufacturing technologies as well as advanced R&D approaches. We continuously develop solutions ranging from power-electronics interconnects with copper thicknesses of several hundred micrometers to ultra-fine structures with line/space dimensions down to 2 µm. In addition, we provide highly precise component integration directly into substrates. Our services include:

- Design-for-Manufacturing (DfM) optimization
- Embedding of passive and active components, including bare dies and pre-packaged devices
  Multilayer fabrication using advanced PCB materials with ultra-low CTE and high thermal or electrical conductivity
- Build-up fabrication of organic and next-generation glass substrates
- Laser and mechanical drilling of through vias and blind vias
- Quality assessment and failure analysis using AOI, flying-probe testing, SEM/FIB, and X-ray microscopy

Mold Encapsulation Lab

The lab offers various encapsulation processes, related material and package analysis and reliability characterization tools as a one-stop-shop. The focus is on FO-WLP / PLP, on sensor packages with freely accessible surface and on power SiPs. Production-ready machines facilitate the transition into industrial production.

- Precision assembly and compression molding on wafer- and panel-level (610 x 456 mm²)
- Redistribution/metallization on encapsulants in 2D (PCB-based and thin film) and 3D (TMV, shielding and AiP) on WL/PL
- Transfer molding of SiPs/MAPs for sensors and power
- Material model development based on precision material analysis and process simulation
- Digital environmental and process monitoring for generation of digital twins

Soldering Lab

- Vapor phase soldering with vacuum enables manufacturing of voidless large-area solder joints for power electronics
- Fluxless soldering of printed circuit assemblies using active gas in oxygen free nitrogen or vapor phase atmosphere

Photonics Lab

- Direct laser structuring of glass
- fs-Laser modification of glass (+ KOH etching), selective-laser-etching and laser-induced deep etching
- Optical and thermal characterization of LEDs and LDs
- fs-Laser writing of optical waveguides
- 2-photon-polymerization for micro lenses and photonic wire-bonds

Quantum Lab

- Laser sealing for hermetic cavities (vacuum/gas)
- Automated coupling for quantum chips/PICs
- Automated characterization of optical waveguides
- Refracted-near-field measurements
- Scanning-near-field optical microscope
- Laser scanning microscope

Material Analysis

Moisture Lab

- Comprehensive simulation-based reliability assessment of humidity-induced phenomena in microelectronic components and systems
- Surface analysis through atomic force microscopy, EBSD analysis and Nano/Pico indentation
- Analysis methods for sorption, permeation and diffusion of water in materials

Long-term Testing and Reliability Lab

- Fast temperature cycling tests in the range from -65 °C to 300 °C and temperature storage up to 350 °C
- Active power cycling, H3TRB and dynH3TRB; combined testing (temperature, humidity, vibration)
- Component and assembly qualification in accordance with AEC, IPC, JEDEC

Power Lab

- Testing of hetero highly integrated power modules
- Active cycling of power modules for lifetime assessment
- Calorimetric measurement of the effectiveness of highly efficient devices

Design

High Frequency Lab

- Free-space measuring station up to 170 GHz, Fabry-Pérot resonators up to 140 GHz and THz system for HF material characterization
- Semi-automatic sample station with thermal chamber (-60 °C to 300 °C)
- EMC and test environment for wireless communication systems in the multi-gigabit and terabit-range
- Antenna measuring system for up to 330 GHz
- Test lab for mm wave modules for radar and communication, signal source (AWG) and spectrum analyzer up to 325 GHz
- Time domain measuring station (sample oscilloscope up to 60 GHz / BERT up to 64 Gbit/s)
- Network analysis up to 500 GHz

Microelectronics Lab

- Development and qualification of mechatronics systems and energy-efficient wireless sensor systems
- PXA for range calculation, conformity checks, and failure analyses; allows the recording of very fast signals (from 162 µs)

Further laboratories include:

- Micro Battery Lab with battery development and assembly line
- Laboratory for Textile-integrated Electronics (TexLab)
- Photoelectron spectroscopy and electron spectroscopy for chemical analysis (ESCA)
- Corrosion Lab
- Electronics Condition Monitoring Lab (ECM) for functional tests of electronic systems under environmental stress, salt spray, shaker
- Thermal & Environmental Analysis Lab

In Europe, the U.S., and Asia – at around 20 conferences and trade shows – IZM scientists presented the results of their research in 2025.

Events & Promoting Young Talent

Research in Dialogue – The IZM event calendar for 2025

In 2025, Fraunhofer IZM's event portfolio was once again colorful and diverse – characterized by professional development opportunities, international collaboration, and events aimed at a broader public.

Digital formats such as online expert sessions or the INCREACE Crash Courses offered practical insights into current research fields. With the Green ICT Courses and the Green ICT Connect conference, the topic of sustainability remained a key focus, complemented by initiatives such as the online game »ICT.factory« or participation in STADTRADELN competition.

Engaging directly with a specialist audience, Fraunhofer IZM presented its technologies and services at international conferences and trade fairs, including the EMPC in Grenoble and productronica, where it showcased a live production line. In-house events such as the Electronic Packaging Days provided additional opportunities for networking and discussion. The year was rounded off by high-profile public events such as the Long Night of the Sciences or contributions to Science Week. The following pages provide an insight into the scope of these activities.

Events

From left to right: Prof. Klaus-Dieter Lang (former Director of Fraunhofer IZM), Prof. Martin Schneider-Ramelow, Prof. Ulrike Ganesh (Director, Fraunhofer IZM), Prof. Albert Heuberger (Director of Fraunhofer IIS), Dr. Manuela Junghähnel (Site Director of Fraunhofer IZM-ASSID), Dr. Stephan Guttowski (FMD), M. Jürgen Wolf (former Site Director, Fraunhofer IZM-ASSID), Dr. Babett Gläser (SMWK), Dr. Christian Koitzsch (ESMC), Frank Bösenberg (Silicon Saxony e. V.)

15 years of Fraunhofer IZM-ASSID – A success story in 2.5D and 3D hetero-integration

Fifteen years ago, Fraunhofer IZM's »All Silicon System Integration Dresden« (ASSID) was launched with the vision of establishing a leading European platform for wafer-level system integration, 2.5D/3D heterointegration, and high-density packaging technologies. Today, a decade and a half later, this vision has become a reality: ASSID is one of Fraunhofer IZM's most strategically important technological units and an integral part of the European microelectronics landscape. The growing momentum in global wafer-level packaging has given the site the opportunity to position itself along new research priorities while simultaneously expanding its industrial relevance. A key driver in this process was the synergy between process development, materials expertise, and industry-oriented manufacturing processes, which led to numerous R&D collaborations. The site's innovative strength is closely linked to its ability to transfer new technologies to production-oriented environments at an early stage.

Parallel to its technological advancement, ASSID over the years has grown into an important structural element of Fraunhofer IZM. Today, the center is a central component of Fraunhofer's strategy to strengthen European sovereignty in microelectronics and packaging. The 300 mm pilot line in Dresden enables the implementation of chiplet integration, TSV/RDL processes, and hybrid bonding technologies at a level that is unique in Europe.

The site's visibility and networking have also expanded significantly over the past 15 years. ASSID shapes international forums such as the »3D & Systems Summit« and is a regular presence at international trade shows such as SEMICON West, Europe, and Japan.

The »15 Years of ASSID« anniversary was celebrated on June 24, 2025, at the Moritzburg site as part of a symposium that combined a look back with a forward-looking perspective. Welcoming remarks from the scientific community, politics, and Fraunhofer IZM acknowledged past achievements and also highlighted the strategic outlook for future projects such as APECS or CEASAX.

Green ICT Courses 2025 – Sustainable skills for resource-efficient ICT

In 2025, Fraunhofer IZM once again offered a comprehensive continuing education and workshop program as part of the »Green ICT @ FMD« Competence Center. The goal of the Green ICT Courses was to impart expertise on sustainable information and communication technology (ICT) and to strengthen the transfer of current research findings into practical applications. The course series included numerous online seminars that addressed key topics such as life-cycle assessment and the climate neutrality of ICT, and presented practical tools for environmental assessment for companies.

In addition, the events covered the energy-efficient design of IoT systems and future wireless networks up to 6G, potential solutions for reducing electronic waste, resource-optimized electronics production, and EU environmental legislation for Green ICT. Thus, the Green ICT Courses once again offered in-depth insights and concrete solutions for a more resource-efficient digital future.

»Electronic Solutions for Challenging Environments« – Expert session series

From March to April 2025, Fraunhofer IZM hosted the online expert session series »Electronic Solutions for Challenging Environments«, which presented innovative technologies for electronic systems operating under harsh conditions. The series comprised four online sessions in which institute experts Dr. Martin Hempel, Sigrid Rotzler, Dr. Stefan Wagner, and Dr. Joshua Wilson provided insights into the development, integration, and optimization of electronics that must withstand extreme temperatures, mechanical stress, and high humidity, while simultaneously meeting specific safety and compatibility requirements.

The topics covered ranged from robust sensor packaging for maritime applications and the washability of textile-integrated electronics to reliability issues in automotive electronics and solutions for long-lasting neuroimplants.

Events organized by Fraunhofer IZM (selection)

»Electronic Solutions for Challenging Environments« – Expert session series	March – April 2025, online
15 years of Fraunhhofer IZM-ASSID	June 2025, Dresden
Symposium on »Next-Generation 3D Heterointegration«	June 2025, Dresden
Electronic Packaging Days	November 2025, Berlin
EcoReliability Working Group	March 2026, Berlin

Senator for Economic Affairs Franziska Giffey and Senator for Science Dr. Ina Czyborra at the Fraunhofer IZM's Start-A-Factory

Promoting technology transfer and start-up collaborations – Senators visit Start-A-Factory

In 2025, Fraunhofer IZM strengthened its role as a catalyst for innovation and start-up support in Berlin. On April 22, 2025, a press conference was held at the institute's own Start-A-Factory with Berlin Senators Franziska Giffey and Dr. Ina Czyborra. A new pre-seed fund from IBB Ventures was presented, designed to provide targeted support for science-based spin-offs in the early stages.

During the press conference, Institute Director Prof. Ulrike Ganesh highlighted the capabilities of the Start-A-Factory as a unique infrastructure for hardware startups: From the initial idea to the first prototype, the lab complex supports startup projects through individual consulting and tailored solutions.

Events with Fraunhofer IZM participation (selection)

High-Level Round Table: Building Networks for the Future	March 2025, Berlin
INCREACE Recyclability Assessment Tool RAT	March 2025, online, Eindhoven (NL)
PCIM Europe 2025	May 2025, Nuremberg
ECTC 2025	May 2025, Dallas (USA)
Silicon Saxony Day 2025	June 2025, Dresden
3D & Systems Summit 2025	June 2025, Dresden
Long Night of the Sciences	June 2025, Berlin
Component-to-System Level Packaging Workshop	July 2025, Berlin
Green ICT Camp 2025	September 2025, Dresden
EMPC 2025	September 2025, Grenoble (FR)
European Microwave Week 2025	September 2025, Utrecht (NL)
CIGRE 2025	September-October 2025, Montreal (CA)
SEMICON West 2025	October 2025, Phoenix (USA)
MikroSystemTechnik Congress 2025	October 2025, Duisburg
Green ICT Connect 2025	October 2025, Berlin
COMPAMED 2025	November 2025, Düsseldorf
SEMICON Europe 2025	November 2025, Munich
productronica 2025	November 2025, Munich
SEMICON Japan 2025	December 2025, Tokyo (JP)

Fraunhofer IZM at EMPC 2025 in Grenoble

From September 16 to 18, 2025, the institute was represented at the European Microelectronics & Packaging Conference (EMPC) in Grenoble. Fraunhofer IZM traveled to EMPC with numerous researchers to present the latest research results in the field of microelectronic packaging. On the day before the conference, Prof. Ivan Ndip, Dr. Tanja Braun, and Markus Wöhrmann led short courses. Institute Director Prof. Ulrike Ganesh delivered a highly acclaimed keynote speech on the topic »Advanced Packaging – The Key Technology for Chiplet Integration«. Fraunhofer IZM also contributed additional technical presentations and welcomed visitors at their exhibition booth.

Long Night of the Sciences 2025

Every two years, Fraunhofer IZM and TU Berlin's Research Center for Microperipheric Technologies open their doors to the public as part of the Long Night of the Sciences. On June 28, 2025, visitors of all ages had the opportunity to get an up-close look at research and development in the fields of microelectronics and microsystems technology.

With a diverse program of lectures, experiments, and guided tours, both institutions provided vivid insights into current research topics. The guided tours of the cleanroom, hands-on activities such as crafting at the Start-A-Factory, and practical demonstrations – such as measuring radar systems – were particularly popular. The event offered participants the chance to experience science in a practical way and gain direct insight into everyday research life.

Green ICT Connect 2025

On October 15 and 16, 2025, the German-language conference »Green ICT Connect« took place in Berlin for the third time. The event was organized as part of the »Green ICT @ FMD« competence center, in which Fraunhofer IZM participates together with project partners and the Research Fab for Microelectronics Germany (FMD).

The conference addressed key issues related to environmentally conscious digitalization and the sustainable design of microelectronics. In keynotes, technical presentations, and industry pitches, the ecological impacts of advancing digitalization were discussed, and current requirements for research and development were examined.

INCREACE Crash Course Series – Webinar series on the circular economy for WEEE plastics

From September to November 2025, Fraunhofer IZM organized a compact online crash course series as part of the EU project INCREACE, specifically addressing the circular economy of plastics from waste electrical and electronic equipment (WEEE). The series comprised eight weekly online seminars in which experts examined key aspects of the WEEE plastics value chain – from the procurement of high-quality plastic fractions through design strategies and policy frameworks to modern recycling technologies and systemic challenges. The Crash Courses brought together experts from research, industry, politics, and academia, offering practical insights, case studies, and in-depth discussions to promote resource efficiency and the sustainable use of recycled plastics in future applications.

Meeting with Sébastien Dauvé, CEO of CEA-Leti, at IZM-ASSID

On June 26, 2025, Fraunhofer IZM-ASSID welcomed CEA-Leti CEO Sébastien Dauvé for a high-level exchange at its Moritzburg site. The visit provided an excellent opportunity to further deepen scientific collaboration between the two institutions and develop joint strategic perspectives. The meeting focused on the strategic work streams of FAMES, CEA-Leti's FD-SOI pilot line under the European Chips Act. During a tour of the cleanrooms and laboratories, Sébastien Dauvé gained a comprehensive insight into ASSID's technological expertise, particularly in the field of wafer-level system integration. The visit provided an important impetus for further collaboration and marks a new milestone in the successful partnership between CEA-Leti and Fraunhofer IZM-ASSID.

Sensitive surfaces: The future of interaction

What if surfaces reacted to touch and communicated with us intuitively? This is exactly what Fraunhofer IZM is working on with its »Soft Interfaces« project, which was presented in Berlin in November as part of Science Week 2025. In collaboration with the WINT Design Lab, innovative textile interfaces were developed that are stretchable, touch-sensitive, and infused with conductive liquid metal.

These »sensing« textiles combine functionality with aesthetic design and open up new forms of interaction: Traditional switches and controls become obsolete, as controls can be seamlessly integrated into surfaces. This saves resources and creates sustainable solutions for applications in smart homes or vehicles.

»Soft Interfaces« at Science Week 2025: Thanks to conductive liquid metal, the stretchable textile surfaces are touch-sensitive.

IZM-ASSID pedals for STADTRADELN

At this year's STADTRADELN in Dresden, nearly 150 researchers from six Fraunhofer institutes in Dresden, including 16 colleagues from Fraunhofer IZM-ASSID, dedicated much time and energy to climate-friendly mobility. Together, they covered a total of over 40,000 kilometers by bicycle, sending a strong message in support of sustainable transportation and team spirit.

Launch of the online game »ICT. factory«

On October 23, 2025, the online game »ICT. factory« was unveiled. During the event, school students in particular had the opportunity to test the game for the first time and exchange ideas with experts on sustainable electronics.

The game was developed as part of the »Green ICT @ FMD« project, in which Fraunhofer IZM participated, and conveys knowledge about resource-efficient production in a playful way. Players have the opportunity to manage their own production line online and design it to be environmentally friendly and sustainable.

»City cycling« in Dresden

Electronic Packaging Days 2025

In early November, Fraunhofer IZM created a central platform for exchange and networking around microelectronic packaging and heterogeneous system integration with its Electronic Packaging Days 2025. Over two days in Berlin, around 200 experts from industry and research gathered to discuss current developments, technological challenges, and strategic perspectives. In addition to technical presentations, lab tours and expert sessions facilitated direct exchange between researchers and industry partners. The event impressively demonstrated how closely technological innovation, industrial application, and European collaboration are linked in the field of packaging and system integration

»Future Packaging« Production Line at productronica 2025

From November 18 to 21, 2025, Fraunhofer IZM presented the »Future Packaging« live production line at productronica. The end-to-end production chain showcased real-world processes in assembly production across the entire value chain, offering a hands-on experience of industrial workflows – from the naked board to the fully processed and separated module.

During daily guided tours, trade visitors gained insights into modern assembly and interconnection technology as well as its industrial implementation. A special focus was placed on automation, digitalization, and sustainability: For the first time, real-world consumption data was collected to develop a carbon footprint calculator for manufacturing processes.

Promoting Young Talent at Fraunhofer IZM

Enthusiasm for the technology of tomorrow

For Fraunhofer IZM, training and supporting young talent is a key investment in the scientific excellence of tomorrow. In 2025 as well, the institute launched a variety of initiatives to inspire students to pursue STEM careers and provide them with hands-on insights into the world of microelectronics.

Early career guidance and strong partnerships

At the heart of our work with the next generation is our ongoing cooperation with the Gabriele-von-Bülow-Gymnasium. In addition to participating in the school's Careers Day, the institute once again opened its doors for Girls' Day in 2025. Twelve girls were able to experience the work in laboratories and cleanrooms up close.

The results of our training and internship programs underscore the high level of interest: A total of eight young professionals completed their dual training at Fraunhofer IZM – seven in the field of microtechnology and one aspiring office communications specialist.

Over the past 24 years, a total of 56 microtechnologists and surface coating specialists have been trained at the institute, including 22 young women. Of the graduates, 23 continue to work at the institute today as technicians or – after completing a degree – as engineers.

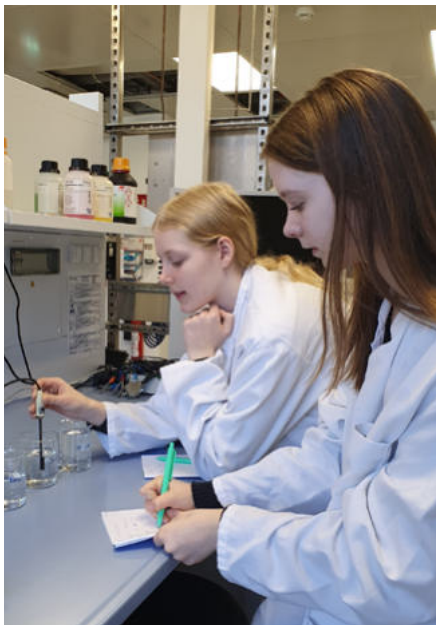
In addition, 20 young people took the opportunity to get a taste of research through a student internship at the Berlin location and at IZM-ASSID in Dresden-Moritzburg.

To specifically promote young female talent, Fraunhofer IZM also offered two female interns from the EnterTechnik project the opportunity for career orientation in technical fields. In this one-year program, young women can explore up to four technical professions at various companies.

Focus on sustainability: The Voluntary Ecological Year

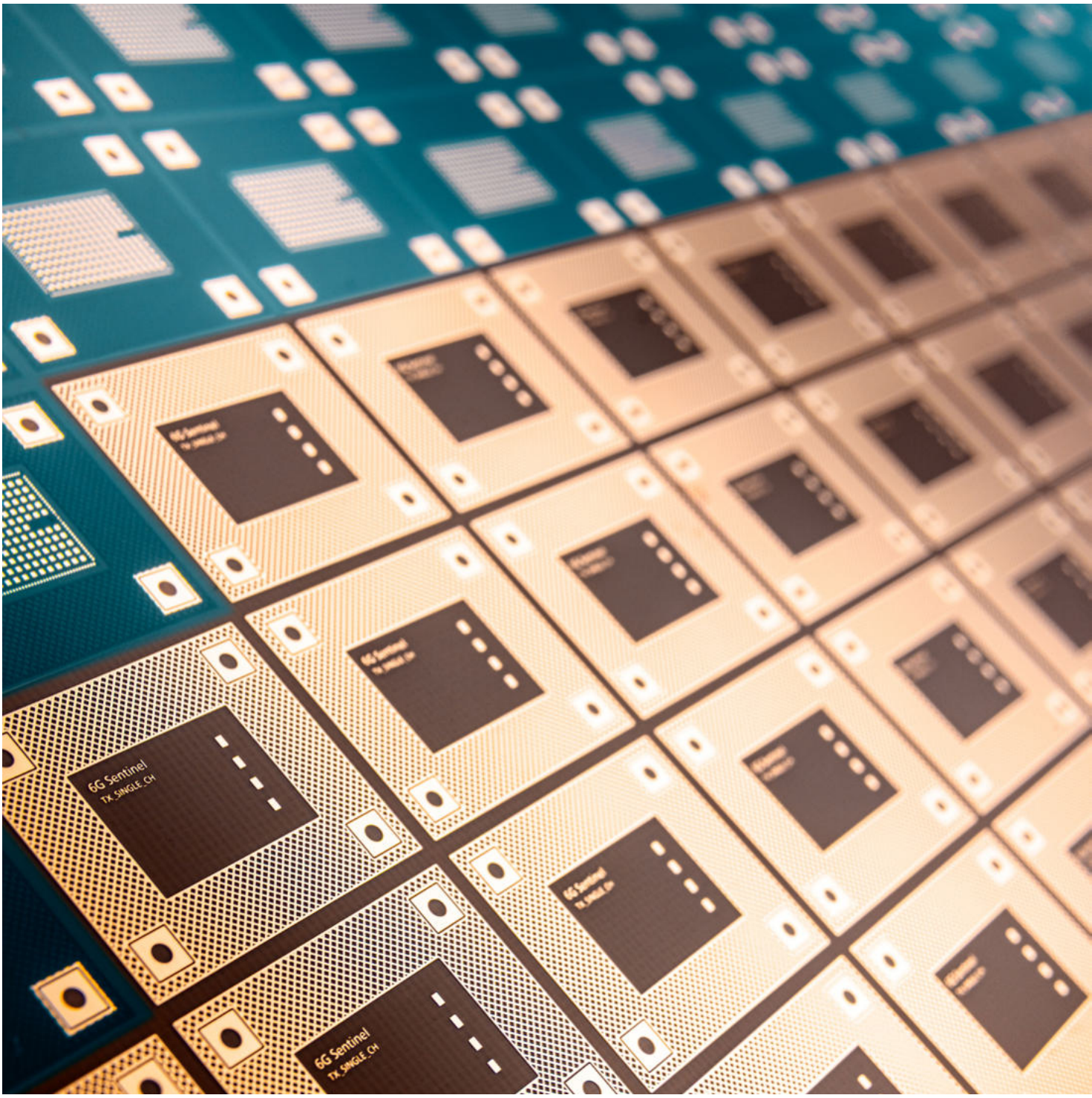
In addition to purely technical training, ecological responsibility is a top priority. In the »Environmental & Reliability Engineering« department, young persons participating in a Voluntary Ecological Year (FÖJ) explore the energy efficiency and climate compatibility of modern electronics. In 2025, two FÖJ participants supported the team in developing concepts for a more sustainable technological world.

Special thanks go to the numerous employees whose dedicated support and mentorship make this success possible.



Measuring and recording – in the lab, students from the Gabriele-von-Bülow-Gymnasium discover what matters when selecting materials for microelectronics.

Facts & Figures



Fraunhofer IZM: Facts and Figures

Financial performance

Fraunhofer IZM looks back on a year full of dynamism and success. With revenue of 47.1 million euros, the institute has reaffirmed its position as an innovation partner for industry and business. Revenue from research contracts with German and international companies as well as trade associations totaled 17.3 million euros. This means that 36.8 percent of costs are covered by direct industry contracts. The volume of externally funded projects rose to 34.5 million euros, meaning that 73.2 percent of the operating budget was secured through third-party funding – a testament to the appeal and relevance of Fraunhofer IZM as a research partner in challenging times.

Investments in infrastructure and equipment

To further expand its leading technological position, Fraunhofer IZM allocated over 1.8 million euros from its own funds in 2025 toward the targeted modernization and expansion of its equipment. These investments ensure maximum efficiency and innovative strength in research processes. An additional 1.8 million euros was allocated to structural improvements to boost the institute's performance and set new standards in occupational safety.

The expansion of the Research Fab Microelectronics Germany in the field of quantum and neuromorphic computing (FMD-QNC) was consistently advanced. The consortium's goal is to create the technological infrastructure for forward-looking research in Germany and to bridge the gap between science, industrial manufacturing, and application. To this end, Fraunhofer IZM invested 6 million euros in equipment and facilities to secure its innovation lead.

It allocated an additional 3.2 million euros at its Moritzburg site to establish the »Multi-hub Test and Experimentation Facility (TEF) for Edge AI Hardware«.

In 2025, the institute made a massive investment of 7.7 million euros in the development of the APECS pilot line (Advanced Packaging and Heterogeneous Integration for Electronic Components and Systems). Funded by the EU, the BMFTR, and the federal states under the EU Chips Act, the line offers industry, SMEs, and research institutions access to technologies, infrastructure, and expertise for innovations in the areas of chiplets, system integration, and industrial implementation.

An additional 3.6 million euros was allocated for technical expansion as part of the Center for Advanced CMOS & Heterointegration Saxony (CEASAX), which offers access to state-of-the-art 300 mm technologies ranging from IP development to pilot production.

Staff development

Fraunhofer IZM is firmly committed to the advancement and development of its employees and young researchers. In 2025, the team at the Berlin, Cottbus, and Dresden/Moritzburg locations grew once again: to 463 employees, including 131 interns, bachelor's and master's students, and student assistants, who received intensive support and guidance. This underscores the institute's strong commitment to education and professional development. Students are offered the opportunity to combine their studies with hands-on scientific work in the offices and laboratories of Fraunhofer IZM. In addition, eight apprentices were trained in the professions of microtechnologist, surface coater, and office management assistant.

Through targeted programs to promote young talent, such as the close partnership with the Gabriele-von-Bülow-Gymnasium and the long-standing involvement in Girls' Day, Fraunhofer IZM inspires young talent in technology and science, thereby laying the foundation for tomorrow's innovative strength.

Fraunhofer IZM 2025

Budget	47.1 million euros
External revenue	34.5 million euros (73.2 percent of total turnover)
Sites	Berlin, Cottbus und Dresden/Moritzburg
Laboratories	> 8.000 m^2
Staff	463 (including 131 interns, bachelor and master students, student assistants, and 8 apprentices)

Awards

From left to right: Dr. Nils F. Nissen, Prof. Ulrike Ganesh, Dr. Lutz Stobbe, and Prof. Martin Schneider-Ramelow

Making sustainable microelectronics measurable and explaining it in an understandable way: The 2025 Research Award went to Dr. Lutz Stobbe

Dr. Lutz Stobbe received the 2025 Research Award from Fraunhofer IZM for his pioneering research in the field of sustainable information and communication technologies. His work focuses on the life-cycle assessment of ICT infrastructures such as data centers and network technologies. Together with the »Sustainable Networks and Computing« research group, he develops high-resolution assessment models that capture the environmental impacts of digital systems across their entire life cycle.

»Only what can be measured can be improved« – Dr. Lutz Stobbe consistently follows this guiding principle. His research provides quantitative foundations for informed decisions regarding CO_2 emissions, material use, and energy efficiency, and enables the targeted identification and optimization of ecological weaknesses. In doing so, he combines data-driven analysis with clear, understandable communication.

As a career changer with an original background in the humanities, Dr. Lutz Stobbe brings a unique perspective to technological issues. It is precisely this perspective that continues to shape his work to this day – as does his commitment to making research not only technically sound but also socially impactful. In addition to his scientific achievements, the research award specifically recognized his successful translation of research into industry-relevant applications.

Creative science communication with societal impact: Theresa Marie Aigner received the IZM Communication Award 2025

Theresa Marie Aigner was honored with the IZM Communication Award 2025 for her outstanding achievements in science and project communication. With great dedication and a high degree of personal responsibility, she developed a comprehensive concept for cross-media communication. This includes, among other things, programming an app for schoolchildren, her active participation in initiatives for young talent, and the organization and moderation of the Sustainability Weeks at Fraunhofer. With creativity and persuasiveness, she makes a significant contribution to raising awareness of socially relevant topics.

Awardee Theresa Marie Aigner

Prof. Ivan Ndip honored with the Sidney J. Stein International Award 2025

At the 58th International Symposium on Microelectronics (IMAPS 2025) in San Diego, Prof. Ivan Ndip was awarded the Sidney J. Stein International Award in October 2025. The award recognizes his outstanding international contributions to technological progress in microelectronic packaging as well as his longstanding and exceptional commitment to the International Microelectronics and Packaging Society (IMAPS).

Prof. Ndip is an internationally recognized expert in miniaturized high-frequency sensors, high-speed systems, and innovative millimeter-wave and terahertz packaging solutions. He is a professor at the Brandenburg University of Technology Cottbus-Senftenberg and has been with Fraunhofer IZM since 2000, where he heads the RF & Smart Sensor Systems Department in Berlin and the branch office for high-frequency sensors and high-speed systems in Cottbus.

With over 250 scientific publications, more than 35 patents, and numerous national and international awards – including the IMAPS Outstanding Educator Award 2024 – Prof. Ndip is one of the leading figures in his field.

Prof. Ivan Ndip and the First Chair of IMAPS Germany, Prof. Martin Schneider-Ramelow

Dissertations, Editorials

Dissertations

Development of Cu Particle Sintering as Die Attach Solution for High Temperature Electronics Applications
Bhogaraju, Sri Krishna

Fundamental Investigations of Cu-In Based Fine-pitch Joints for 2.5D/3D System Integration
Bickel, Steffen

Galvanische Aluminiumabscheidung für das Wafer Level Thermokompressionsbonden mit dicken Aluminium-schichten
Braun, Silvia

Numerical Evalution and Optimization of the Mechanical Properties of Particle Reinforced Composites
Happ, Pascal Alexander

Optimization Strategies in Public Grid Connected Power Electronic Systems Applying High Pulse Frequencies
Kaiser, Elisa

Longevity of Conformally Coated Active Implants
Nanbakhsh, Kambiz

Pre-design Accounting of Reinforced Concrete Struc-tures' Nonlinear Behavior under the Action of Intensive Loads
Novozhilov, Yury

Degradationsmodi der Oberseitenkontaktierungen von SiC-Leistungshalbleitern
Sankari, Rasched

Circular Data Value Creation
Wagner, Eduard

Editorials

Bioelectronic Medicine Journal
Giagka, V. (Associate Editor)

International Journal of Microelectronics and Electronic Packaging
Ndip, I. (Associate Editor)

Lectures

Aalborg University

Prof. E. Hoene
- EMC in Power Electronics

BTU Cottbus-Senftenberg

Prof. I. Ndip
- Fundamentals of Antennas
- Antennas I & II
- Signal/Power Integrity and Electromagnetic Compatibility

Delft University of Technology

Prof. V. Giagka
- Active Implantable Biomedical Microsystems
- Bioelectricity
- Neurostimulation

Dresden University of Technology

Prof. J. Panchenko
- 3D System Integration and 3D Technologies
- Micro-/Nanomaterials and Reliability Aspects

German International University in Berlin

Dr. T. Tekin
- Sensor Technology
- Strength of Materials
- Solid State Electronics

Technical University of Berlin

B. Adams
- Fundamentals of Medical Engineering and Signal Processing

Dr. J. Jaeschke, Dr. O. Wittler
- Reliability of Electronic Systems

Dr. P. Mackowiak, Dr. M. Schiffer
- Manufacturing Technologies for Semiconductor Sensors

Prof. W. H. Müller
- Structural Analysis and Basic Strength of Materials
- Hands-on Project Finite Element Analysis

Dr. N. F. Nissen
- Environmentally Friendly Product Development

Prof. M. Schneider-Ramelow
- System Integration Technologies
- System Integration Materials

University of Applied Sciences for Engineering and Economics in Berlin

J. Hamani
- Programmable Logic

Dr. T. Tekin
- Nano Technology

Dr. H. Walter
- Materials in Microsystem Technology

Cooperation with Universities (Selection)

Some of Fraunhofer IZM's university partners

Aalborg University, Denmark
Aalto University, Finland
AGH University of Science and Technology, Poland
Binghampton University, USA
Delft University of Technology, The Netherlands
Eindhoven University of Technology, The Netherlands
ETH Zurich, Switzerland
Hanyang University, South Korea
KU Leuven, Belgium
Michigan State University, USA
University of Tokyo, Japan
University of Zurich, Switzerland
Université du Québec à Trois-Rivières, Canada
University College London, United Kingdom
University of Utah, USA

Berlin University of the Arts
Bielefeld University
Bundeswehr University Munich
Chemnitz University of Technology
Heidelberg University
Humboldt University of Berlin
Otto-von-Guericke University Magdeburg
Rhenish Friedrich Wilhelm University of Bonn
Technische Hochschule Ingolstadt
University of Erlangen-Nuremburg
University of Freiburg
University of Mainz
University of Münster
University of Rostock
Weißensee Academy of Art Berlin

Close collaboration with universities is a key pillar of the Fraunhofer success model. While universities contribute their innovative capacity and expertise in basic research, Fraunhofer provides not only application-oriented research but also excellent technical facilities.

Cooperation with the Technical University of Berlin

Since its founding in 1993, Fraunhofer IZM has cooperated with the Research Center for Microperipheric Technologies at the Technical University of Berlin; together, they established one of the world's leading research institutions in the field of interconnect and packaging technology in the 1990s. Since 2024, Professor Ulrike Ganesh has headed not only Fraunhofer IZM but also the Research Center at TU Berlin. There, she holds the Chair of »Design and Hetero-Integration of Microelectronic Systems«.

Fraunhofer IZM-ASSID collaborates with TU Dresden

As part of the joint professorship »Nanomaterials for Electronics Packaging« between Fraunhofer IZM-ASSID and TU Dresden, Prof. Juliana Panchenko and her team are working on new materials and technologies for fine-pitch interconnects in 3D/2.5D Si structures. Since November 1, 2025, she has served as director of the Institute for Electronic Assembly and Interconnection Technology (IAVT) at TU Dresden.

Collaboration with BTU Cottbus-Senftenberg

Through its branch office for high-frequency sensor systems in Cottbus, Fraunhofer IZM collaborates closely with the local BTU Cottbus-Senftenberg. Since early February 2023, IZM department head Prof. Dr. Dr. Ivan Ndip has held the Chair of Antennas and High-Frequency System Integration there. Research activities within the framework of the Innovation Campus (iCampµs) Cottbus focus on the design, testing, and characterization of integrated antennas, the co-design of chip-package antennas, and system integration solutions for the realization of miniaturized high-frequency sensor systems.

Cooperation with Industry (Selection)

Adeia Inc. / Xperi	San Jose, CA (USA)
AEMtec GmbH	Berlin (D)
Ajinomoto Group	JP
Allegro MicroSystems	Manchester, NH (USA)
Amkor Technology, Inc.	Tempe, AZ (USA)
ams AG	Premstätten (AT)
AnSem NV	Leuven (BE)
AT&S Austria Technologie & Systemtechnik AG	Leoben (AT)
AUDI AG	Ingolstadt (D)
Baker Hughes Inteq GmbH	Celle (D)
BASF SE	Ludwigshafen am Rhein (D)
Berliner Nanotest und Design GmbH	Berlin (D)
BMW AG	Munich (D)
Bosch Semiconductor Manufacturing	Dresden (D)
Carl Zeiss SMT GmbH	Jena (D)
CERN	Meyrin (CH)
Contag GmbH	Berlin (D)
Corning Inc.	Corning, NY (USA)
Delo GmbH	Windach (D)
DeltaHeat GmbH	Berlin (D)
Diehl Aerospace GmbH	Überlingen (D)
DISCO Corporation	JP
DResearch	Berlin (D)
DuPont Electronics & Imaging	Marlborough, MA (USA)
EV Group	St. Florian am Inn (AT)
Evatec AG	Trübbach (CH)
FIRST SENSOR	Berlin (D)
Fujifilm Electronic Materials	EU, USA
GEFRAN S.p.A.	Provaglio d'Iseo (IT)
Heraeus	Hanau (D)
IMASENIC Advanced Imaging S.L.	Barcelona (ES)
InnoSenT GmbH	Donnersdorf (D)
KSG GmbH	Görnsdorf (D)
Lidrotec GmbH	Bochum (D)
LTB GmbH	Radebeul (D)
Malvern PANalytical B.V.	Almelo (NL)
MENNEKES Elektrotechnik GmbH&Co. KG	Kirchhundem (D)
Meta Platforms Technologies, LLC	Menlo Park, CA (USA)
Micro Systems Engineering GmbH	Berg (D)
Mitteldeutsche Netzgesellschaft Strom mbH	Halle (D)
Multi Channel Systems MCS GmbH	Reutlingen (D)
Nagase ChemteX Corporation	Osaka (JP)
Nexperia	Nijmegen (NL)
NEXT FUEL R&D LTD	Neve Yamin (IL)
NGK	Nagoya (JP)
OSYPKA AG	Rheinfelden (D)
Philips	NL
Picosun Oy	Masala (FI)
Pilz GmbH & Co. KG	Ostfildern (D)
Plath	Ostfildern (D)
Rapidus Corp.	JP
RENA Technologies GmbH	Gütenbach (D)
Resonac	Tokyo (JP)
Robert Bosch GmbH	Renningen (D)
Rolls-Royce Deutschland Ltd & Co KG	Cottbus (D)
Saltec GmbH	Salzhausen (D)
Schaeffler AG	Herzogenaurach (D)
Schlumberger	Paris (FR)
Schmoll Maschinen GmbH	Rödermark (D)
Semsysco GmbH	Salzburg (AT)
sensiBel AS	Oslo (NO)
Siemens AG	Berlin, Erlangen, Munich (D)
SLAC National Accelerator Laboratory	Menlo Park, CA (USA)
Süss MicroTec SE	Garching, Munich (D)
Swissbit Germany AG	Berlin, Broschhofen (CH)
Texas Instruments	Munich, London (D, GB)
Thales Group	Paris (FR)
The Chemours Company	Wilmington, DE (USA)
Tokyo Electron Ltd. TEL	Albany, NY (USA), Tokyo (JP)
United Monolithic Semiconductors (UMS)	Villebon-sur-Yvette (FR)

Memberships (Selection)

3D & Systems Summit (SEMI)	Dr. M. Junghähnel	Member Program Committee
3DInCites	Dr. M. Junghähnel	Member Advisory Board
AMA Fachverband Sensorik, Wissenschaftsrat	H. Pötter	Member
Cluster Optik BB, Photonik für Kommunikation und Sensorik	Dr. H. Schröder	Spokesman
Deutsche Gesellschaft für Kardiologie (DGK)	B. Adams	Member
Deutscher Verband für Schweißtechnik DVS	Prof. M. Schneider-Ramelow	Representative of Fraunhofer IZM, Chairman of Arbeitsgruppe Bonden
ECPE Competence Centre	Prof. M. Schneider-Ramelow	Member
EFDS – Europäische Forschungsgesellschaft Dünne Schichten e. V.	Dr. M. Junghähnel	Member
Fachausschuss »Beschichtungstechnologien für optische und elektronische Funktionalisierung – FABF«	Dr. M. Junghähnel	Member
Wissenschaftlicher Beirat des EFDS	Dr. M. Junghähnel	Elected Member
European CMP & WET Users Group	C. Rudolph	Member, Co-organizer
European Photonic Industrial Consortium (EPIC)	Dr. H. Schröder	Representative of Fraunhofer IZM
European Technology Platform for the Future of Textiles	S. Rotzler	Member
European Technology Platform on Smart Systems Integration (EPoSS) (until December 31, 2025)	H. Pötter	Member Executive Committee, Board Member
FED Fachverband Elektronik-Design e. V.	Dr. N. F. Nissen	Member
Fraunhofer Forschungsbereich Textil	M. von Krshiwoblozki	Representative of Fraunhofer IZM
futureSAX	Dr. K. Reinhardt	Member
Heterogeneous Integration Roadmap (HIR)	E. Jung	Chair Technical Working Group SiP
IEEE Electronics Packaging Society	R. Aschenbrenner	Fellow
IEEE EPS Board of Governors	Dr. T. Braun	VP of Conferences
IEEE TC RF High-Speed Components of Systems	Prof. I. Ndip	Senior Member
IMAPS International Microelectronics Assembly and Packaging Society	Prof. M. Schneider-Ramelow, Prof. I. Ndip	Fellows
IMAPS Deutschland	Prof. M. Schneider-Ramelow	President
IMAPS Deutschland	Dr. K. Reinhardt	Member
IMAPS Europe ELC	Prof. M. Schneider-Ramelow	Member
Int. Conference on Coatings on Glass and Plastics (ICCG)	Dr. M. Junghähnel	Board Member
Int. Conference on Planarization/CMP Technology (ICPT)	C. Rudolph	Program Committee
Int. Electronics Manufacturing Initiative (iNEMI)	Dr. T. Braun	Member
IVAM Fachverband für Mikrotechnik, Fachgruppe »Sensors«	E. Jung	Leader
OPTICA	Dr. G. Böttger	Representative of Fraunhofer IZM
Organic Electronics Saxony (OES)	E. Jung	Chairman
Photonics 21	Dr. R. Jordan	Board of Stakeholders
Photonics West Optical Interconnects Conference	Dr. H. Schröder	Chair
PLASMA GERMANY	Dr. M. Junghähnel	Elected Expert
SEMI ESiPAT Group	Dr. T. Braun	Member
Silicon Saxony e. V.	Dr. M. Junghähnel	Member
Strategischer Arbeitskreis Silicon Germany	Prof. M. Schneider-Ramelow	Member
Wissenschaftlich-techn. Rat der Fraunhofer-Gesellschaft	Dr. M. Hampicke	Representative of Fraunhofer IZM
Verband Sichere Digitale Identität e. V.	Christine Kallmayer	Member

Publications (Selection)

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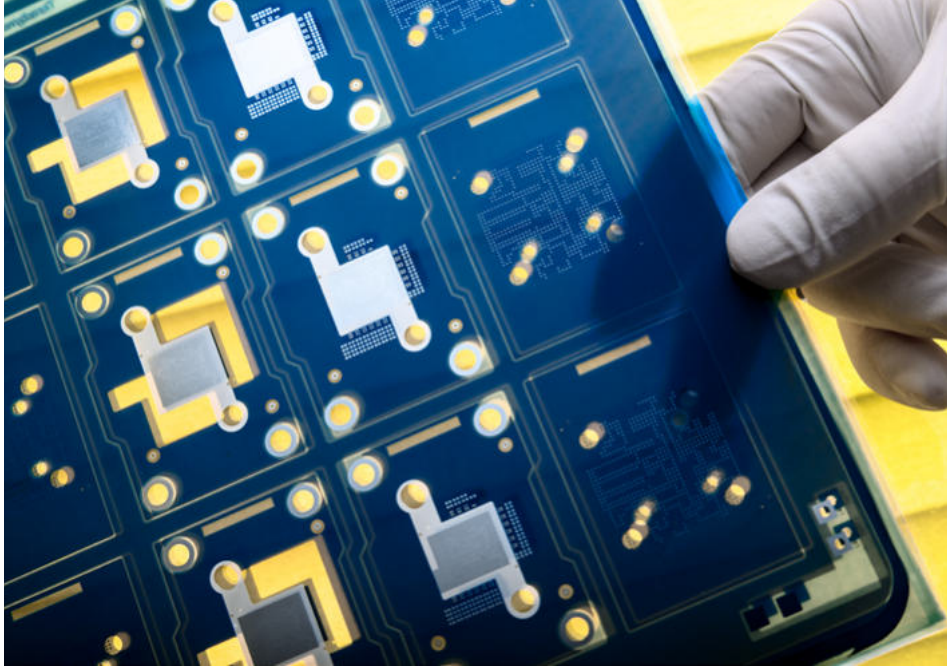

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Title

The image shows CeCaS test modules (Mannheim Project) with a 40 × 40 mm² silicon area in monolithic and chiplet configurations for the adaptation of manufacturing processes and the qualification of advanced packaging materials.
The manufacturing data collected during this process forms the basis for a digital twin used for reliability assessment.

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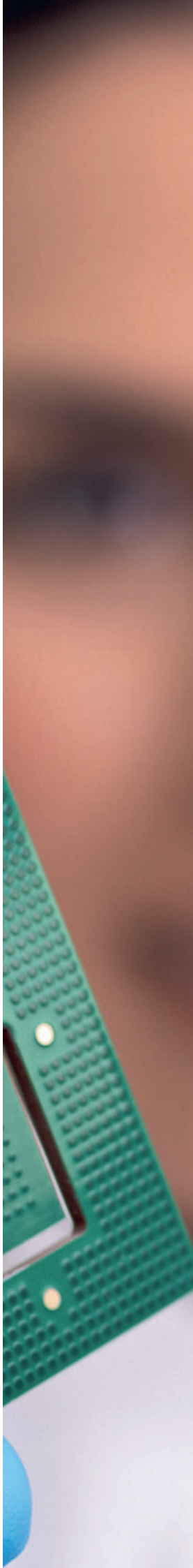

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