PRESS RELEASE

The great connector bows out

His colleagues know and appreciate him as a celebrated expert for electronics system integration and specialist for durable chip connections: Professor Klaus-Dieter Lang is retiring from his post as the long-standing and successful Director of the Fraunhofer Institute for Reliability and Microintegration IZM. Time for a look back at his achievements and his contributions to the world of microelectronics.

"People say: You should leave while it's still fun." Klaus-Dieter Lang cannot see how this applies to him: "Applied research is always fun, and nowhere more so than in innovative microelectronics and microsystems technology." After completing a much-celebrated thesis, he set up not one, but several organizations dedicated to his field of work, was appointed to the Chair of Nano-Interconnect Technologies at the Technical University of Berlin, became an active contributor at countless committees and research bodies, and doubled the commercial revenue of Fraunhofer IZM almost in passing. His story seemed geared for success from the very beginning.

Strategy: Turning technologies into applications
Fresh from graduating in electrical engineering in the 1980s, Klaus-Dieter Lang turned his attention to semiconductors, assembly and interconnect technologies, packaging, and quality assurance in his work at the Electronics department of Humboldt University. His work for his doctorate and post-doc research for his lecturership led to him winning the Humboldt Prize. After establishing the micro joining and optical interconnection technology section at SLV Hannover, he was one of the founding members of Fraunhofer IZM in 1993 and continued to shape the story of the Institute whose Director he became in 2010.

One constant thread in his strategy for Fraunhofer IZM was the steady build-up of competences and resources across the value chain of microelectronics systems, based on cutting-edge packaging technologies to pave the way for sophisticated applications. His focus was on optimized integration concepts, greater reliability, integrated sensors and actuators, and the miniaturization and adaptation of components to any product design or installation space. His efforts led to the formation of five business areas, chosen specifically to match the needs of industrial clients.

An enterprising academic and academic entrepreneur
Klaus-Dieter Lang's work was an almost archetypal expression of the Fraunhofer principle of combining scientific creativity perfectly with efficient innovation management and dependable performance. He is the prolific author and co-author of four monographs and no fewer than 430 contributions to publications on interconnect

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technology, packaging, microsystems engineering, and system integration, and he holds more than a dozen patents. Under his careful stewardship, Fraunhofer IZM was recognized by the German Science Council for its scientific excellence as one of the countries top research organizations in the field of electrical engineering. In his years at the helm, the operating budget of the Institute increased by more than 60 percent (from €23.1 million in 2010 to €37.6 million in 2020), and revenues from industry cooperations almost doubled (rising from €7.5 million in 2010 to €14.4 million in 2020). This story of continued success is also reflected in the growth of the Institute's human resources, with more than 130 new colleagues joining in the same period.

A diplomat and networker

The academic world has come to see Klaus-Dieter Lang as a master at integration. And this applies not just to his exceptional skill at miniaturizing and integrating microelectronics structures in virtually any application; it also reflects his ability to bring together and link up researchers and scientists with partners from industry. His efforts in this arena include his role as a co-founder and long-standing spokesperson for the Center for Microsystems Technology ZEMI in Berlin-Adlershof, dedicated to pooling the region's R&D resources in microsystems engineering.

Not content with his achievements in the regional and national scientific community, Klaus-Dieter Lang was soon in great demand for his wit and expertise on the global stage: As a member of the Scientific Advisory Board of EURIPIDES (European Smart Electronic Systems), his contributions included coordinating the direction of research roadmaps influencing industrial developments in Europe and linking up the resources of R&D actors from more than 20 countries with leading research policy makers.

In recognition of his exceptional achievements in science and research, Klaus-Dieter Lang was awarded the Fraunhofer medal in 2014, followed in 2017 by the William D. Ashman Achievement Award for Electronic Packaging and System Integration of the international IMAPS society. Other awards included the DVS association's honorary ring in 2016, and the IEEE Fellowship in the field of heterointegration and microelectronics packaging in 2018. A recent crowning addition to this list of honors was the GMM Award of October 2019, the top award given out by the VDE Society for Microelectronics, Microsystems, and Precision Engineering. Klaus-Dieter Lang is also a Fellow and Life Member of IMAPS.

Acquisition and management of major projects

All Silicon System Integration Dresden

The Fraunhofer Society has benefitted immensely from Klaus-Dieter Lang's unique skill at acquiring and managing major projects. It was under his stewardship that the center for

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3D system integration in Saxony, the "All Silicon System Integration Dresden" (ASSID) got off to a flying start in 2010. Since these early days, the ASSID and its now 40 staff members have become a key force to be reconned with in the development and practical application of novel wafer-level packaging technologies for stacking semiconductor components on the 300 mm scale.

The ASSID was set up from the very beginning to combine research endeavors with industry-ready prototype development.

Klaus-Dieter Lang won €49 million in financial support for establishing and getting the ASSID up and running from the German Federal Ministry of Education and Research, the Free State of Saxony, and the European Union.

The Fraunhofer IZM ASSID has profited from Klaus-Dieter Lang's personal commitment to making it a strong part of the research and industry landscape with enterprises from Silicon Saxony and a primary driver for the "High Performance Center Functional Integration for Micro / Nanoelectronics Chemnitz". Today's ASSID is an independent organizational unit in its own right, integrated in the Fraunhofer model, and was lauded for its excellence in a 2013 evaluation. In 2018, the ASSID's management processes were formally certified according to the ISO 9001 standard.

Berlin Center for Intelligent Systems on Circuit Board and Module Scale

It was due to Klaus-Dieter Lang's untiring efforts that the IZM's campus established itself as a permanent fixture in Berlin's research landscape. In his time, the Institute won approx.40 million in funding from the EU, the State of Berlin, and Federal Ministry of Education and Research, and the Fraunhofer Society itself for the AdaptSys Innovation Center. These funds not only allowed forward-looking research into novel microelectronics applications and other technological innovations, but also directly contributed to securing more than 400 high-value jobs in the city.

This is where extremely advanced integration technologies are being pioneered on the wafer and substrate level and where methods and processes are born that make it possible for any type of product – from car seats or tools and household appliances to fabrics and clothes – can be made with cutting-edge technology to include electronics and sensors right from their initial production, instead of having to place or mount such elements at a later stage.

The end result is technologies and products that are leading the competition from their very first design. The close links between R&D and real-life applications means that

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researchers have direct access to a constantly growing store of product expertise and can leave their mark on trends that are reshaping entire industries.

Eyes on the future

Klaus-Dieter Lang's commitment means that Fraunhofer IZM is one of the world's leading research institute's determining the key aspects of modern microelectronics:

- New research into high-frequency system integration technologies for 5G and 6G
- A revolution in packaging technologies: Breaking down the boundaries between fan-out wafer and fan-out panel level packaging
- Chiplets and quantum technologies at the heart of future processor designs
- Novel integration concepts that combine biological systems and electronic elements
- Specially shielded packages and integration solutions for holistic hardware security
- Climate-positive and sustainable technologies and more resource efficiency

In 2017, Fraunhofer IZM became part of the Research Fab Microelectronics Germany, Europe's largest R&D collaboration in micro and nanoelectronics funded by the Ministry of Education and Research.
And there is more: On top of its sites in Berlin and Dresden, Fraunhofer IZM has come to Cottbus to pursue new high-frequency sensor technologies with leading local partners and focus on the design, testing, and characterization of integrated antennas, the co-design of chip-package antennas, and system integration solutions for miniature HF sensor systems.

Hardware start-ups have also featured prominently at Fraunhofer IZM under Klaus-Dieter Lang. For the last four years, the Institute has given young and aspiring SMEs an opportunity, in the form of the "Start-A-Factory" prototyping space funded by the Senate of Berlin, to turn unique ideas into first professional prototypes, using a unique equipment and workspace infrastructure with cutting-edge technical facilities and access to a whole network of Fraunhofer IZM researchers and other partners.

On 30 September, Professor Lang will hand over a successful and globally respect microelectronics research institute to his successor. His are indeed big shoes to fill, but his own history makes him certain that the transition will run smoothly: In 2010, he had himself taken over from a packaging pioneer of global renown, Professor Herbert Reichl. And Klaus-Dieter Lang also knows his Institute in good hands, as he is passing control over to interim director Professor Martin Schneider-Ramelow with the best wishes for the future of his Institute.

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A quiet retirement?

What does retirement have in store for Klaus-Dieter Lang? He will continue to contribute his voice in his field, as he will remain an active member of a host of working groups, committees, and events.
In his more private hours, he will indulge in his passion for travel and various sports, and he is already looking forward to spending more time with his grandchildren – an echo of his passion for working with and mentoring junior researchers in his time as an active educator and scientist.
One passion he plans to pursue more in future will come as a surprise for some: Klaus-Dieter Lang is an avid student of antiquity, and one can expect to soon find him wandering around the great ruins and sites from that period of history.

Fraunhofer IZM thanks Klaus-Dieter Lang for more than 28 years of untiring support and a decade of careful and forward-looking guidance and wishes him all the best for a healthy, inspired, and inspiring retirement.

An academic life:

1976-1981: Electronical engineering studies at the Humboldt University of Berlin, degree: engineering diploma.
1985-1989: Doctorate (Dr.-Ing.) and post-doc studies (Dr. sc. techn.) with Professor Dr.-Ing. habil. Wolfgang Scheel
1981 – 1991 Research Assistant at the Humboldt University of Berlin, Department of Electronics
1991-1993: Establishment of the micro joining and optical interconnect technologies at the SLV Hannover
1993-2004: Group Leader at Fraunhofer IZM in Berlin
2001: Establishment and management of the interdisciplinary project group on "Microsystems Engineering" at Fraunhofer IZM and the Key Research Area Microperipherals Technologies at the Technical University of Berlin in Berlin-Adlershof (ZEMI-Partner).
2004-2006: Head of the "Photonic and Power System Assembly" department at Fraunhofer IZM
2006 -2010: Deputy Director of Fraunhofer IZM
Since 2010: Director of Fraunhofer IZM and (from 2011 to 2020) Professor at the Chair for "Nano Interconnect Technologies" at the Technical University of Berlin

Committee Memberships and Appointments

- Chair of the curating committee for the SMT/HYBRID/PACKAGING expo and conference
- Scientific chair of the "Technologien Elektronischer Baugruppen" conference
- Member of the steering committee of the microsystems engineering congress
- Deputy chair of the VDE Society for Microelectronics, Microsystems, and Precision Engineering GMM
- Member of the Advisory Council of the Deutschen Verbandes für Schweißtechnik (DVS)
- Member of the Scientific Advisory Board of EURIPIDES
- Chapter Chair Germany of the IEEE Components, Packaging, and Manufacturing Technology Society

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- Member of the SEMI Europe Award Committee
- Member of the Board of OptecBB (Competence Network Optical Technologies in Berlin and Brandenburg)
- Spokesman of the Board of the Center for Microsystems Engineering Berlin

Looking forward to an active retirement – Professor Dr.-Ing. Dr. sc. techn. Klaus-Dieter Lang.
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The **Fraunhofer-Gesellschaft**, headquartered in Germany, is the world's leading applied research organization. With its focus on developing key technologies that are vital for the future and enabling the commercial exploitation of this work by business and industry, Fraunhofer plays a central role in the innovation process. As a pioneer and catalyst for groundbreaking developments and scientific excellence, Fraunhofer helps shape society now and in the future. Founded in 1949, the Fraunhofer-Gesellschaft currently operates 75 institutes and research institutions throughout Germany. The majority of the organization's 29,000 employees are qualified scientists and engineers, who work with an annual research budget of 2.8 billion euros. Of this sum, 2.4 billion euros are generated through contract research.

Fraunhofer IZM: Invisible - but indispensable: nothing works without highly integrated microelectronics and microsystems technology. The basis for their integration into products is the availability of reliable and cost-effective packaging and interconnection technologies. Fraunhofer IZM, a world leader in the development and reliability assessment of electronic packaging technologies, provides its customers with customized system integration technologies at wafer, chip and board level. Research at Fraunhofer IZM also means making electronics more reliable and providing its customers with reliable information on the durability of the electronics.

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