Microelectronics News

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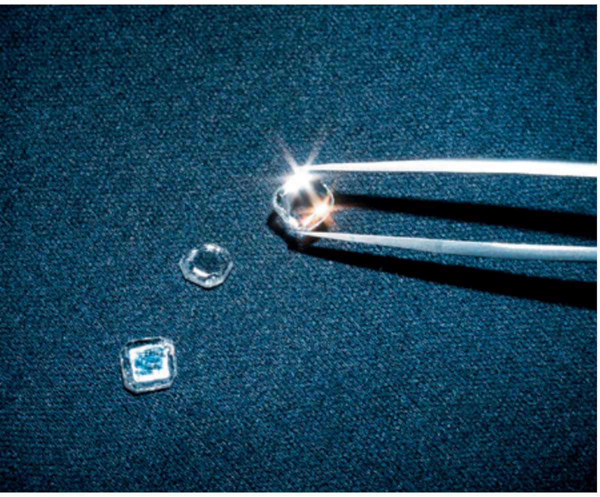
High-precision diagnostics using NV-doped diamond



Biomagnetic measurements have become a standard part of modern diagnostics. The necessary precision can, however, currently only be achieved with complex and expensive processes. Fraunhofer IAF is working with partners from industry and research on developing a high-precision alternative at room temperature. »» page 4

In refrigeration systems typical for industry – such as the one at Fraunhofer IISB in Erlangen – optimization of the operating parameters and targeted investments were able to save around 20% on energy costs. © MEV Verlag

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Protective sheath for embedded systems

Some burglars only need a drill thinner than 1 mm in order to get to data. The consequences can be serious, particularly in sensitive areas such as banking or health care. Businesses and hackers have long been locked in a battle, and the technological tricks are getting more and more sophisticated.

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Within the Q.Link.X Project, Fraunhofer HHI and several partners initiate the dawn of quantum technology.© istock.com / BlackJack3D, edited by Fraunhofer HHI

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Date	Event / WWW	Location	Group institutes involved
02/25 – 02/28	Mobile World Congress 2019 www.mwcbarcelona.com	Barcelona, Spain	IIS, ISIT
02/26 – 02/28	embedded world 2019 www.embedded-world.de	Nürnberg, Germany	Group institutes
02/27 – 03/01	Battery Japan www.batteryjapan.jp/en-gb.html	Tokyo, Japan	IKTS
03/03 – 03/07	OFC www.ofcconference.org	San Diego, USA	IPMS
03/12 – 03/14	JEC World www.jeccomposites.com/knowledge/international-composites-agenda/jec-world-2019	Paris, France	IKTS
03/12 – 03/16	IDS www.ids-cologne.de	Cologne, Germany	IKTS
03/18 – 03/21	DAGA 2019: 45. Jahrestagung für Akustik 2019.daga-tagung.de	Rostock, Germany	ISIT
03/25 – 03/27	Munich Satellite Navigation Summit www.munich-satellite-navigation-summit.org/	Munich, Germany	IIS
03/26 – 03/27	PIC International Conference 2019picinternational.net	Brussels, Belgium	HHI
03/27 – 03/29	AES: International Conference on Immersive and Interactive Audio www.aes.org	York, UK	ISIT
03/31 – 04/05	13th European Conference on Antennas and Propagation www.eucap.org	Krakow, Poland	FHR
04/01 – 04/05	Hannover Messe www.hannovermesse.de	Hannover, Germany	FMD, Group institutes
04/06 – 04/11	NAB Show www.nabshow.com	Las Vegas, USA	HHI
04/22 – 04/26	Radar Conference 2019 www.radarconf19.org/	Boston, USA	FHR
04/24 – 04/26	Opie'19 www.opie.jp	Pacifico Yokohama, Japan	HHI

Tamper-resistant foil wrapped around an electronics housing. © Fraunhofer EMFT / Bernd Müller

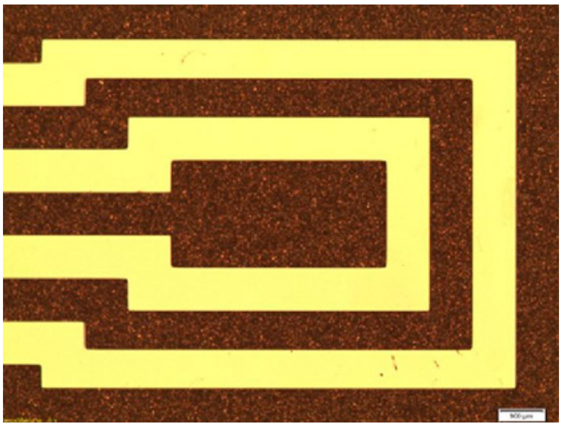
Protective sheath for embedded systems

Not every burglar needs a crowbar – some of them only need a drill thinner than 1 mm in order to get to data. If their attempt is successful, there can be serious consequences, particularly in sensitive areas such as critical infrastructure, banking and finance, or health care. Businesses and hackers have long been locked in a battle, and the technological tricks are getting more and more sophisticated.

"Given this background, it is no longer enough to place tamper prevention at the software level only," says Martin König from the Fraunhofer Research Institution for Microsystems and Solid State Technologies EMFT. In the collaboration between Fraunhofer EMFT and the Fraunhofer Institutes for Applied and Integrated Security AISEC and Microelectronic Circuits and Systems IMS, the expertise from the foil development, security, and microelectronics departments complement one another. The solution resulting from this cooperation provides protection against hostile attacks even at system level: it comprises a tamper prevention foil with an electrically conductive grid structure wrapped around the entire circuit board. "After start-up, individual fluctuations in production of the foil are surveyed as a physical unclonable function (PUF) in order to inspect the integrity from the inside," explains Matthias Hiller from Fraunhofer AISEC. If the grid is damaged, this automatically initiates deletion of the critical information such as cryptographic keys.

Great interest

The system offers reliable protection against drill attacks up to a diameter of 300 µm. Approaches are already being developed to improve this protection further in the future. The Fraunhofer researchers are pleased to be able to report interest from industry even at this development stage. "The feedback from potential customers who have taken a closer look at our solution helps us greatly in orienting our protective foil even more closely to the needs of its later users," says König. In order to continue preparing the protective foil for use in practice, the research team will also test it fully for security gaps in complex attack scenarios. "To maintain the protective effect of our foil, the integrity of the measuring circuits included must also be tested comprehensively," says Alexander Stanitzki from Fraunhofer IMS. In the future, it ought to be harder for data thieves to reach the desirable information found inside chips.



"Stored data can only be decoded if the foil is completely intact," explains Matthias Hiller from Fraunhofer AISEC. © Fraunhofer EMFT

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Imaging processes such as magnetic resonance imaging (MRI) make it possible to detect brain activity and to treat diseases in good time.
© Okrasyuk / shutterstock

High-precision diagnostics using NV-doped diamond

Biomagnetic measurements have become a standard part of modern diagnostics. The necessary precision can, however, currently only be achieved with complex and expensive processes. Fraunhofer IAF is working with partners from industry and research on developing a high-precision alternative at room temperature.

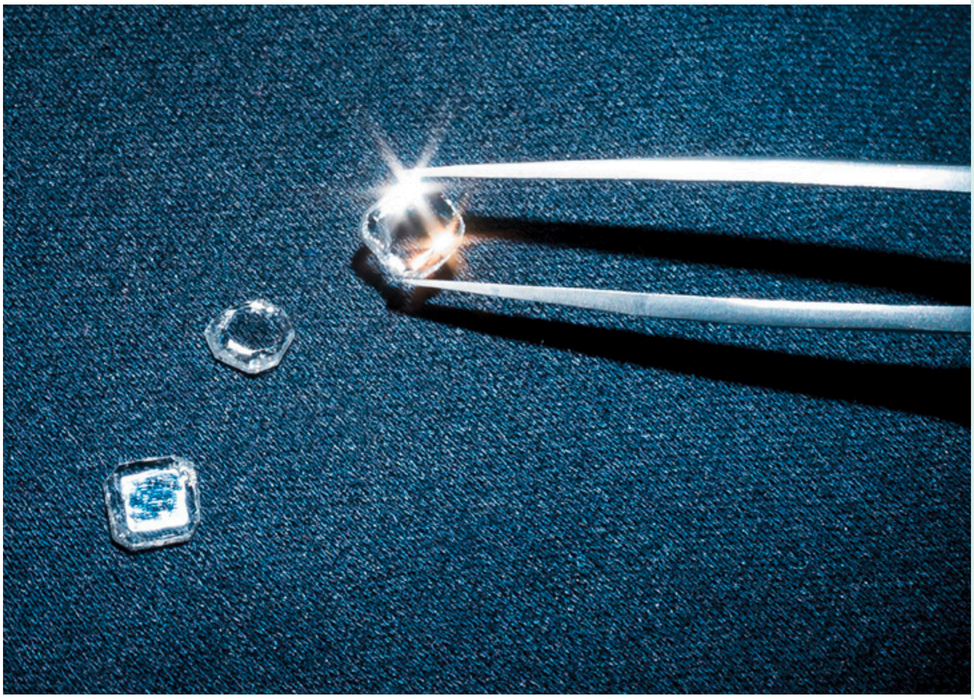
The project NV-doped CVD Diamond for Ultra-sensitive Laser Threshold Magnetometry, or DiLaMag for short, is developing the world's first laser threshold magnetometer (LTM).

Nitrogen vacancy centers improve diagnostic options

The system is based on NV-doped diamond. This means that the diamond has been enriched with nitrogen vacancy centers (NV centers). This allows for the highest level of precision in measuring and imaging diagnostic processes. This would, for example, allow for the measurement of brain and heart activities of unborn babies, and therefore help prenatal treatment of diseases. The NV centers react with light emission to magnetic fields in tissue and can detect even the smallest current flows in the nerve cells. The LTM technology is intended to help achieve a higher contrast in tomographic images thus making magnetic resonance imaging more precise.

Diamond as laser medium

In initial tests, diamond has proven itself suitable as a laser medium due to its high density and its usability at room temperature. As part of the project, the Fraunhofer Institute for Applied Solid State Physics IAF is using a specially set-up NV diamond laser laboratory to optimize the process of enriching diamond layers with as many NV centers as possible in plasma CVD reactors. In the subsequent project phases, the relevant physical and optical parameters will be characterized and the first demonstrators will be developed. In the last step, the researchers will optimize the sensitivity of the system in order to be able to put it into practical application as soon as possible. In addition to Fraunhofer IAF, the DiLaMag project also involves SIGMA Medizin-Technik GmbH as well as biomagnetism experts from the Freiburg and Heidelberg university clinics. The project is being funded by the German Federal Ministry of Education and Research (BMBF) as part of its youth competition NanoMatFutur.



Diamond – a material of the future.
© Fraunhofer IAF / Achim Käflein

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"An ultraprecise sensor operating at room and body temperature"

Laser threshold magnetometry is about to set new standards in medical diagnostics. Fraunhofer Microelectronics spoke to Dr. Jan Jeske from Fraunhofer IAF about the possibilities offered by this technology.

Dr. Jan Jeske. © Fraunhofer IAF

About Jan Jeske:
Dr. Jan Jeske is head of the junior research group "quantum magnetometry" at Fraunhofer IAF and project manager of DiLaMag. He previously developed the concept of laser threshold magnetometry and demonstrated the first direct measurement of stimulated emission of NV centers during his four-year postdoc at RMIT University in Melbourne, Australia. He previously attained his PhD at the same university, investigating largely theoretical topics regarding decoherence in quantum systems. He obtained his degree in physics at the Karlsruhe Institute of Technology (KIT). After a total of seven years in Melbourne, he is not only bringing new ideas back to Germany, but he has also made some additions to his private life: His move to Freiburg sees him return to Germany with dual German-Australian citizenship and his Australian wife. Both of them are looking forward to a new phase of their lives in Germany.

Dr. Jeske, you are the DiLaMag project manager. What is the project's goal?

We want to make laser threshold magnetometry (LTM) a reality, i.e. build the first laser using nitrogen-vacancy (NV) centers in diamond and make use of the intrinsic amplification offered by a laser system for more precise magnetic field sensors. To this end, we must first understand and improve the properties of the NV diamond for this application, e.g. absorption, homogeneity, and birefringence. In the second part of the project, we then hope to be able to demonstrate initial applications and to continue to improve sensitivity.

What are the advantages of NV-doped diamonds when compared to other laser media?

The point is that the laser medium can be used as a sensor itself. The laser output will ultimately be a direct indicator of the strength of the magnetic field. This is possible because the absorption and fluorescence of the NV centers depend on the state of the associated electron spin and that the spin, in turn, can be controlled by means of magnetic resonance. To this end, weak resonant microwaves of a certain resonance frequency are applied to the laser medium. The exterior magnetic field determines this resonance frequency. This mechanism is already being used by research on NV centers to measure magnetic fields. It is new, however, that the mechanism is being used as a laser medium and that the measuring signal is thus a laser output rather than a fluorescence signal. The laser threshold itself and thus the laser intensity above the threshold are affected by an exterior magnetic field. The laser will become a very sensitive magnetic field sensor.

What options are offered by the LTM technology?

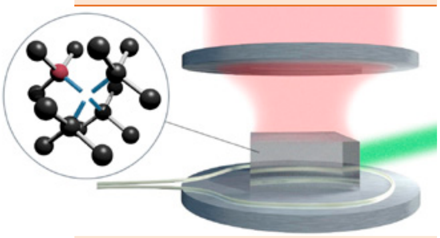
The most significant advance of the LTM concept is improving the sensitivity. At the laser threshold and slightly above it, the intensity of the laser light changes very significantly. You can take advantage of this as an intrinsic amplification of only a small change of the fluorescence. Competition between spontaneous and stimulated emission of the laser, the improved contrast, the higher photon yield, and stronger signals thanks to large NV ensembles all contribute to higher precision in magnetic field measurements than if you were only measuring the fluorescence. This could mean that NV sensors could reach the sensitivity range of the most precise magnetic field sensors – such as those used in medical engineering, e.g. for brainwave measurements via MEG. This allows, for example, wide clinical use to achieve a better understanding of – and better treatment options for – epilepsy, Alzheimer's, or Parkinson's. Other capabilities offered by the LTM concept are practical ones: enabling an ultraprecise sensor operating at room and body temperature, as well as a sensor based on a laser cavity that can be addressed and read out using fiber optics.

In what other future areas of application will NV-doped diamonds play a role?

NV centers in diamond are an extremely promising system and a material for the future: a controllable quantum system at room temperature. Beyond magnetic field sensors, this also allows measurement of electric fields, temperature, and pressure at the highest possible spatial resolution with the aim of attaining a high level of measurement precision. Research is also being done into NV centers as a technology for a possible future quantum computer, as a source of single photons, or for quantum communication and cryptography.

Dr. Jeske, thank you very much for talking to us.

Dr. Jeske was talking to Judith Siegel and Marco Krämer.



Schematic of laser threshold magnetometry. Small picture: Representation of an NV center in diamond. © Fraunhofer IAF

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Intelligent catheters to combat arteriosclerosis

Future catheters equipped with micromechanical ultrasonic transducers from Fraunhofer IPMS will offer better functionality, be smaller, be cheaper to manufacture, and be easier to operate. © Philips

In June 2018, Fraunhofer IPMS launched the collaborative EU "POSITION II" project researching micromechanical ultrasound transducers for smart catheter applications.

Arteriosclerosis is the most common of all vascular complaints. Narrowing of the arteries results in reduced blood flow to organs and other parts of the body – which can lead to heart attack or stroke. Patients must undergo surgery to expand narrowed or blocked blood vessels. This surgery consists of a physician inserting a catheter through a vein into the arterial vasculature to relieve harmful constriction using either a balloon or stent.

The majority of these surgeries can be performed using minimally invasive procedures supported by a variety of smart imaging and sensory catheters, allowing doctors to see exactly where a catheter is at any point during operative treatment.

Many benefits offered by micromechanical ultrasound transducers

In the recently launched "POSITION II" project aiming to further develop features of intelligent catheters, the Fraunhofer Institute for Photonic Microsystems IPMS strives to make procedures easier for doctors and safer for patients. The project aims to provide more functional medical instruments that are also smaller and cheaper as well as safer and easier to use. The technological basis is formed by micromechanical ultrasound transducers.

Ultrasound transducers for medical imaging are currently based primarily on the piezoelectric effect for both signal generation and evaluation, using special, potentially toxic piezo materials. These materials are also difficult to manufacture, making them very expensive.

The Fraunhofer IPMS technology offers an alternative by implementing MEMS structures (known as MUT components) for the construction of ultrasonic transducers. This achieves a compact structure. A post-CMOS module offers an integration capability, providing for production cheaper than is possible with piezo-based ultrasonic transducers. In another advantage, higher frequency can be achieved, resulting in better resolution – and thus, more accurate analysis of medical imaging.

Existing MUT technologies will now be compared with one another within the project, and subjected to further development. The aim is to select optimal variants or combinations of concepts, technologies, and devices for each application.

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Intelligent catheters equipped with the CMUT technology from Fraunhofer IPMS will, in the future, make physicians' jobs easier, will offer more features, and will make medical procedures safer. © Philips

As part of the Bavarian energy research project SEEDs, Fraunhofer IISB identified and implemented various efficiency measures. © MEV Verlag

Rethinking energy systems – potential savings offered by refrigeration systems

As part of the Bavarian energy research project SEEDs, an interdisciplinary research team at Fraunhofer IISB is investigating the potential savings offered by refrigeration systems in an industrial setting. Targeted operating point optimization – based on detailed monitoring, smart control and feedback control systems – can be used to reduce energy consumption and costs.

In a typical larger industrial operation, refrigeration energy is needed both for air conditioning of offices and production halls and for cooling processing machines and server rooms. Over the years, cooling systems are often expanded and revised. New consumers, refrigerating machines and pipelines are added, and old components need to be replaced. The original central control unit of the refrigeration system is decentralized more and more by the use of individual components. This allows inefficiencies to creep in – costing a company a lot of money.

Increased efficiency through optimization measures

The attractiveness of efficiency measures is therefore considerable. Experts estimate the potential savings of refrigeration systems at up to 56% of the total operating costs. As part of the Bavarian energy research project SEEDs, researchers at the Fraunhofer Institute for Integrated Systems and Device Technology IISB have taken a closer look at their own laboratory and building infrastructure as a model for a typical medium-sized industrial operation and have successfully implemented many optimization measures. The result is very respectable: the refrigeration systems' efficiency has increased by over 20%. This represents an annual saving of 135 MWh of electrical energy. A comprehensive survey of the status quo needs to be taken in order to attain these kinds of results. This can be performed using stationary and mobile non-invasive measuring technology. The data recorded during operation is documented continuously and is then analyzed in order to define initial measures for optimizing operating parameters of the refrigeration system. Efficiency can also be increased, for example, by integrating energy storage devices, utilizing free cooling or considering tailored operating strategies for refrigeration system components.

Research results can be transferred to industrial operations

The potential savings of individual measures are always dependent on the boundary conditions of the site in question. Fraunhofer IISB operates a refrigeration system on an industrial scale in which very different strategies were successfully combined and implemented.

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In refrigeration systems typical for industry – such as the one at Fraunhofer IISB in Erlangen – optimization of the operating parameters and targeted investments were able to save around 20% on energy costs. © Fraunhofer IISB / Kurt Fuchs

Gallium nitride for a powerful 5G cellular network

Dr. Dirk Schwantuschke is group manager in the microelectronics department and supervises the 5G GaN2 project on the part of Fraunhofer IAF. © Fraunhofer IAF

The fifth-generation cellular network (5G) will enable data transmission between people, devices, and machines in real time. So far, no technology exists that allows for a reliable, fast and energy-efficient 5G network. In the EU project "5G GaN2", 17 partners from research and industry join forces in order to develop technologies based on gallium nitride.

To date, primarily people communicate via the wireless radio network. In the cellular network of the fifth generation (5G), however, cars, devices, and production machines will also transmit data in real time. In the future, these high data rates will be covered by frequency bands in the millimeter-wave range (> 24 GHz). They provide a ten times higher bandwidth in comparison to currently available frequency bands (< 3 GHz). However, these new frequency ranges cannot be served efficiently with present mobile and antenna technology.

Increased energy efficiency using gallium nitride technology

"It is crucial to improve the available output power and energy efficiency of the network infrastructure for these innovative frequency bands by using advanced gallium nitride technology," says Dr. Dirk Schwantuschke, who manages the project on the part of the Fraunhofer Institute for Applied Solid State Physics IAF. In the 5G GaN2 project, components, devices, and circuits for the 5G base stations will be developed on the basis of gallium nitride (GaN). The contribution of Fraunhofer IAF to the overall project will be the development of power amplifiers in what is known as the E-band, the frequency range around 80 GHz.

Lowering costs and improving performance

Electronic devices and systems based on GaN are significantly more energy-efficient than conventional silicon (Si) ones. The GaN devices will optionally be applied on cost-efficient Si substrates. Another aspect of the project is the combination of various devices in a single package using innovative approaches with regard to packaging technologies, in order to reduce costs. The aim of the project is the realization of demonstrators at 28 GHz, 38 GHz, and 80 GHz. These demonstrators will serve as key technologies for the development of a powerful and energy-efficient 5G cellular network based on GaN.

The project reflects the entire value creation chain of cellular technology. Wafer suppliers, semiconductor manufacturers, and system integrators develop innovative GaN-based technologies for the cellular network of the fifth generation together with universities and research institutes.

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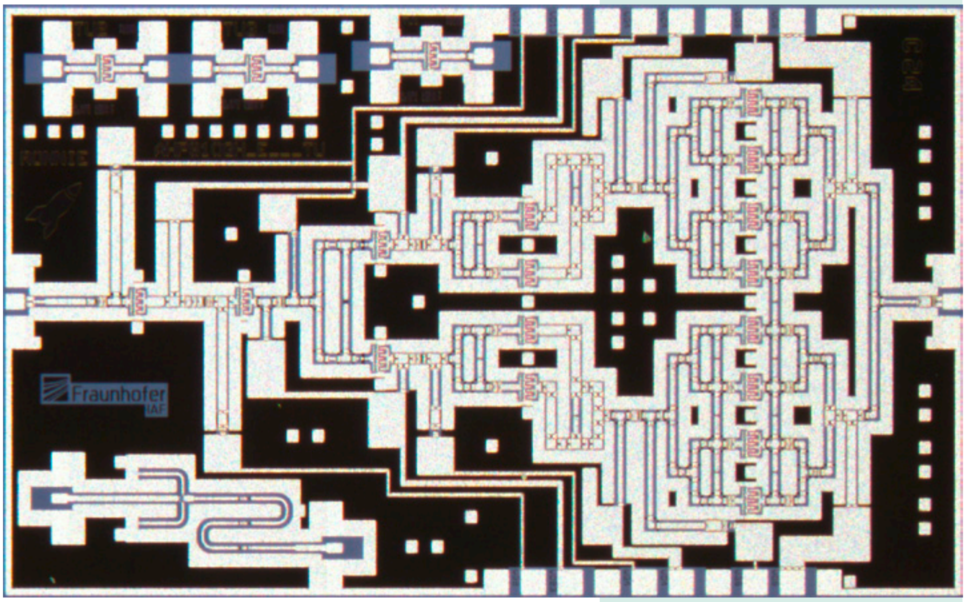

The E-band amplifier chip developed at Fraunhofer IAF measures only 4 × 2.5 mm². © Fraunhofer IAF

The underlying quantum technology allows for tap-proof fiber-glass networks. © MEV Verlag

Dawn of quantum technology

With increasing digitalization, data and communications security is also becoming more and more important. Quanta are tap-proof, which makes them a promising means of communication. The Fraunhofer Heinrich Hertz Institute and 23 other partners from research and industry are developing systems for quantum communication within the scope of the project "Quanten-Link-Erweiterung" (Q.Link.X).

This technology uses quantum states as information carriers. This means that the data cannot be copied or read unnoticed.

Expansion of range

The aim of the project is to develop physically tap-proof fiber-glass networks. The quantum information is transmitted through photons. The range, however, is currently limited to under 100 km. The solution: quantum repeaters (QRs) that reinforce, process, and link the signals of the individual stages without security restrictions.

Test environment for QR systems

The Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute, HHI provides the application-oriented fiber-glass test environment for the developed QR solutions. Various systems, from quantum points to diamond F-centers and a combination of atomic and ionic systems are compared with one another and evaluated on transmission paths between 10 km and 100 km in length – an important step when it comes to transferring the principle into an application. As part of the project, improved wavelength multiplexing protocols with additional quantum communication and classic transmission channels are being tested for existing fiber-glass communication networks.

The following partners are involved in Q.Link.X in addition to Fraunhofer HHI:
- Rheinische Friedrich-Wilhelms-Universität Bonn
- Technical University of Munich
- Technical University of Dortmund
- Technical University of Berlin
- University of Stuttgart
- University of Paderborn
- Saarland University
- Free University of Berlin
- Leibniz Institute for Solid State and Materials Research Dresden
- Ruhr University Bochum
- Swabian Instruments GmbH
- Leibniz University, Hanover
- Max Planck Institute of Quantum Optics (Garching)
- Julius-Maximilians-Universität Würzburg
- University of Bremen
- Heinrich Heine University Düsseldorf
- University of Ulm
- Humboldt University of Berlin
- University of Kassel
- Johannes Gutenberg University of Mainz
- Karlsruhe Institute of Technology
- Ludwig-Maximilians-Universität, Munich

The project is being funded by Germany's Federal Ministry of Education and Research.

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Fraunhofer HHI is working on a quantum communication system. © istock.com / BlackJack3D, edited by Fraunhofer HHI

Wireless energy supply for wearables

There is a new technology gripping the markets of the future – technology to wear. Wearables, as they are known, are portable systems that contain sensors to collect measured data from our bodies. Powering these sensors without wires calls for pliable batteries that can adapt to the specific material and deliver the power the system requires.

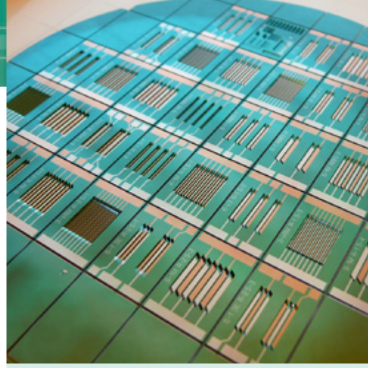
How to power these smart accessories poses a significant technical challenge. There are the technical considerations – durability and energy density – but also material requirements such as weight, flexibility, and size, and these must be combined, for example in a smart wristband that has been developed to the prototype stage by the Fraunhofer Institute for Reliability and Microintegration IZM. It can, quite literally, collect data first hand. The silicone band's technical pièce de résistance is its three gleaming green batteries. With a capacity of 300 mAh, these batteries supply the wristband with power. They can store energy of 1.1 Wh and lose less than 3% of their charging capacity per year. With these parameters, the new prototype has a much higher capacity than smart bands available on the market so far, enabling it to supply even demanding wearable electronics with energy. The available capacity is actually sufficient to power future smartwatch products with significantly expanded functionality.

Success through segmentation

Dr. Robert Hahn, a researcher in Fraunhofer IZM's department for RF & Smart Sensor Systems, explains the recipe for success: "If you make a battery extremely pliable, it will have very poor energy density – so it's much better to adopt a segmented approach." Instead of making the batteries mechanically extremely pliable at the cost of energy density and reliability, the institute has turned its focus to designing very small and powerful batteries and optimized packaging. The batteries are pliable in between segments. In other words, the smart band is flexible while retaining a lot more power than other smart wristbands available on the market.

Smart plaster to measure sweat

In 2018, the institute began to work on a new wearable technology, the smart plaster. Together with Swiss sensor manufacturer Xsensio, this EU-sponsored project aims to develop a plaster that can directly measure and analyze the patient's sweat. The sweat can then be used to draw conclusions about the patient's general state of health. In any case, having a convenient, real-time analysis tool is the ideal way to better track and monitor healing processes. Fraunhofer IZM is responsible for developing the design concept and energy supply system for the sweat measurement sensors. The plan is to integrate batteries that are extremely flat, light, and flexible. This will require the development of various new concepts, while also ensuring that materials are selected that are inexpensive and easy to dispose of. After all, a plaster is a disposable product.



Fabrication of micro batteries with side-by side electrodes on silicon wafer. © Fraunhofer IZM

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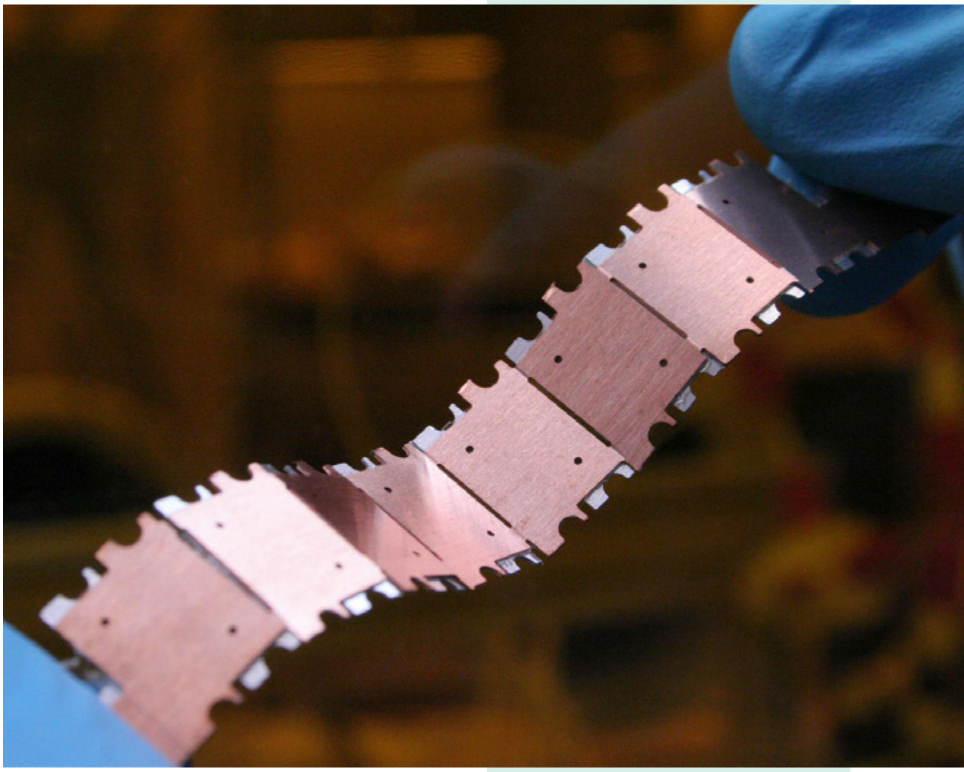
Mechanically flexible battery strips made from segmented micro batteries. © Fraunhofer IZM



EYEMATE allows doctors and patients to continuously monitor the intraocular pressure. © MEV Verlag

Monitoring intraocular pressure with EYEMATE

Increased intraocular pressure makes glaucoma more likely. Often, the disease is not recognized in time. The EYEMATE sensor system developed by Fraunhofer IMS and Implandata Ophthalmic Products GmbH makes continuous monitoring of intraocular pressure easier, allowing for optimum treatment.

Our eyes are home to a constant exchange of aqueous humor – new humor is produced and old humor is expelled. If, however, the quantity of new aqueous humor is greater than the quantity of humor being expelled, the intraocular pressure rises, which may result in irreversible damage, even death of the optic nerve. This condition is referred to as glaucoma.

Until now, only physicians have been able to measure intraocular pressure. The data is often collected at irregular intervals, and values from throughout the day are not collected. Medical or surgical treatments can thus often only be started once irreversible damage has occurred. Furthermore, a lack of data increases the risk of incorrect treatment decisions being made.

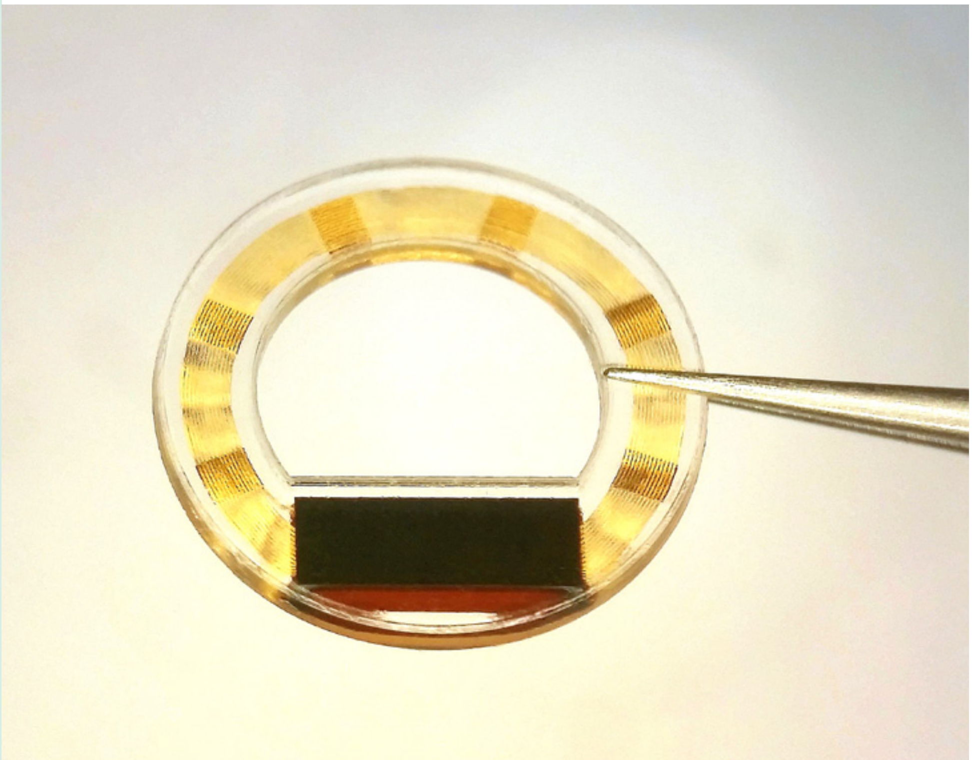
At-home measuring system

The EYEMATE handheld reader allows patients to measure these parameters themselves within a few seconds. The digitalized data is displayed straight away and changes across time can be viewed using a mobile app. A cloud connection can also allow the doctor to access the data and thus to start or optimize the right treatment in good time.

Regular check-ups

The handy format and user friendliness will encourage patients to use the device as often as possible, creating a useful store of data. The system has already proven itself in clinical studies; the CE approval process has been completed.

Encapsulated sensor implant for measuring intraocular pressure. © Fraunhofer IMS



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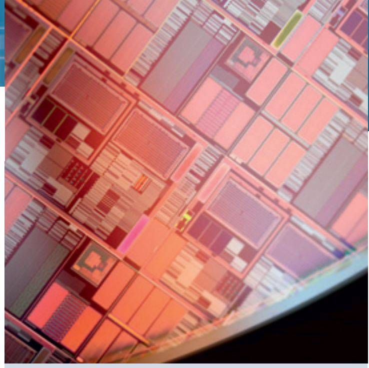

Cut-out of a 300 mm wafer with test chips.
© Fraunhofer IPMS / Globalfoundries

Fraunhofer IPMS and Globalfoundries Dresden expand their collaboration

In September 2018, Fraunhofer IPMS and Globalfoundries Dresden signed a research contract to expand the development collaboration they have been pursuing for 13 years. The focus for the next two and a half years will be on the development of innovative materials, processes, and devices for the energy-saving technology FD-SOI, which is particularly in demand in the growth markets Internet of Things and automotive, but which also plays a role in medical engineering, logistics, and aerospace.

The partners are hoping for a more intensive and sustainable strategic direction for their joint research activities and a strengthening of Dresden as a technology location. To promote up-and-coming scientific talent, the collaboration also includes a doctoral candidate program for up to 16 young scientists.

As part of the project, the Fraunhofer IPMS cleanroom will be expanded to approximately 900 m² and will receive new equipment. The German Federal Ministry of Education and Research is providing funding under the auspices of the Research Fab Microelectronics Germany.

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DRIVE-E Student Awards 2018 presented

Several up-and-coming young scientists have been presented with the DRIVE-E Student Award by the German Federal Ministry of Education and Research (BMBF) and the Fraunhofer-Gesellschaft for their outstanding student work. The ceremony took place at the Transport Center of the Deutsches Museum in Munich.

The award is part of the DRIVE-E Academy, an annual summer academy at which 50 selected students from all over Germany become better acquainted with the theory and practice of electromobility.

First place in the master's thesis category went to Julian Hölzen from the Leibniz University of Hanover, who got to grips with technological modeling and economic analysis of hybrid-electric drive systems. First place in project/bachelor's theses was taken by Adrian Candussio from the Technical University of Munich. In his thesis on energy storage, he analyzed the aging of lithium-ion cells.

DRIVE-E was initiated jointly in 2009 by the BMBF and the Fraunhofer-Gesellschaft. With the DRIVE-E Student Award, the BMBF and the Fraunhofer-Gesellschaft seek to honor innovative student work on electromobility. In 2018, graduates and students from German universities and other third-level institutes were once again able to submit their scientific dissertations. This year, with Munich University of Applied Sciences as a university partner, DRIVE-E made its first-ever stop in the Bavarian capital.

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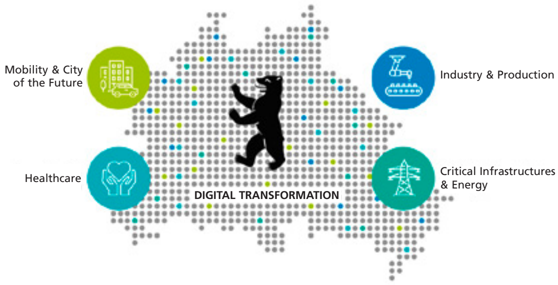
Presentation of the DRIVE-E Student Awards 2018 during the DRIVE-E Academy in September 2018. Hermann Riehl (BMBF), Adrian Candussio, Maximilian Wilhelm (TU Kaiserslautern), Julian Leon Hölzen, Martin Gerlach (RWTH Aachen), Prof. Martin März (Fraunhofer IISB), and Prof. Hubert Lakner, Chairman of the Fraunhofer Group for Microelectronics. (from left to right)
© Marc Müller / dedimag / DRIVE-E

© Fraunhofer FOKUS

Mayor Michael Müller visits the Berlin Center for Digital Transformation

As part of his science tour, Michael Müller, Berlin's Governing Mayor and Senator for Higher Education and Research, visited the IoT Lab at the Berlin Center for Digital Transformation. During the visit, it was announced that the Berlin Center for Digital Transformation is entering the second phase, two years after its foundation. The Center is being funded by the state of Berlin, the Fraunhofer-Gesellschaft, and by monies from the European Regional Development Fund (ERDF) to the tune of 6 million euros until the end of 2020.

The focus of the Center lies on the development and provision of practice-oriented solutions for digital transformation. Research is carried out on basic and cross-sectional technologies as well as on solutions for four specific fields of activity: Networked Healthcare, Networked Mobility & City of the Future, Networked Industry & Production, and Networked Critical Infrastructures & Energy. The four Berlin-based Fraunhofer institutes FOKUS, HHI, IPK, and IZM have pooled their expertise within the Center. Industrial partners and public bodies can collaborate on research projects with these Fraunhofer institutes.



The Berlin Center for Digital Transformation's fields of activity. © Fraunhofer FOKUS

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10 years of Fraunhofer ENAS

On October 17, 2018, guests from Germany and abroad from government, business, and science attended and celebrated the tenth anniversary of Fraunhofer ENAS in Chemnitz.

In his speech, the President of the Fraunhofer-Gesellschaft, Prof. Reimund Neugebauer, underlined the fact that the institute's work in smart systems integration has been making a significant contribution to digitalization for many years. The Premier of the Free State of Saxony, Michael Kretschmer, also assured Chemnitz and its researchers continuing support from the Free State.

Institute Director Prof. Thomas Otto presented current work from the various business units. In addition to its technology-oriented business units, the institute focuses on the application of technologies and systems for smart production, smart health, and smart power and mobility. To support digitalization in agriculture in a sustainable way, the institute is developing smart systems for cultivation and animal health, e.g. within the MANTRA project (the mastitis-pathogen and antibiotic-resistance test for on-site analysis).

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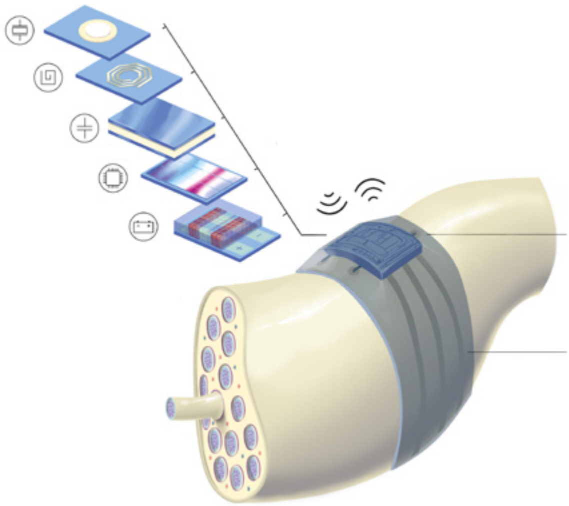
Institute Director Prof. Thomas Otto (second from right) with the other introductory speakers: President of the Fraunhofer-Gesellschaft Prof. Reimund Neugebauer (r.), President of TU Chemnitz Prof. Gerd Strohmeier, Premier of the Free State of Saxony Thomas Kretschmer, Mayor of Chemnitz Barbara Ludwig (from left to right). © Fraunhofer ENAS

Notes

New working group developing bioelectronic medicine

The newly founded Technologies for Bioelectronic Medicine working group at Fraunhofer IZM has been doing research into the basics of what's known as “electroceutics” since September 2018. These are intelligent, customizable micro-implants that can target certain regions of the nervous system and thus intervene directly in the body’s own regulatory circuits. This allows results to be attained that are comparable to those of pharmaceutics without the associated systemic side effects.



Tiny implants with a compact 3D layout, with all components responsible for smart targeting of nerves integrated on the device.
© Fraunhofer IZM

Bioelectronic medicine aims to treat a number of diseases, such as diabetes, hypertension, or migraine. As the stimulation is adapted to each patient personally, highly individualized treatment is possible. The working group is led by Dr. Vasiliki Giagka, who also teaches at the TU Delft.

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Improved in-vehicle digital radio reception

Newer vehicles and electric cars are based on complex open- and closed-loop electronic control systems. These can interfere with digital radio reception, causing brief but repeated signal disruptions. With an upgrade to the established DAB+ (Digital Audio Broadcasting) software library from Fraunhofer IIS, the quality of digital radio reception will be significantly improved by efficient spur suppression technology. It moreover enhances the reception sensitivity of the radio receivers. In turn, this extends the range of coverage for broadcasters and increases the number of channels that can be received in vehicles. The software upgrade moreover includes the DAB+ Emergency Warning Functionality (EWF) that enables the radio receivers to automatically switch to emergency broadcasts – a simple, reliable and extremely quick way to alert the public to natural disasters and emergencies.

The Fraunhofer IIS DAB+ software library upgrade improves in-vehicle reception of digital radio. © MEV Verlag

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Robotics laboratory tests latest sensor developments

The robotics laboratory at Fraunhofer IAF offers a measuring station for a wide range of testing scenarios. Equipped with various measuring heads, the freely movable robot arm can test material samples and the latest sensor developments, among other things. This offers the ability to perform measurements flexibly in 3D and at the highest frequencies. The measuring laboratories at the institute can also be used by interested outside parties. For more information, please contact the experts at Fraunhofer IAF.

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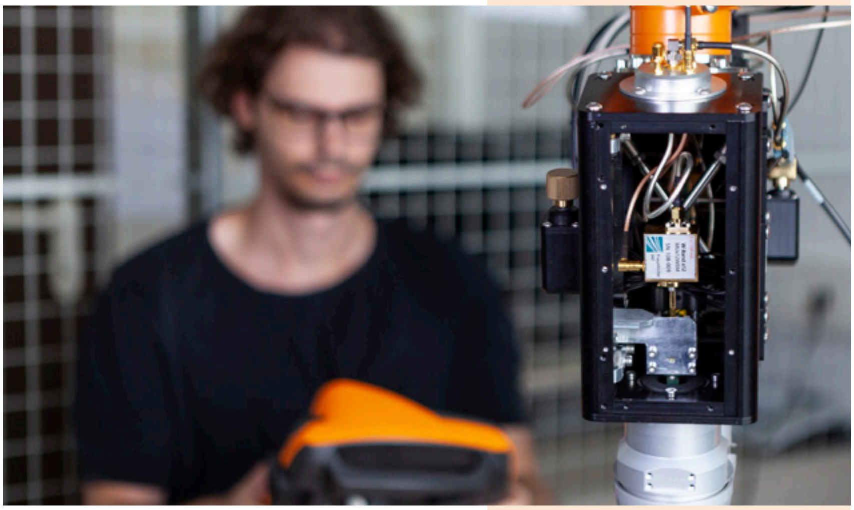
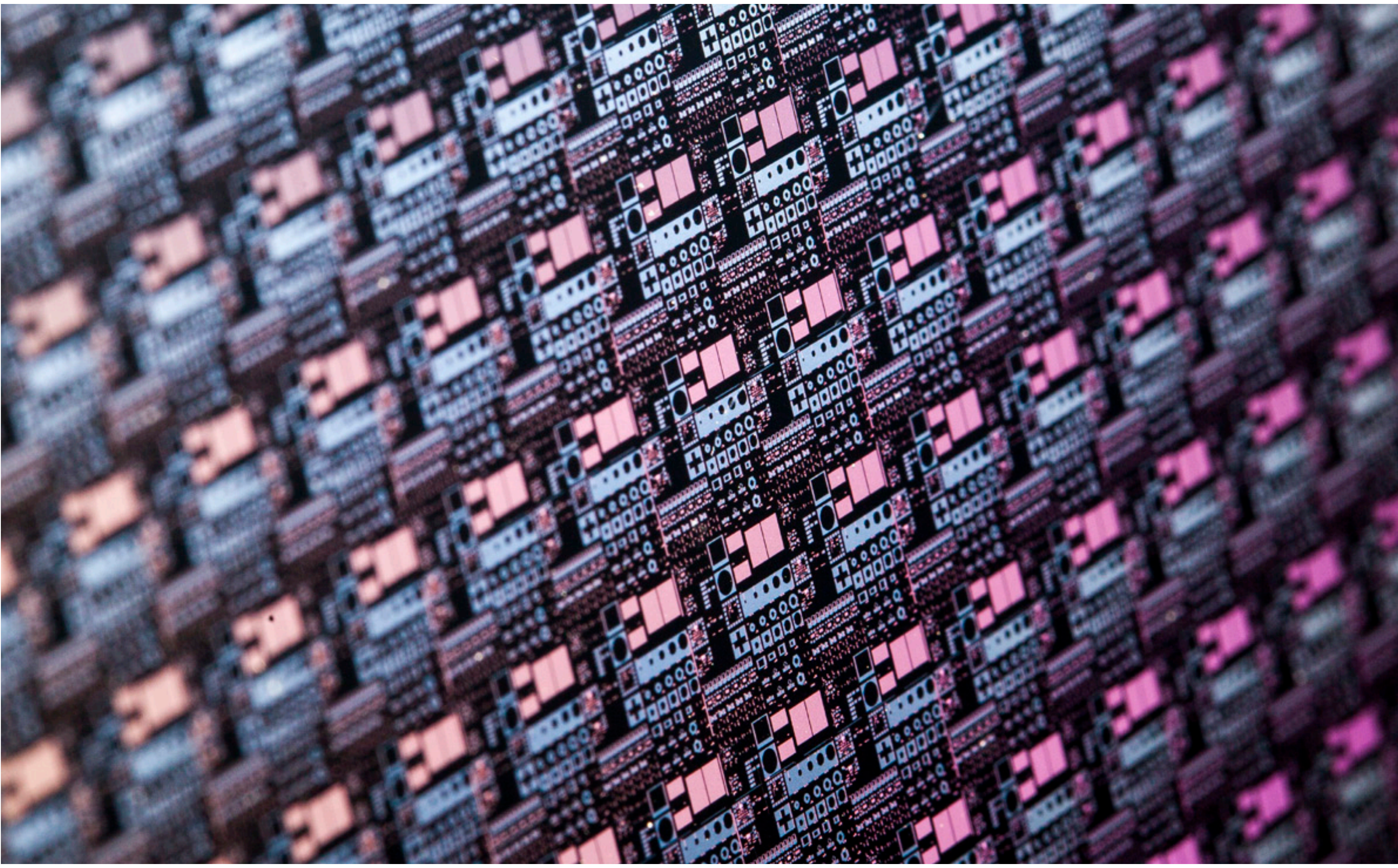
Has a wide range of uses: the robotics laboratory at Fraunhofer IAF. © Fraunhofer IAF





The photo shows an AlGaN/GaN transistor – the detail is of the ohmic contact metal. Our scientists developed the transistor on cubic SiC on Si (111). It offers a high level of electron mobility, and thus is known as a high-electron-mobility transistor (HEMT). HEMTs are the present and future of high-frequency applications – from radar and satellite communication to the 5G data communication system. Cubic SiC on Si also makes it possible to manufacture more cost-effective products. © Fraunhofer IAF

Editorial notes

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The Fraunhofer Group for Microelectronics, founded in 1996, combines the expertise of 17 Fraunhofer institutes, with a total of more than 3,000 employees. Its main focus is the preparation and coordination of interdisciplinary research projects, conducting studies and to assist in the process of identifying strategies.

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The last word ...

Christian Lüdemann.
© Fraunhofer Mikroelektronik

... goes to Christian Lüdemann from the Fraunhofer PR-network

The new year saw some changes at the business office of the Fraunhofer Group for Microelectronics. After almost 18 years, Christian Lüdemann (Communications Director) is moving to Fraunhofer-Gesellschaft headquarters in order to concentrate fully on the Fraunhofer PR-network.

Mr. Lüdemann, what will you take with you into the future when you think back on your time with the Group?

I am very grateful for a team that handles both big and small issues with happiness, respect, responsibility, and plenty of humor while also getting some important things off the ground.

Which of the projects that are being worked on by your colleagues in a Fraunhofer institute interests you in particular?

I always find it fascinating when very diverse people from different disciplines sit down at the table together, develop ideas, and then implement them in very different ways. It is the diversity of approaches and capabilities that I like.

What invention would you not like to do without in daily life?

From a practical point of view: the dish-washer – every family's savior! But from a personal point of view: the radio. Since my childhood it has been like a movie theater in my head.

What do you wish you had more time for?

It might be hard to believe, but I am actually happy with the way I divide my time.

Let's look into the future. What would you like to have achieved in five or ten years' time?

I'm no spring chicken and, in ten years, I'll probably be busy with retirement! Before then, however, I hope to continue to have some good ideas at work. I would like to experience a lot with my family and I hope to stay relatively physically fit.

What song belongs to the "soundtrack" of your life?

"Cantaloupe Island" by Herbie Hancock and everything by Steely Dan.

What was the last book you read?

Befuddlement by Christoph Hein: a journey through time in the GDR (Catholic child-hood, career, homosexuality, the fall of the Berlin Wall...).

Can you tell us what motto you live by?

Don't make a mess of things!

Lastly, the entire editorial team of Micro-electronics News would like to thank you and wish you all the best. Now you literally have space for a "last word."

I look forward to seeing my microelectronics colleagues again when working on various projects, and to initiating something new together once again.

About Christian Lüdemann::
Born in 1962, grew up in the Berlin borough of Pankow when it was still in East Germany. 1986: Moved from East to West Berlin. University, worked as a taxi driver etc. After obtaining his degree, worked in PR for a hospital project developer. Joined Fraunhofer in 2000. Married, two adult sons. "I left the GDR because I wanted to see the world. I did that, and I still get great pleasure out of traveling with my wife."

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Cape Agulhas, the most southerly point in Africa. © Private collection