Microelectronics News

Fraunhofer MIKROELEKTRONIK

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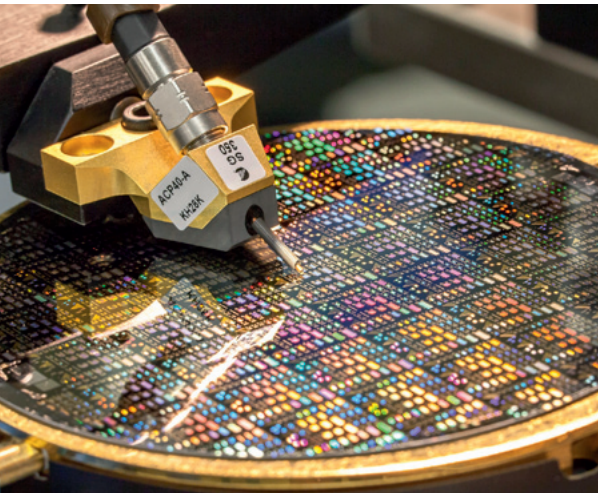
New material to push the boundaries of silicon-based electronics



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Scandium aluminum nitride (ScAlN), is being used in the recently launched project "Power Electronics 2020+" to develop more efficient power electronic systems and to pave the way for the next generation of electronics. This is because electronics based on silicon (Si), which has so far dominated the market, will no longer be able to meet increasing industrial demands in the foreseeable future.

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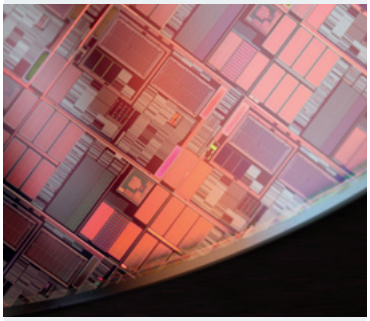

FDSOI becomes the key for European industry.
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Breakthrough in magnetic resonance imaging of the heart

Cardiovascular diseases are the number-one cause of death globally. To date, several areas of significant unmet needs remain unaddressed. The MetaboliQs project combines diamond-based quantum sensor technology and medical imaging to advance personalized diagnostics.

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Incorrectly installed system components can lead to system failure. Even inspections cannot always reveal these errors to the technicians. Our solution is AcoustiX – a "listening" sensor system developed by Fraunhofer IZFP.

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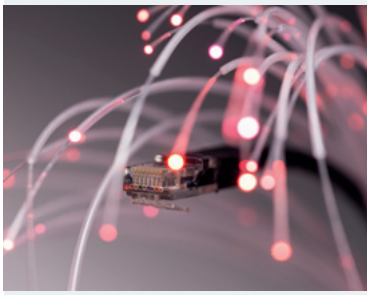

CiViQ brings quantum technologies to the telecommunications arena.
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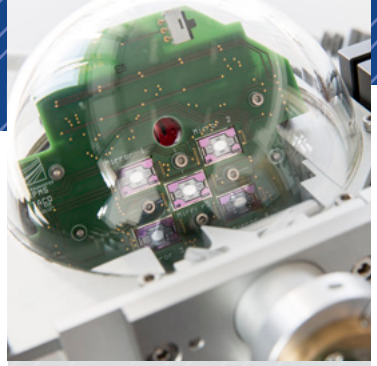
■ Content:

Events

Date	Event / WWW	Location	Group institutes involved
05/12 – 05/17	2019 IEEE International Conference on Acoustics, Speech and Signal Processing https://2019.ieeeicassp.org	Brighton, UK	IZFP
05/14 – 05/17	Techtextil 2019 https://techtextil.messefrankfurt.com/frankfurt/en.html	Frankfurt / M., Germany	IMWS
05/15 – 05/17	ees Europe 2019, electrical energy storage www.ees-europe.com/en/home.html	Munich, Germany	ISIT
05/21 – 05/22	8th FOKUS Media Web Symposium www.fokus.fraunhofer.de/go/mws	Berlin, Germany	FOKUS
05/21 – 05/23	Automotive Testing Expo 2019 www.testing-expo.com/europe/en/index.php	Stuttgart, Germany	FHR
05/28 – 05/31	ECTC – 2019 IEEE 69th Electronic Components and Technology Conference https://ectc.net/index.cfm	Las Vegas, Nevada	IIS / EAS, IZM
06/16 – 06/20	International Wheelset Congress (IWC) www.iwc2019.com	Venice, Italy	IZFP
09/16 – 09/20	ION GNSS+ 2019 www.ion.org/gnss/index.cfm	Miami, Florida	IIS
06/23 - 06/26	IEEE NEWCAS Conference www.newcas2019.org/	Munich, Germany	EMFT
06/23 – 06/27	Transducers 2019, Eurosensors XXXIII https://transducers-eurosensors2019.org/	Berlin, Germany	ISIT, IZM
06/24 – 06/27	LASER World of Photonics https://world-of-photonics.com	Munich, Germany	Group Institutes and FMD
06/25 – 06/27	Sensor + Test 2019 www.sensor-test.de	Nürnberg, Germany	HHI, IMS, IZM
06/26 – 06/28	International Radar Symposium www.dgon-irs.org/en/home/	Ulm, Germany	FHR
07/04	Wachtberg-Forum 2019 www.fhr.fraunhofer.de/de/veranstaltungen/2019/wachtberg-forum-2019.html	Wachtberg, Germany	FHR
07/09	Fraunhofer-Leti Workshop "New Paradigms in Microelectronics" www.grenoble-alps.com/letisemiconwest2019/Call1_04-2019.htm	San Francisco, California	Group Institutes and FMD
07/09 – 07/11	Semicon West www.semiconwest.org	San Francisco, California	Group Institutes and FMD
08/27 – 08/29	AES International Conference on Headphone Technology www.aes.org/conferences/2019/headphones/	San Francisco, California	ISIT
09/04 – 09/06	2019 International Conference on Simulation of Semiconductor Processes and Devices http://sispad2019.org/	Udine, Italy	IISB
09/12 – 09/22	International Motor Show IAA www.iaa.de/en	Frankfurt / M., Germany	FHR



Within the FMD, there are a variety of R&D activities for each individual component of a LiDAR system.
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Forschungsfabrik Mikroelektronik Deutschland

The construction kit for smart system solutions

Microelectronics is a firm part of all aspects of our daily lives. Whether in cars, medical engineering, or consumer electronics, a wide variety of microelectronic system solutions are required for the various applications. The Research Fab Microelectronics Germany (FMD) is a one-stop-shop that offers a wide range of R&D services for system solutions. These are constantly being further developed by more than 2000 scientists in 13 member institutes.

Technologies for the entire length of the value creation chain within micro- and nanoelectronics

With their broad technology portfolio, the scientists develop tailor-made system solutions. The R&D work at the member institutes covers the entire value chain of microelectronics and nanoelectronics.

This comprises:

- Design and design methods for systems and components
- Materials, processes, and devices as well as the integration of new material systems
- Heterointegration, i.e., the merging of different devices and elements
- Characterization, testing, and reliability

Technology platforms with different focal points

The value chains are considered in six thematic platforms. Here, the existing expertise that the institutes have on the topic in question is bundled. The customer benefits from having only one contact person in the business office, but access to the technologies and know-how of all 13 member institutes.

The content focuses within the technology offering are:

- Microwave and terahertz: leading-edge devices and circuitry for frequencies up to and including the THz range
- Power electronics: power-electronic devices and the integration thereof in modules and systems
- Extended CMOS: design and manufacture of CMOS circuitry as well as the integration thereof in systems
- Optoelectronic systems: data transmission (up to and including the Tbit/s range) from the transmitter to the receiver
- Sensor systems: design and manufacture of sensors as well as the integration, characterization, and testing thereof within systems
- MEMS actuators: design and manufacture as well as the characterization, testing, and system integration of MEMS actuators

Transfer into application-based concepts

The customer can choose expertise and technologies from these platforms; these are then transferred into application-based concepts. The focus is on the areas of transport and mobility, energy, digital life, health, digital industry, civilian security, and occupational safety.

LiDAR – tailor-made components for a wide range of applications

An example of an application in the field of transport and mobility is LiDAR, a method for distance and speed measurement. It is central to the development of systems for autonomous driving. For each individual component of a LiDAR system, there is a varied spectrum of R&D activities within the FMD. The scientists there are continuously advancing the laser sources, transmission optics, and beam guidance systems as well as receiving optics and detectors. In addition, various partners from industry contribute their knowledge and list their requirements for the system. The research know-how can thus be tailored for the individual applications and the resulting system specifications.

Further information on the technology and applications offered by the Research Fab Microelectronics Germany can be found at: https://www.forschungsfabrik-mikroelektronik.de/en.html.

In the field of LiDAR, FMD offers a wide range of research services for a variety of applications in the automotive and industrial sectors.
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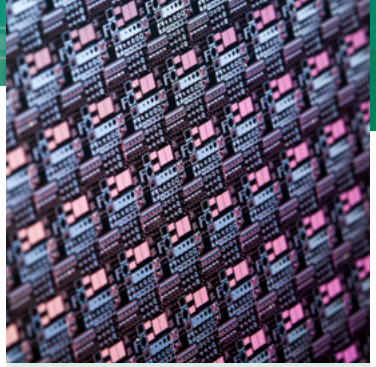
New material to push the boundaries of silicon-based electronics



The market in electronics is growing rapidly and it is already foreseeable that silicon-based technologies will no longer meet the industrial demands in the field of power electronics in the future. © Fraunhofer IAF

Scandium aluminum nitride (ScAlN), a semiconductor material that has so far been little researched in microelectronics, is being used in the recently launched project "Power Electronics 2020+". The aim is to develop more efficient power electronic systems and to pave the way for the next generation of electronics. This is because electronics based on silicon (Si), which has so far dominated the market, will no longer be able to meet increasing industrial demands in the foreseeable future.

Limits of silicon technology

Silicon, a low-cost semiconductor material with an almost perfect crystalline structure, is beginning to hit its physical limits: power electronic components made of Si are inadequate, especially with regard to the required power density and compactness.

New material composition for more power and efficiency

The use of the semiconductor gallium nitride (GaN) in power electronics has already overcome the limitations of Si technology. At very high voltages, temperatures, and switching frequencies, GaN offers better performance than Si and thus enables significantly higher energy efficiency. In the project "Research into Functional Semiconductor Structures for Energy-Efficient Power Electronics"– or "Power Electronics 2020+" for short – researchers are working on further increasing the energy efficiency and service life of future electronic systems. To this end, another material is to be used for the first time: ScAlN.

First ScAlN-based devices

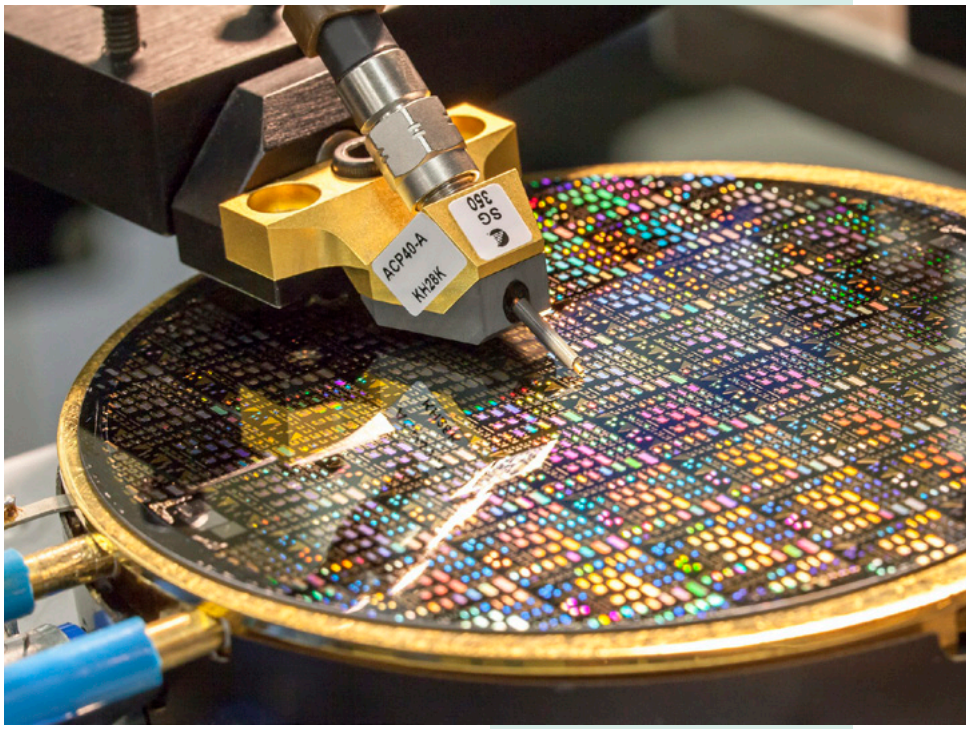
ScAlN is very promising as a piezoelectronic semiconductor material because its physical properties make it particularly suitable for use in power electronic components. Specifically, the aim is to grow ScAlN on a GaN layer, adapted to the lattice, and to process transistors with high current carrying capacity with the heterostructures produced from it.

"The components achieve a higher power density measured on the chip surface as well as higher switching speeds and higher operating temperatures, which amounts to lower switching losses, higher energy efficiency, and more compact systems," explains Prof. Oliver Ambacher, Director of the Fraunhofer Institute for Applied Solid State Physics IAF.

Pioneering work in materials research

One of the biggest challenges of this project is crystal growth, as neither growth recipes nor empirical values exist for this material structure. The project team will have to jump this hurdle in the coming months in order to achieve reproducible results and produce layer structures that can be successfully used for power electronic applications.

A research team at Fraunhofer IAF (Fraunhofer Attract project »PiTrans«) has been investigating the piezoelectric properties of ScAlN for use in high-frequency filters for many years. The photo shows devices such as these being tested on a wafer. © Fraunhofer IAF



Project participants:
- University of Freiburg
- Fraunhofer IAF
- Fraunhofer IIS
- Leistungszentrum Elektroniksysteme
- Sustainability Center Freiburg

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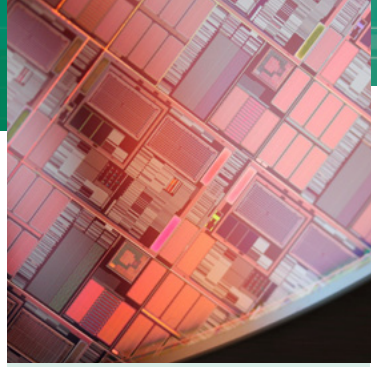

Section of a test chip.
© Fraunhofer IPMS / Globalfoundries

FDSOI becomes the key for European industry

Microelectronics is the motor of digitalization. Competitive industrial products require highly integrated, energy-efficient, and intelligent semiconductor components. This applies in particular to cars, but also to products within mechanical engineering, plant construction, energy technology, and medical engineering. And this is where THINGS2DO entered the picture in 2014. With the completion of the project, German industry now has a powerful chip development system for industry-capable 22FDX® technology at its disposal.

THINGS2DO is a joint European project with over 40 partners. The objective of the project was to give European industry access to the FDSOI-based 22FDX® technology. The project extended far beyond making FDOI technology available, and now, at the end of the project, all of the essentials needed for successful development of semiconductor components are at hand. This covers, in particular, the provision of tried-and-tested process design kits (PDKs), efficient design methods, a comprehensive library of design IPs, and attractive SoCs as demonstrators and reference designs.

SoC demonstrator shortens the project duration

The performance capability of the development results has been proved with several demonstrators, including a video and image detection SoC with outstanding performance data for automotive applications. The project partner Bosch has investigated radar modulation concepts in the context of THINGS2DO and developed high-frequency circuits in 22FDX® technology. The radar system demonstrator thus created showed that modern CMOS technologies offer new opportunities for automobile radar applications.

Generally speaking, the results have far exceeded expectations: the 22FDX® technology introduced is more powerful and saves more electricity than foreseen at project launch in 2014. The SoC demonstrator has considerably more processing power and the duration of the project was shortened by six months. The early availability of the results has already contributed to the 22FDX® technology and associated IP portfolio of the design partners being established on the market. This has significantly helped expand commercialization plans.

Basis: 22FDX® technology from joint European research

The underlying 22FDX® technology also originated in European developments. The substrate material comes from the SOITEC company in France and the 22FDX® technology was developed by GLOBALFOUNDRIES in Dresden in close collaboration with the STMicroelectronics company and the French research laboratory LETI.

About THINGS2DO

THINGS2DO was funded by the German Federal Ministry of Education and Research (BMBF) and ENIAC, a public-private partnership fund of the European Commission. Fraunhofer IIS / EAS as well as Fraunhofer EMFT, Airbus, Dream Chip Technologies, GLOBALFOUNDRIES, MunEDA, Bosch, the University of Tübingen, and Leibniz University in Hannover were involved in the work.

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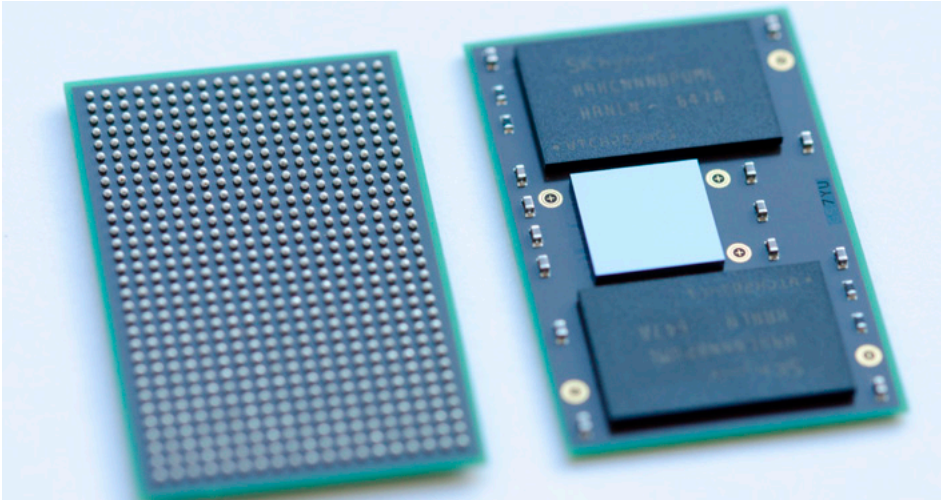


Fine-pitch package substrate for a multifunctional system-on-chip.
© Fraunhofer IIS / EAS

Breakthrough in magnetic resonance imaging of the heart

Cardiovascular diseases (CVDs) are the number-one cause of death globally. To date, several areas of significant unmet needs remain unaddressed. The "MetaboliQs" project combines diamond-based quantum sensor technology and medical imaging to advance personalized diagnostics.

Magnetic resonance imaging (MRI) methods have been used widely in past decades as a safe, non-invasive, and non-radioactive method of diagnosing CVDs. However, even the most expensive MRI scanners (with the strongest magnets) cannot detect and visualize molecular and metabolic activity in the heart with sufficient sensitivity. To this end, emerging hyperpolarization-based MRI techniques play a pivotal role, as they allow the sensitivity of MRI to be increased by up to five orders of magnitude.

Unfortunately, the hyperpolarization process takes a very long time (90-180 minutes per procedure), is extremely costly and cumbersome (>$2 million initial cost, room-sized equipment), and requires temperatures colder than -270 °C. The MetaboliQs project, in which also the Fraunhofer Institute for Applied Solid State Physics IAF is involved, therefore aims to enable a new method for MRI by leveraging new advances in quantum physics.

Higher-precision diagnostics and personalized treatment using advances in quantum physics

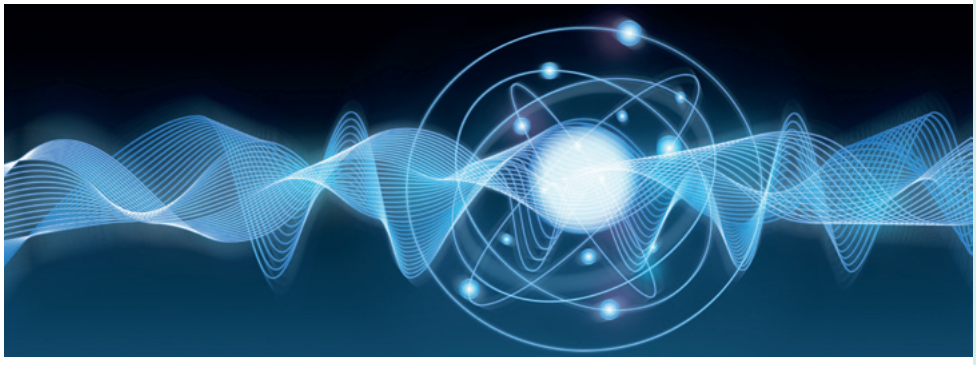
The method, termed hyperpolarized MRI, will allow imaging and visualization of key metabolic substrates in the heart and other organs (e.g., kidney, liver) via hyperpolarization of nuclear spins of substrates that are natural to the body and non-toxic. In this way, a number of important metabolic reactions can be tracked non-invasively. This technology will enable a previously unachievable and highly sensitive quantification of metabolic activity, paving the way for precision diagnostics and better patient-centered treatment of cardiovascular diseases. For example, it will become possible to distinguish patients who will most likely benefit from invasive or pharmacological treatments from those who would be more suited to other medical treatment approaches. It may also become easier to accurately diagnose patients at the disease's early stages.

The MetaboliQs project will leverage the transformative features of diamond nitrogen vacancies (NV), such as high quantum coherence and quantum control, to offer a breakthrough in hyperpolarized MRI. A low-cost and high-throughput diamond polarizer is to be developed for use with any commercial MRI scanner and shows results within minutes instead of hours.

This unique utilization of quantum coherence is made possible by new technology to atomically grow diamond material (quantum-grade diamond), including 12C isotopic purification, precise control of nitrogen defect concentration, and nanofabrication of the diamond surface.

The MetaboliQs project is part of the overall Quantum Flagship initiative, funded by the European Union.

The MetaboliQs project combines diamond-based quantum sensor technology with medical imaging. © Fraunhofer IAF



New technologies for the atomic growth of diamond material will improve MRI. © Fraunhofer IAF

About MetaboliQs

The members of the multidisciplinary consortium MetaboliQs are:

- Fraunhofer IAF in Freiburg, a leading research institute for quantum technology with diamond
- NVision Imaging Technologies GmbH, Germany, a quantum technology company supported by Silicon Valley
- Element Six Limited, UK, a world leader in the research and production of synthetic diamond
- Hebrew University of Jerusalem (HUJI), Israel, a leading research institute for diamond quantum technologies
- Bruker BioSpin GmbH – market leader in preclinical MRI and NMR spectroscopy
- ETH Zürich in Switzerland
- Technical University of Munich, Germany.

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With the aid of ultrasound technology integrated into their otoscopes, physicians can differentiate between the different stages of disease much more precisely in the case of middle ear infections. © MEV Verlag

Innovative probe with MEMS components makes diagnosis of middle-ear infections easier

Researchers at Fraunhofer IPMS have developed a unique ultrasound transducer based on their own MEMS (micro-electromechanical systems) technologies. OtoNexus Medical Technologies, Inc. – a Seattle-based start-up – is using this technology in a test device for the diagnosis of middle-ear infections.

The Fraunhofer Institute for Photonic Microsystems IPMS is a leading research and development center for micro-electromechanical systems (MEMS). Recent developments focus on exploiting the existing technological base to develop ultrasound components. The Fraunhofer IPMS approach here uses a special MEMS technology that is highly reproducible and reliable in manufacturing. Besides the technologically intrinsic capability of producing millions of identical units, it can also be used for integrating driver and evaluation electronics in one chip together with the ultrasound transducer, making for complex and reliable systems that can be manufactured in large quantities at lower cost. The components are manufactured to be RoHS-compliant in accordance with the European Parliament and Council Directive, and thus without the use of hazardous or toxic materials. They meet the requirements for Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).

Functionality of the CMUTs

The capacitors manufactured on silicon wafers use one of the electrodes as a spring and can therefore oscillate dynamically. The Fraunhofer IPMS technology allows the structures to be stimulated within a broad frequency range to generate ultrasound signals. These CMUTs (capacitive micromachined ultrasound transducers) can both generate and receive ultrasound signals.

Detecting middle-ear infections reliably

Fraunhofer IPMS cooperates with OtoNexus Medical Technologies in the field of ultrasound transducers. OtoNexus develops innovative medical devices for the fast and accurate provision of quantitative information to assist physicians in diagnosing middle ear infection (otitis media). By implementing a unique type of CMUTs, this new kind of probe can be used to examine the human auditory canal to analyze the area behind the eardrum within seconds. With that capability it can be determined whether the middle ear contains air or fluid and a differential diagnosis can be made between various disease conditions. This valuable information helps clinicians decide if a course of antibiotics is needed.

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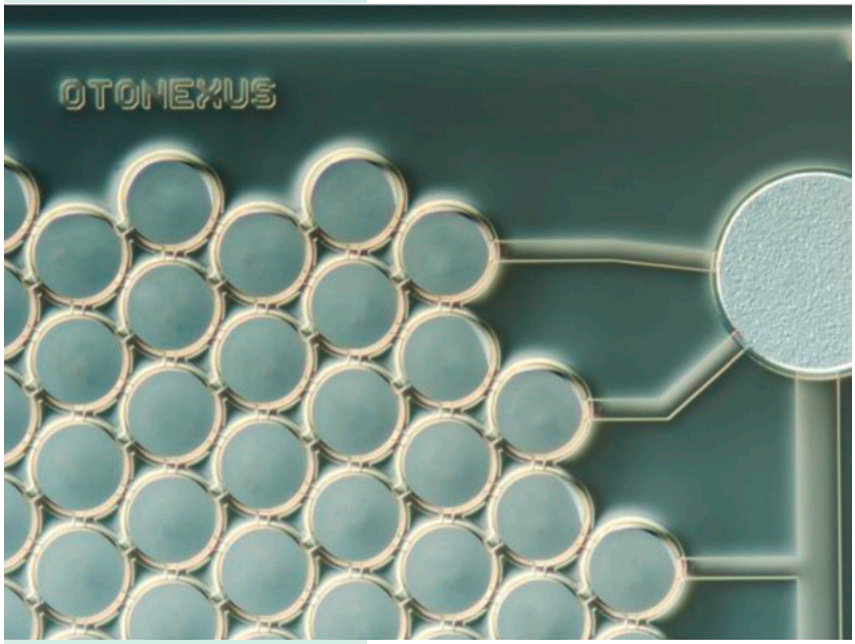


The unique CMUT device from Fraunhofer IPMS incorporates ultrasound into the innovative otoscope from OtoNexus Medical Technologies. © OtoNexus

Acoustic monitoring of machines and systems

Defective or incorrectly installed components in large machines and systems can lead to their failure. This makes final assembly inspection and quality monitoring during operation all the more important. Often the assembly personnel are entrusted with this testing task if they have good hearing and long experience. However, human hearing is rather subjective: it gets tired after a certain amount of time and ambient noise can have a negative effect. Fraunhofer IZFP has developed the "listening" sensor system "AcoustiX" as a more reliable alternative.

Errors or irregularities in the equipment cause characteristic vibrations. AcoustiX can capture and evaluate these sound patterns quickly, automatically, and reliably. Unlike conventional monitoring systems, AcoustiX does not require extensive adjustment or calibration.

Algorithms reliably detect faults

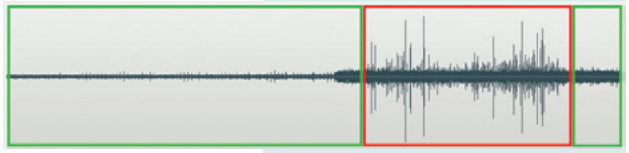
The sound data is constantly recorded with acoustic sensors or microphones and then analyzed and logged. Information about the functionality of the system is available within a few minutes. The medium-term aim of further development is exact fault localization and detailed determination of the type of fault. The underlying algorithms can be integrated into existing test systems and adjusted to satisfy customer requirements.

Industrial application

AcoustiX is already in use at John Deere for the permanent final assembly inspection of the cutting units of combine harvesters and is currently being transferred to other series applications. In the future, the system is intended to be used for monitoring autonomous large machines or evaluating the quality of assemblies on test benches.

Detailed view of the sound sensor.
© Fraunhofer IZFP / Uwe Bellhäuser

Signal evaluation reveals faults in the system.
© Fraunhofer IZFP / Uwe Bellhäuser



The sensor system inspects the rotating cutting unit of a combine harvester for defective vibrations by means of structure-borne sound sensors and microphones.
© Fraunhofer IZFP / Uwe Bellhäuser

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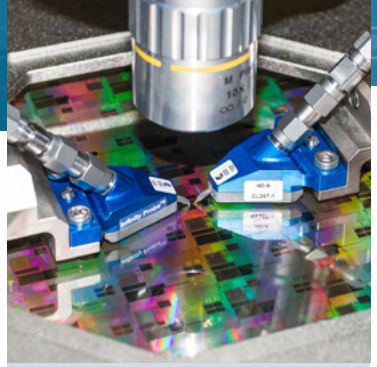

Characterization of a wafer with components in LF15A technology.
© LFoundry

Aging simulation for automotive product development

Reliable and durable electronics are essential for many applications. This is all the more true for safety-critical features such as in automobiles or industrial automation. If semiconductor manufacturers want to offer technologies for durable components in these application fields, they therefore need to demonstrate that individual transistors can perform their task perfectly under defined operating conditions even after a long time.

That is why the primary focus during the joint work of Fraunhofer IIS / EAS with semiconductor manufacturer LFoundry was on models for the 150 nm technology. These models are integrated into what are known as "process design kits" (PDK) to allow aging simulations. Using PDKs, customers are able to bring their own developments to the market more quickly on the basis of LFoundry technologies. What is more, the design flow with regard to the highest quality requirements of automotive product development will receive the best possible support. The researchers at Fraunhofer IIS / EAS primarily analyzed the effects of different wear-out mechanisms on components within the LFoundry technology.

The expanded PDK was made available in December 2018. Furthermore, together with Fraunhofer, additional optimizations of the proof of reliability are planned. For example, in the future even more precise simulation results will be obtained from advanced aging models so that the electronics can also be used more specifically in new application areas.

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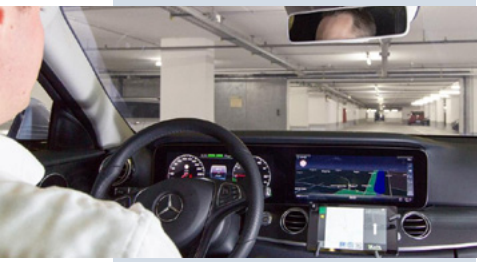
A laid-back drive to the autonomous parking garage



High degree of automation in the parking garage and on the way to it.
© Fraunhofer FOKUS

New services for networked, automated, and autonomous electromobility: the aim of the "iKoPA" project is to make autonomous driving and parking even better and more compliant with data protection requirements.

We're about to pull off: the driver gets into her networked electric car and uses a smartphone app to select a free charging spot in a parking garage at her destination. The car then receives information about available spots. During the journey, the car is already communicating with the traffic lights en route. Its speed is automatically adjusted to ensure that all intersections have a green light. This saves the time and energy that would be wasted by braking to a stop and pulling off again.

Once our driver arrives at the parking garage, the car communicates with the barrier at the entrance using vehicle-to-X communication. The pseudonymized ID authentication guarantees that data protection provisions are complied with. The barrier opens and the car is autonomously driven to the reserved space. Just before reaching the space, the vehicle communicates with the charging station to initiate charging. The driver can keep track of the charging progress at any time using her smartphone. If she needs her car, she can use a secure connection to tell it to meet her at the entrance to the parking garage.

One focus of the project is on securing users' privacy. Existing and newly developed communication concepts are being merged with mechanisms for pseudonymization. Integration of the traffic infrastructure allows for new and optimized driving, parking, and charging functions with a high degree of or even complete automation.

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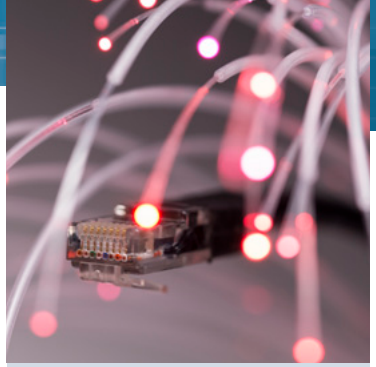
About "iKoPA"
iKoPA was funded by Germany's Federal Ministry of Education and Research (BMBF). The following partners were involved:

- Bayerische Medien Technik (bmt) GmbH
- Fraunhofer FOKUS
- Fraunhofer SIT
- Daimler Center for Automotive Information Technology Innovations (DCAITI) at TU Berlin
- University of Applied Sciences in Saarbrücken (htw saar)
- NXP Semiconductors Germany GmbH
- SWARCO Traffic Systems GmbH
- Unabhängiges Landeszentrum für Datenschutz Schleswig-Holstein (Independent State Center for Data Protection in Schleswig-Holstein) (ULD)



Even today, around every second bit transported through the Internet comes into contact with classic receiver technology developed at Fraunhofer HHI. © MEV Verlag

CiViQ brings quantum technologies to the telecommunications arena

Fast-growing technologies such as the Internet of Things, Virtual Reality, and other applications of Artificial Intelligence enable a new way of sharing information.
As a result, data generation, storage, and traffic are increasing exponentially. Much of this information, e.g., related to health, finance, or even security-related communication, is extremely sensitive and needs to be handled with protocols and procedures that ensure the highest degree of security. Since these procedures do not have sufficient protection against attacks by emerging quantum computers, additional quantum cryptography-based protocols are developed within the framework of the European CiViQ project. This adds an additional future-proof physical/hardware level to the existing overarching security protection architecture of the communication structures. Quantum Key Distribution (QKD) is already the most widely used among quantum cryptography protocols. The current aim is to make it more flexible and cost-effective, as well as to ensure that it can be easily integrated into existing telecommunication infrastructures.

CiViQ will also create new quantum cryptography systems and protocols to provide easily accessible services to private individuals, industry, and institutions. Fraunhofer HHI is part of the consortium of 21 partners and is developing a quantum cryptography receiver.

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Virtual operating room

In cooperation with partners from industry and research, Fraunhofer IIS has developed the surgical simulator HandsOn.surgery

HandsOn.surgery allows the surgeon to practice procedures that involve drilling into the bone. Using a haptic arm as an input device and looking at a 3D scene displayed on an auto-stereoscopic monitor (does not require glasses) the surgeon controls a virtual drill and operates on a 3D bone model extracted from real CT-data. The current focus lies on procedures from the Ear-Nose-Throat (ENT) domain. An important use case here is to drill into the temporal bone (behind the ear) and create an access to the hearing channel.

Surgical training simulators are especially useful to young surgeons in order to get a feel for the forces involved in the interaction of the drill with bone tissue. The system has been validated by a group of experienced ENT surgeons who tuned the underlying physical model until it felt like the "real thing". Risk structures such as nerves or blood vessels can optionally be overlaid on top of the 3D model. Additionally, the bone area removed by an expert surgeon can be made visible as a reference.

Force feedback, original sound recordings, and the autostereoscopic 3D monitor recreate the operation visually, haptically, and acoustically. An additional touchscreen is used to control the simulator, select among various drilling heads and simultaneously view where the drill's tip is currently located within the CT-data from three directions. Recently at MEDICA 2018, interested visitors were able to see the system's functionality for themselves, and experts evaluated the simulator as part of the 19th Erlangen Petrosal Course. The next chance to experience HandsOn.surgery will be at the German ENT-congress in Berlin in May.

HandsOn.surgery trainer: virtual bone with risk structures and surgical bur (top right); haptic arm for virtual milling (bottom right). © Fraunhofer IIS

About »HaptiVisT«
The product was developed as part of the HaptiVisT project, in which Fraunhofer IIS and the following partners are involved:
- szenaris GmbH (project coordinator)
- Clinic and Polyclinic for Ear, Nose, and Throat Medicine at the University of Leipzig Medical Center
- Clinic and Polyclinic for Trauma Surgery at the University Hospital Regensburg
- Ostbayerische Technische Hochschule Regensburg
- SeeFront GmbH
- Haption GmbH

The project is being funded by the German Federal Ministry of Education and Research (BMBF).

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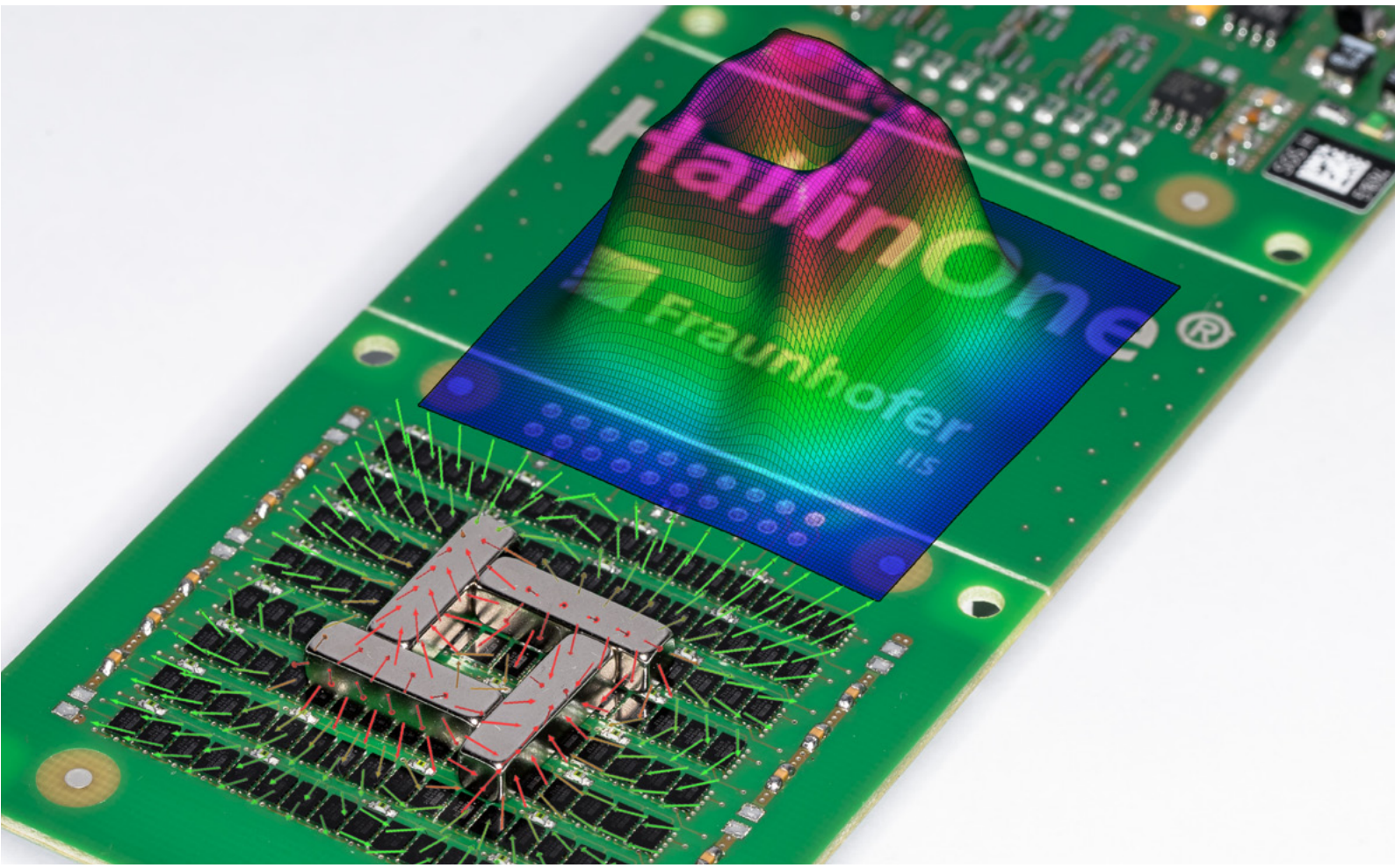

Our photo shows the HallinSight® technology from Fraunhofer IIS. 3D hall sensors are arranged in an array to form a 3D magnetic-field camera. This is used to measure the vectors of magnetic fields in real time at a recording speed of 200 fps. The camera's measuring resolution is 10 µT. The finest details within the magnetic field are made visible. This makes the camera suitable for applications such as quality assurance in the manufacture of magnetic systems, and for laboratory tests. © Fraunhofer IIS / Philip Beran

Editorial notes

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The Fraunhofer Group for Microelectronics, founded in 1996, combines the expertise of 16 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 …

… goes to Dr. Loreto Mateu from Fraunhofer IIS

Dr. Mateu, what do you find particularly fascinating about microelectronics?

Microelectronics is at the heart of complex electronic systems. Today, it provides the necessary integrated circuitry for IoT, Industry 4.0, and AI.

How would you explain your work to your grandmother?

In the Advanced Analog Circuits (AAC) group at the Fraunhofer Institute for Integrated Circuits IIS in Erlangen, we work on miniaturized analog circuits. These types of circuits enable, among other things, the sensor signals captured to arrive and be understood in the integrated circuit. With a digital thermometer, for example, the measured temperature (analog signal) is shown as a number on the digital display.

What project are you currently working on?

The AAC group is currently working on the USeP (Universal Sensor Platform) and OCEAN12 (Opportunity to Carry European Autonomous driviNg further with FDSOI technology up to 12 nm node) projects. Here, we use smaller technologies (22 nm and 12 nm FDSOI technology) to develop analog to digital converters and back-bias generators. Currently I am also preparing project proposals in the area of neuromorphic hardware with an analog deep learning accelerator.

Which of the projects being worked on by your colleagues in other Fraunhofer institutes interests you in particular?

I find the development of non-volatile memories with FeFETs for neuromorphic hardware at the Fraunhofer Institute for Photonic Microsystems IPMS in Dresden very interesting. I also find the memristive memories from the Fraunhofer Institute for Electronic Nanosystems ENAS in Chemnitz, which are also non-volatile memories, very exciting.

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

Antibiotics and vaccines have saved many lives and will continue to do so. Washing machines and dishwashers have also greatly simplified our lives.

Let's look into the future. What would you like to have achieved in five or ten years' time, either in your career or your personal life?

After eleven years, I still find it exciting to work at Fraunhofer IIS, and I want it to stay that way. In the future, I would like to work on a few projects connected to neuromorphic hardware.

If you could meet someone well known – from either the past or present – who would it be and why?

I would love to meet Marie Curie. I consider her a role model for female scientists. She won Nobel Prizes for both chemistry and physics, which I find very impressive.

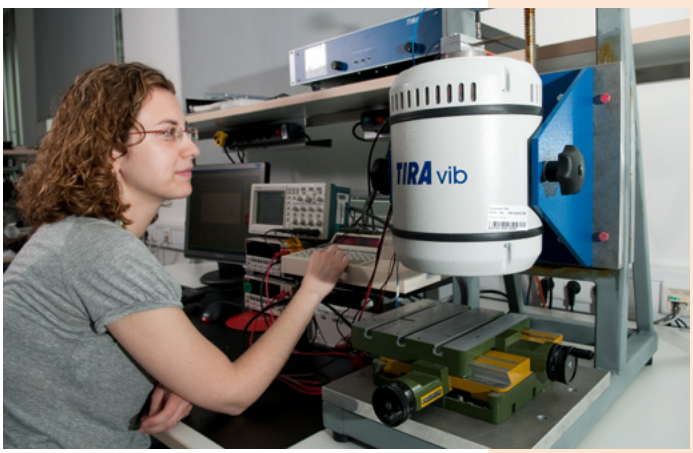
What song belongs to the "soundtrack" of your life?

There are a lot, such as "Devuélveme la vida" by Malú and Antonio Orozco, "It's My Life" by Bon Jovi, "Summer of '69" by Bryan Adams, "Solamente Tú" by Pablo Alborán, and "My Hometown" by Bruce Springsteen.

Last, but not least: Can you tell us what motto you live by?

"Never put off till tomorrow what you can do today."

Dr. Mateu worked in the Localization and Networking department of Fraunhofer IIS until 2018. She now dedicates her time to the institute's AAC group. © Fraunhofer IIS / Rida El Ali



Dr. Loreto Mateu.
© Fraunhofer IIS / Paul Pulkert

About Dr. Loreto Mateu

Dr. Loreto Mateu obtained her bachelor's degree in industrial engineering at the Universitat Autònoma de Barcelona in 1999. Until 2002, she was working on her master's in electrical engineering at the Universitat Politècnica de Catalunya in Spain. In 2009, she completed her thesis on "Energy Harvesting from Human Passive Power." She has worked at Fraunhofer IIS since 2007, first as a research associate and then – since 2012 – as a lead scientist in the Power-optimized Systems department. She has been group head of Advanced Analog Circuits in the Integrated Circuits and Systems department since 2018. Her interests are power management and the electrical modeling of electromechanical actuators and neuromorphic hardware.

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