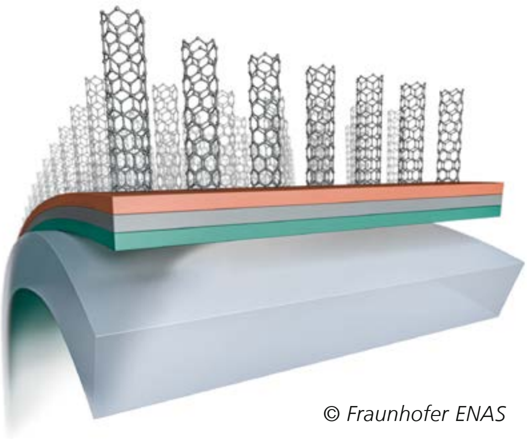
Microelectronics News

November 2019 76

Fraunhofer MIKROELEKTRONIK

Title

New CNT integration method



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Fraunhofer ENAS has developed a modular method that overcomes previous hurdles in integrating carbon nanotubes (CNTs). This modular technological concept allows a nano-layer system to be established before merging with the final substrate. »» page 4

Together with partners from industry and research, Fraunhofer IZM is optimizing the service life and maintenance requirements of offshore wind turbines. © Fotolia *» page 8*

From the institutes

Technologies based on a human model

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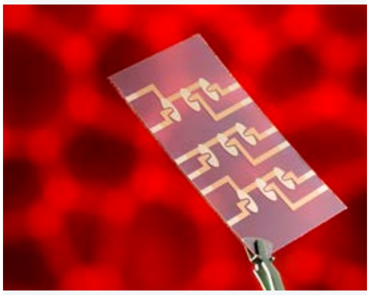

Multi-electrode layout for automated electroanalytical investigation of cell cultures.
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The last word …

… today goes to Dr. Joachim Pelka from the Fraunhofer Group for Microelectronics

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Content:

Events

Date	Event / WWW	Location	Group institutes involved
11/05/2019	Workshop: Machine Learning for 5G and Beyond – The influence of machine intelligence on future networks www.ai4comm.org	Berlin, Germany	HHI
11/05/2019 – 11/07/2019	Microtech Innovation Summit www.microtechinnovationsummit.com	San Jose, California	IPMS
11/07/2019 – 11/08/2019	10th FOKUS FUSECO Forum www.fokus.fraunhofer.de/ngni/events/fuseco_forum_2019	Berlin, Germany	FOKUS
11/10/2019 – 11/16/2019	AGRI TECHNICA www.agritechnica.com	Hannover, Germany	ENAS
11/11/2019	Workshop: Automotive Packaging Reliability Requirements www.emft.fraunhofer.de/en/about-us/events/automotive-packaging-reliability-requirements.html	Munich, Germany	EMFT
11/12/2019 – 11/15/2019	SEMICON Europa 2019 www.semiconeuropa.org	Munich, Germany	ENAS, IZM-ASSID
11/12/2019 – 11/15/2019	productronica www.productronica.com/index.html	Munich, Germany	Group institutes
11/14/2019	EDA-Workshop »Radar Signatures & EM Benchmarks« 2019 www.fhr.fraunhofer.de/en/events/eda-workshop-radar-signatures-and-em-benchmarks.html	Brussels, Belgium	FHR
11/18/2019 – 11/21/2019	COMPAMED www.compamed.de	Düsseldorf, Germany	EMFT, ENAS
11/21/2019 – 11/22/2019	Conferece: FUTURAS IN RES www.fraunhofer.de/en/events/whats-the-iq-of-ai.html	Berlin, Germany	Group institutes
11/26/2019 – 11/28/2019	SPS IPC Drives 2019 https://sps.mesago.com/events/de.html	Nürnberg, Germany	Group institutes
12/04/2019 – 12/06/2019	Photonix www.photonix-expo.jp/en-gb.html	Tokyo, Japan	IPMS
12/10/2019 – 12/11/2019	Hands-On-Workshop: Deep Learning and Computer Vision www.iis.fraunhofer.de/de/ff/sse/ai_services/workshop_deep_learning.html	Erlangen, Germany	IIS
01/07/2020	CES 2020 www.ces.tech/About-CES.aspx	Las Vegas, Nevada	HHI
02/05/2020 – 02/07/2020	SPIE Photonics West www.spie.org/conferences-and-exhibitions/photonics-west	San Francisco, California	IPMS

Visions and new paradigms for microelectronics – that was the theme of the workshop held jointly by the FMD and CEA-Leti as part of SEMICON West in San Francisco. © Fraunhofer Mikroelektronik

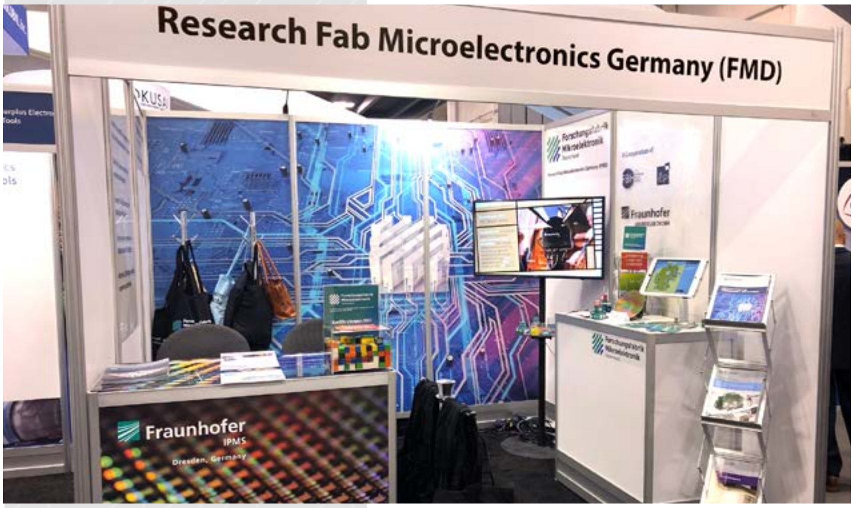
Forschungsfabrik Mikroelektronik Deutschland

Hardware and technologies made in Europe

New visions for microelectronics – as part of SEMICON West, and together with the French research institute CEA-Leti, FMD organized a workshop entitled New Paradigms in Microelectronics – Providing R&D for the 21st Century. From quantum technology to neuromorphic computing and microelectronic devices for the next generation, the focus of the event was on the development of hardware and technologies for next-generation computing.

Joint workshop with CEA-Leti at SEMICON WEST

Whether it's in our cars, in medical engineering, or in consumer electronics, artificial intelligence (AI) already supports our daily lives. Microelectronic devices and systems are the



In addition to the workshop with CEA-Leti, the FMD had the opportunity to showcase its R&D expertise at the SEMICON West trade fair. © Fraunhofer Mikroelektronik

basis of smart applications. The current challenges include performance, security, and energy efficiency of the devices. The solutions to these challenges are the work of scientists at CEA-Leti in Grenoble, France, and the member institutes of the Research Fab Microelectronics Germany (FMD). Experts from both organizations used short keynote lectures to present their work in this area. More than 150 participants from industry and research came together to discuss these topics. In addition to the workshop, the FMD was able to showcase its R&D expertise with a booth at the SEMICON West trade fair in San Francisco.

European alliance for next-generation computing

"We need strong European research and industry in microelectronics in order to meet the coming technological challenges." With these words, Laith Altimime, director of the SEMI Europe association, opened the joint workshop. The workshop took place under the auspices of the Next-Generation Computing Alliance of the three European R&D organizations CEA-Leti, Fraunhofer Group for Microelectronics with the FMD, and Belgium's imec. The aim of the alliance is the joint development of the necessary hardware technologies for AI applications. You can see some more impressions of our appearance at SEMICON West and our joint workshop with CEA-Leti in our video:

Quotes from the workshop:

"We are big and strong together."
Emmanuel Sabonnadière,
Director of CEA-Leti

"We offer sustainable solutions – transparent and trustworthy hardware."
Patrick Bressler, Managing Director of the Fraunhofer Group for Microelectronics

"As an example the FMD offers industrial contract research until pilot fabrication and technology transfer to realize future MEMS-based LiDAR systems."
Jörg Amelung,
Managing Director of the FMD

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New CNT integration method

Fraunhofer ENAS has developed a modular method that overcomes previous hurdles in integrating carbon nanotubes (CNTs).

CNTs are a promising functional material in both nanoelectronics and sensoring. Integrating layers with vertically aligned CNTs can considerably improve the performance of energy storage systems and systems for heat management. Moreover, those layers are considered as a major element of various new sensor concepts in the field of tactile, gas or IR sensing. Widespread industrial use, however, has so far not come to fruition due to integration hurdles like the high process temperature, problems with contacting, and limited compatibility with overall system technology.

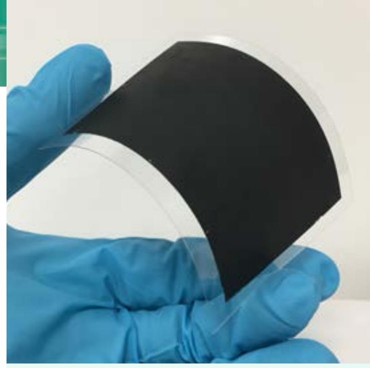
Methods without high-temperature processes

A new method gets around these challenges. A modular approach is taken in which the CNTs are first synthesized on a temporary substrate and are then transferred to the application substrate. To this end, various joining methods such as reactive joining, soldering, or gluing were developed and investigated.

This technology also opens up innovative integration scenarios: in contrast to printing processes and conventional synthesis processes, the CNTs are directly linked to a metallic layer on top of the CNT forest during synthesis – the ideal prerequisites for thermal and electrical interconnection. The self-forming CNT/metal heterostructure on the surface of the layers enables a broad spectrum of microtechnological follow-up processes for layer deposition, structuring, and lithography. In addition to supplemental contact forming processes, complex functional layer stacks of metals and insulators can also be set up before they are transferred to the target substrate.

Potential uses

For demonstration purposes, plastic films were equipped with vertical CNTs including contact metal on the basis of which a flexible supercapacitor was set up. For the future, integrated energy storage modules – which would be of assistance with system-on-a-chip concepts – seem conceivable. The high degree of mechanical flexibility makes numerous applications in flexible electronics and sensoring a possibility. The modular method means that integrated nanostructures can achieve previously impossible performance levels. The development processes will also be considerably truncated, making them cheaper.



PET film with transferred CNT layer including contact metal.
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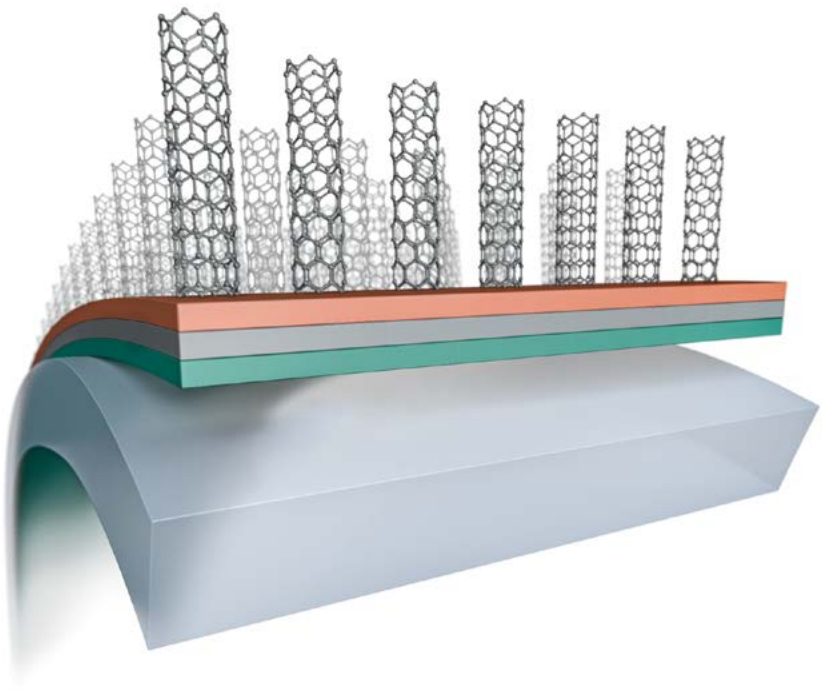

This modular technological concept allows a nano-layer system to be established before merging with the final substrate.
© Fraunhofer ENAS

Quantum cascade laser with emission wavelengths in the mid-infrared range and high scanning frequency of up to 1 kHz. © Fraunhofer IAF

Fingerprint spectroscopy with varied use

Fraunhofer IAF in Freiburg has developed a measurement system that enables the contactless identification of various substances in real time. It is perfect for use in the pharmaceutical, chemical, and food industries.

For pharmaceutical and food production, a continuous control of ingredients is indispensable. Previously, this would have been done via chromatography or infrared spectrometers. The measuring system developed at Fraunhofer IAF identifies substances based on their molecular composition within a few milliseconds, thus enabling quality control in real time.

Measuring procedure

The core of the system is a quantum cascade laser (QCL). The measurement principle is based on wavelength-selective illumination of the substance in the mid-infrared (IR) range. The intensity of the diffusely backscattered light as a function of the illumination wavelength allows to record absorption spectra of the substance. This is known as a spectral fingerprint, which is characteristic for the respective chemical substance. The measured spectral fingerprint is compared with a database containing a large number of spectra of chemical substances, thus enabling unambiguous identification.

The quantum cascade lasers provide an extremely broad spectral scan range and tuning speed combined with compact size. This is achieved by integrating the QCL in an external resonator that scans the entire spectral range of the QC laser chip in just 1 ms and records a thousand complete IR spectra per second.

Potential uses

The measuring system allows not only for contactless identification of a wide range of chemical and pharmaceutical substances in real time. It can also be used to continuously monitor chemical reaction processes. This means that previous complex measuring procedures in the laboratory can be replaced by inline real-time measurements during the ongoing production process.

In addition to the pharmaceutical, chemical, and food industries, quantum cascade lasers can be used in pollutant testing, medical diagnostics, and in the security and safety sector. Additionally, the compact design of the laser modules allows for the development of mobile, and even handheld, measuring systems.

Demonstrator of the measuring system for contactless identification of various chemical substances in real time. © Fraunhofer IAF

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Technologies based on a human model

In the Human Brain Project, 121 partners from twenty countries in Europe and North America have come together in twelve sub-projects. They are researching technologies based on natural models. Their common goal is to create a shared European scientific infrastructure for brain research, cognitive neurosciences, and other sciences inspired by the human brain.

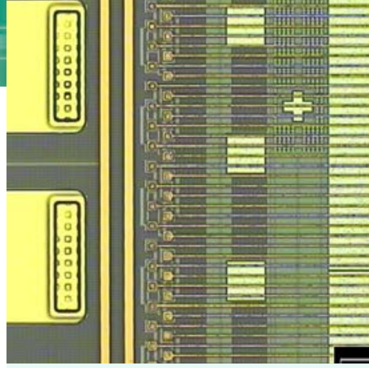
The researchers are working on various platforms for such tasks as brain simulation, neuromorphic computing, medical information, and neurorobotics. A new category of computer hardware will be developed inspired by the circuits of the brain. The end vision is to create the most advanced, brain-inspired hardware to accelerate their work and, e.g., simulate learning processes in real time.

From wafer to board technology

As part of the overall project, the Fraunhofer Institute for Reliability and Microintegration IZM is designing hardware in accordance with the BrainScaleS system of the Kirchhoff Institute for Physics at the University of Heidelberg. This system comprises very fast, energy-efficient analog chips that simulate the physical processes happening in the brain. Wafer-to-system connections are made based on a new embedding technology. In the lamination process, 200 mm silicon semiconductor wafers with a thickness of 250 µm – a stack of printed circuit boards consisting of FR4 frames, two prepreg layers, and two copper foils – are built. Lamination takes place using a heated vacuum high-pressure lamination press.

Establishment of a neuromorphic computing platform

Since the start of the project, the researchers have already marked some important first milestones, including the first active PCB system with an embedded active wafer. Fraunhofer IZM is acting as a technology partner. The Berlin site provides the necessary know-how to link highly complex wafer-level integration strategies synergistically with PCB embedding using its unique skills. The wafer experts are currently optimizing the lamination process and are developing a procedure for avoiding water drift. The next challenge will be to establish a complete neuromorphic computing platform. Half of the funding (€200 million) for the Human Brain Project is coming from the EU. The other half is from EU member states and private sources. The project, which was launched in October 2013, is divided into several phases. The current phase will run until March 2020. Subsequent phases are currently under discussion.



Fraunhofer IZM is working on neuromorphic computing as part of the Human Brain Project. Here: high-density chip-to-chip interconnections. © Fraunhofer IZM

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Artificial intelligence for microelectronics and sensors

Researchers at Fraunhofer IMS have developed artificial intelligence (AI) for microcontrollers and sensors that comprises a fully configurable artificial neural network – a platform-independent machine learning library with which self-learning microelectronics can be realized.

Application fields of AIfES:
- Human/technology interaction
- Smart home
- Industry 4.0
- Metrology
- Medical engineering

Microcontrollers are built into almost every technical device – from washing machines to blood pressure monitors to wearables. So far, software solutions for machine learning have only been available for PCs, and use Python as programming language. There is not yet a solution that enables the execution and training of neural networks even on embedded systems such as microcontrollers.

Machine learning on embedded systems

In AIfES (Artificial Intelligence for Embedded Systems), the Fraunhofer Institute for Microelectronic Circuits and Systems IMS has implemented the vision of a sensor-related AI. This AI is directly integrated into a sensor system. Therefore, training can be undergone straight on the embedded system. In this way, for example, an implanted sensor can calibrate itself. AIfES is a platform-independent and constantly growing machine learning library that is based on the C programming language and exclusively uses standard libraries based on the GNU Compiler Collection (GCC). AIfES already contains a fully configurable artificial neural network (ANN), with a feedforward structure, which can create deep networks for deep learning processes if required. The Fraunhofer IMS team has reduced the source code to a minimum, allowing the ANN to be trained on a microcontroller, too. In addition, the source code is universally valid so that it can be used on other platforms such as PC, Raspberry PI, or Android.

Protecting and reducing data

Independent of more powerful external computers or cloud solutions, AIfES is able to learn on its own. This means that no sensitive data leave the system and data protection can be guaranteed. In order to also reduce the amount of data, only very small neural networks are set up for each task. In addition, AIfES allows the computing power to be decentralized by small embedded systems adopting the data before processing and then making the results available to a higher-level system. This considerably reduces the amount of data to be transferred.

Recognizing and monitoring gestures

The near-sensor AI from Fraunhofer IMS supports handwriting and gesture recognition. If the library is running on a wearable, for example, the input can be controlled by gesture. This makes the integration of AIfES in a wide variety of applications a possibility: for example, a wristband with integrated gesture recognition could be used to control the lighting in a building. Not only gesture recognition is possible; the system can even monitor how well a gesture was executed. In the rehabilitation or fitness sectors, exercises and sequences of motion could be evaluated even if no trainer is present. Since no camera or cloud is used, privacy remains protected.

AIfES demonstrator for handwriting recognition: the numbers are drawn by hand on this touchpad and then recognized and output by AIfES on the microcontroller.
© Fraunhofer IMS

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Robust power electronics for offshore wind farms

Together with partners from industry and research, Fraunhofer IZM is optimizing the service life and maintenance requirements of offshore wind turbines.

In the context of the green energy revolution, offshore wind turbines play a major role due to their high wind yield. However, harsh environmental conditions such as wind, water, and heat reduce service life and increase maintenance requirements. Maintenance work has thus far been associated with high costs and dangers and can only be carried out in the summer months. Delivery of spare parts is also complicated and expensive. The aim of the AMWind and KorSikA projects is therefore to reduce repair and maintenance costs significantly and extend the service life of the wind turbines.

Condition monitoring with AMWind

The AMWind (Autonomous Monitoring of Wind Turbines) project is developing driver boards for continuous and reliable condition monitoring of power electronic components. The approx. 8 × 8 cm² boards are manufactured individually for each power module, and hardware developed by the Fraunhofer Institute for Reliability and Microintegration IZM evaluates the electrical parameters measured at microsecond intervals, providing information about the exact component temperature.

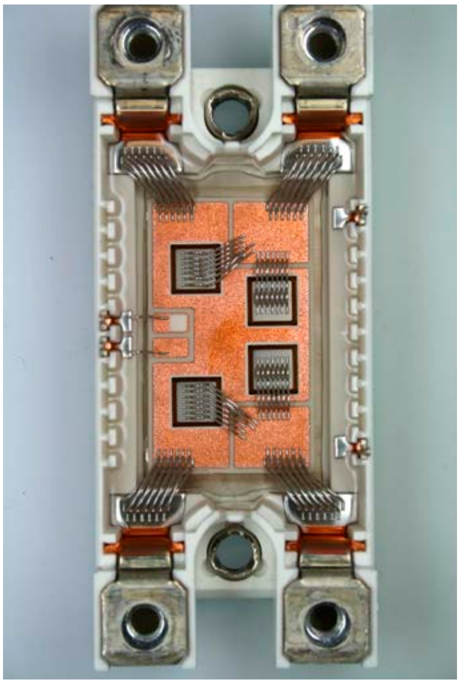
An integrated micro-controller transmits this data directly to the wind farm operator, allowing maintenance work to be planned in good time and efficiently, as well as meaning that measurements can be taken from further distances and in harsh environments, including in the winter months.

Stress tests in KorSikA

In the learning project KorSikA (from the German abbreviation for "corrosion-resistant sintered connection technology for applications at risk of corrosion"), material behavior and the corrosion properties and sensitivity of silver-sintered connections were tested under extreme environmental conditions. The sinter technology had previously been shown in various test processes to be more reliable than the soldered layers previously used. Near-industrially manufactured sintered layers and modules were subjected to the expected temperature fluctuations and humidity loads in the laboratory for a realistic service life of 40 years. The parameters in question were simulated under field-like conditions within a few weeks. The components were then tested for vulnerabilities, thus including the entire value creation chain in the test process.

The analysis produced mission profiles that describe fault mechanisms in detail and that can thus forecast corrosion processes exactly and, in turn, significantly increase the service life of the wind turbines.

Fraunhofer IZM is contributing its expertise in accelerated service life testing, special test methods, material analysis, and condition monitoring to these projects.



The KorSikA project investigated how the use of sinter technology affects the corrosion resistance of wind turbines.
© Fraunhofer IZM / Volker Mai

Offshore wind parks are a key energy source of the future. © Fotolia

About the projects
AMWind is being driven by the following companies and facilities:

- Fraunhofer Institute for Reliability and Microintegration IZM
- Siemens AG
- Infineon Technologies AG
- Technical University of Berlin
- WindMW GmbH
- M&P Gruppe

The project runs from November 2016 to January 2020.

The following partners were involved in KorSikA:
- Fraunhofer Institute for Reliability and Microintegration IZM
- Dr. O.K. Wack Chemie GmbH
- Danfoss Silicon Power GmbH
- Siemens AG
- SEMIKRON Elektronik GmbH & Co KG
- Heraeus Deutschland GmbH & Co. KG
- Forschungs- und Entwicklungszentrum Fachhochschule Kiel GmbH

The project was completed in April 2019 after running for three years.

Both projects were funded by Germany's Federal Ministry of Education and Research (BMBF).

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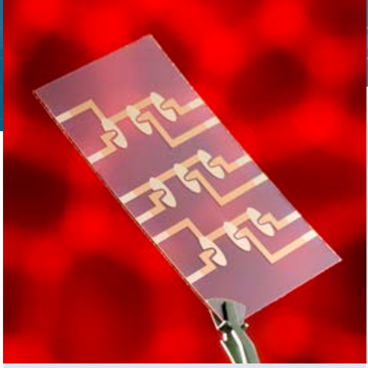

Multi-electrode layout for automated electroanalytical investigation of cell cultures.
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New approach in the fight against viruses

Fraunhofer is involved in a project researching a new method for testing the efficacy of vaccines, combining electrochemical sensors with biotechnology. Currently, these tests are typically carried out in the laboratory on cultured cells using expensive and labor-intensive staining methods. First the blood serum of a previously vaccinated person is injected into the cell culture; then the test cells are exposed to a virus load. If the vaccination was successful, the serum contains sufficient neutralizing antibodies against the viruses and infection remains without consequences. This serves as proof of the efficacy of a vaccine. Only then may the vaccine be deployed in physicians' practices.

The staining method used thus far limits the number of tests that can be carried out. Scientists at the Fraunhofer IBMT and Fraunhofer EMFT together with the companies nanoAnalytics GmbH and innoMe GmbH are working on getting around this restriction. In the new method, the cell cultures are placed on multi-electrode arrays. These allow a state of infection to be detected completely automatically and thus more cost-effectively, using electrochemical measuring methods. Additionally, the cells can also be monitored continuously over a longer period, making information about the development of the cell reaction available over time, which could previously not be mapped.

The research consortium is working on bringing to market a complete system comprising a measuring device, analysis software, and electrode arrays made of printable electrode materials. The German Federal Ministry of Education and Research (BMBF) is funding the ViroSens project under the KMUinnovativ funding guideline to the tune of around €2 million.

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Extension building at Fraunhofer IISB opened

At the beginning of July 2019, a new extension building was inaugurated at Fraunhofer IISB in Erlangen. Numerous guests from government, business, and science attended the opening ceremony. The event included laboratory tours and the subsequent symposium entitled »Energiesysteme neu denken« (Rethinking Energy Systems).

Bavaria's Minister for Economic Affairs, Hubert Aiwanger, and the acting director of Fraunhofer IISB, Prof. Martin März, at the signpost directing visitors through the energy research facilities at Fraunhofer IISB in Erlangen.
© Kurt Fuchs / Fraunhofer IISB

Together with extensive outdoor facilities, almost 3,000 m² of usable space were created for offices and laboratory facilities. The extension now offers enough space for the more than 300 employees of the institute. In addition, the building works as a "living" demonstration and test platform for the innovative energy systems developed at Fraunhofer IISB and the efficient coupling of regenerative power generators, electrical and chemical storage systems, and consumers. Comprehensive energy monitoring, the inclusion of weather data, and the use of artificial intelligence allow optimum operation of the institute's overall infrastructure. A large medium-voltage test bay in the extension building allows the examination of specimens with power of up to 20 MVA and a voltage of up to 30 kV. With a specially developed modular multi-level converter, it is also possible to simulate grid anomalies and failure conditions at a predefined point in time.

Financing to the tune of around €15 million was largely covered by the Bavarian Ministry of Economic Affairs, Regional Development and Energy and the German Federal Ministry of Education and Research (BMBF).

European research cooperation: low-power chips for mobile AI applications

Increasingly, artificial intelligence and machine-learning algorithms are entering our day-to-day applications. At the moment, high-end server farms process the data in the cloud. However, sending data to the cloud costs energy, latency, and is often not preferred for privacy reasons. As such, artificial intelligence applications require energy-efficient local processing.

With the EU's TEMPO project (Technology & hardware for nEuromorphic coMPuting), 19 partners from industry and research are working on developing low-power chips. The chips use new storage technologies for neuromorphic computing and enable applications to run on battery-powered mobile devices instead of cloud-based server racks. The intention is to set up a European AI hardware platform using these technologies. The project will leverage MRAM (imec), FeRAM (Fraunhofer), and RRAM (CEA-Leti) memory to implement both pulsed neural networks and deep neural network accelerators for eight different use cases, ranging from consumer goods to mobility and medical applications.
TEMPO was launched on April 1, 2019, and has a duration of three years. From the Fraunhofer Group for Microelectronics, the Fraunhofer institutes EMFT, IIS, and IPMS are involved. The project is being financed by the ECSEL (Electronic Components and Systems for European Leadership) joint undertaking.

In the EU's TEMPO project, Fraunhofer EMFT, Fraunhofer IIS, and Fraunhofer IPMS are working on developing process technology and hardware platforms for future applications in the field of neuromorphic computing. © imec

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ProSiebenSat.1 invests in Fraunhofer start-up

In its Positioning & Networks division, Fraunhofer IIS develops wireless communications, positioning, and identification technologies for connected digital applications. Holodeck VR, a start-up whose technology has its roots in Fraunhofer IIS, has attracted a new investor in ProSiebenSat.1. The technology enables larger groups of people – wearing special headsets – to have VR experiences in spaces of up to 40,000 m².

The benefits of Holodeck VR's technology include free, wireless movement, coverage of large spaces, reliable and precise positioning in virtual reality, real-time simulation of real scenarios, and interaction between users and the digital world. Virtual reality lets visitors experience theme parks, festivals, or public spaces such as shopping centers from a completely new perspective. Once the technology is installed in a large enough empty room, several thousand visitors can take part in this kind of virtual reality experience per day and installation. Thanks to the partnership with ProSiebenSat.1, the start-up will now benefit from additional sales opportunities and new sales channels for placing its technology in theme and activity parks.

Thanks to Holodeck VR, virtual reality can be experienced together and in large spaces. Holodeck VR GmbH now does business under the new brand name SPREE Interactive. © Kurt Fuchs / Fraunhofer IIS

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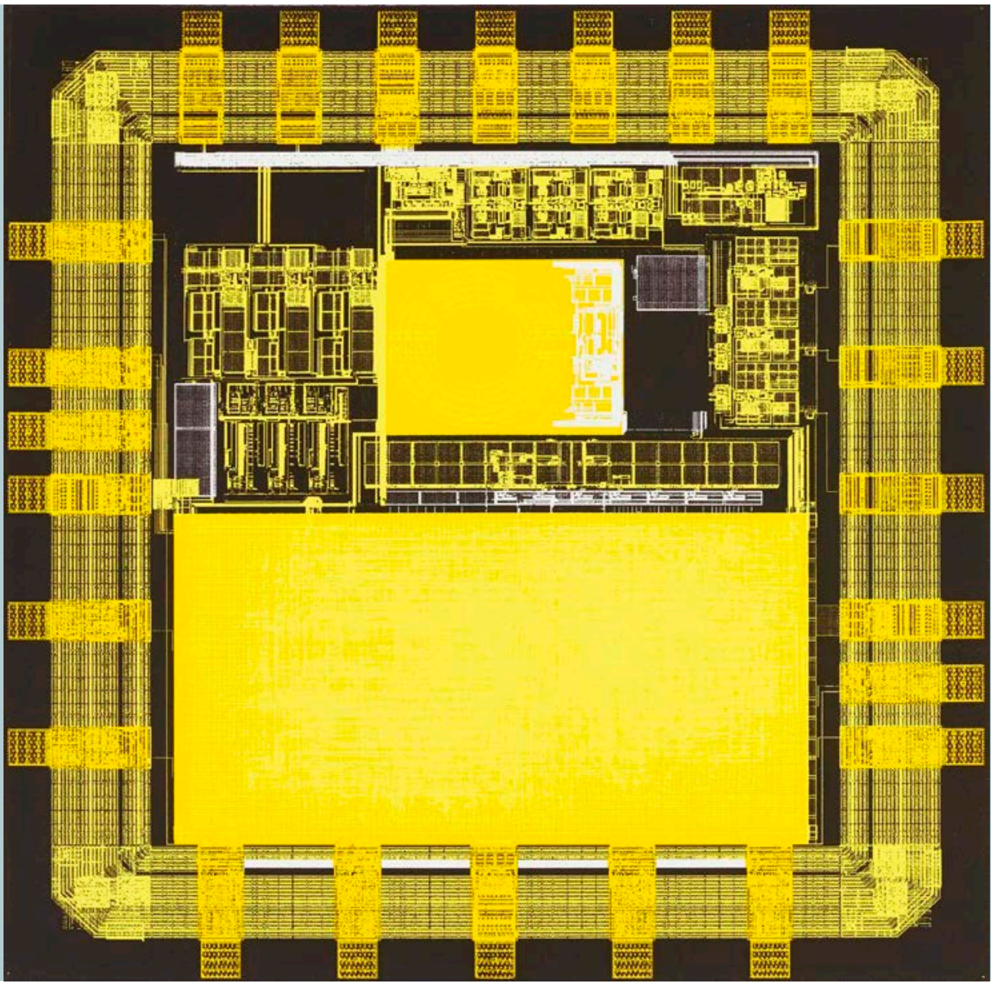

Our photo was taken in collaboration between Fraunhofer IIS and the artist Fred Ziegler. It shows the chip of an ultra-low-power wake-up receiver. The receiver allows for continuous monitoring of a radio channel at power consumption in the microwatt range and can react in milliseconds. For his Poetry of Circuits exhibition, Ziegler has created various print graphics from circuit layouts produced by Fraunhofer IIS. The exhibition can be viewed until the end of 2019 at Fraunhofer IIS in Tennenlohe, district of Erlangen. © Paul Pulkert

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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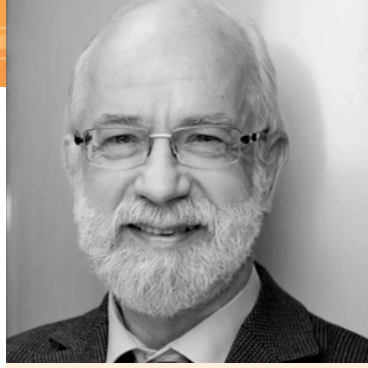

Dr. Joachim Pelka
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… today goes to Dr. Joachim Pelka from the Fraunhofer Group for Microelectronics

After a total of 36 years at Fraunhofer, including 23 years at the business office of the Group for Microelectronics, Dr. Joachim Pelka has now retired.

Dr. Pelka, you were employed at Fraunhofer for 36 years. What do you take with you from this time for your future?

As a lone warrior, you are more or less fighting a losing battle – only in a team can you be successful, especially in today's highly complex world. During my time at Fraunhofer, I was lucky enough to be always part of well-functioning teams. Together we have somehow coped with (almost) all the challenges and problems that have come up.

What memories do you have of your first day at Fraunhofer?

Pretty frustrating ones: after having had a quiet two-person office at university, I suddenly had to share an office with three frequent phone users! The first tasks were also completely different from those presented in the interview, as someone else had been hired in the meantime. But my colleagues were nice.

Which project of your professional career do you attach the greatest importance to?

The highlight of my career was undoubtedly the establishment of the Research Fab Microelectronics Germany (FMD). This was the direct result of a strategic process lasting several years, which I was able to play a key role in shaping.

Looking back, what was the biggest challenge?

It was precisely this strategic process. For the first time, this process succeeded in turning the coexistence of "lone warriors" in the Group for Microelectronics into a coordinated cooperation, a team. And it really wasn't an easy labor. The process teetered on the edge of failure several times. But our success, in the form of the FMD, shows that we mustn't have done everything wrong.

How will you spend your retirement and what do you look forward to the most?

To having time for family; to being able to travel, but not having to, and finally being able to pursue my hobbies again – sailing, model boat sailing, model building, and photography.

If you could change one thing in the world, what would that be?

Definitely ending the narrow-mindedness of humanity when it comes to dealing with each other. I have many friends and acquaintances from all over the world and I don't understand why so many people want to smash each other's skulls in all the time (and often do) just because they don't come from the same place.

If you were able to meet a famous person, alive or dead: who would it be and why?

I would like the chance to go sailing with Jochen Schümann (Olympic sailing champion and two-time America's Cup winner) and to learn from him.

Last but not least, the microelectronics team thanks you for a great cooperation and wishes you all the best for the future. Now you literally have space for a "last word."

With Next Generation Computing (NGC), a new and exciting theme that has been my companion for almost two years is now getting going in the Group for Microelectronics and the FMD. This is intended to raise the FMD to a European level together with the partner institutions imec from Belgium and Leti from France. I wish my successor, Dr. Patrick Bressler, and the team at the Group and FMD business offices a Midas touch and much success in the ongoing preparation and forging of the European NGC Alliance. I will certainly follow what happens next with interest.

About Joachim Pelka:
Born in Berlin in 1954. Married, 2 children. Studied electrical engineering with a focus on semiconductor technology at the TU Berlin. Doctorate on high-barrier pn junctions at the Institute of Materials in Electrical Engineering. After completing his doctorate, he started working for the Fraunhofer-Gesellschaft, first at what is now Fraunhofer ISIT in the fields of dry etching and process simulation, and later at the JESSI coordination office. Then he moved to Fraunhofer IZM and joined the Group for Microelectronics, first as assistant to the chairman, then as managing director. In the middle of 2018, management was handed over to his successor Dr. Patrick Bressler. Since then, Dr. Joachim Pelka has been a senior advisor and a special representative for strategic tasks.

After retirement, Dr. Pelka will devote more time to his hobbies, including photography.
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