

Annual Report 2021 Compact

Greetings

Dear Readers,

Corona dominated events again this year with high infection rates in the spring, a hopeful summer and a massive return of the pandemic in the autumn. ISIT has been able to adapt well to this situation and therefore had a very successful year despite all adversities.

In 2021, we were able to prove not only that we are working on socially important issues, but also that our researchers are achieving outstanding results.



Prof. Dr. rer. NAT. habil. Axel Müller-Groeling

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Editorial



Hugo Geiger Prize of the Free State of Bavaria

In March, ISIT scientist Dr. Simon Fichtner was awarded the Hugo Geiger Prize for his outstanding doctoral achievements in the field of applied research.

Fichtner wrote his dissertation at Kiel University (CAU) in recent years – in close connection with projects of Fraunhofer ISIT. In his doctoral thesis, he made an astonishing discovery: the piezoelectric material AlScN has ferroelectric properties. Ferroelectric components can give semiconductor elements an enormous performance boost, e.g. in the field of next-generation computing. Accordingly, the interest of international experts is great. Fraunhofer ISIT has already received industrial orders for AlScN components worth around four million euros. The Federal Ministry of Education and Research is supporting follow-up research with 2.3 million euros. The U.S. research agency DARPA has also called for the creation of further projects for research into AlScN.

Fraunhofer Prize

The highlight from a scientific point of view for ISIT was the awarding of the Fraunhofer Prize 2021 to ISIT scientists Martin Witt and Michael Kampmann as well as to Dr. Jacqueline Atanelov, scientist from IMS Nanofabrication. On the way to ever smaller and more powerful microchips, the team has been able to push the limits achieved so far. The award was presented by the President of the Fraunhofer-Gesellschaft, Prof. Reimund Neugebauer, for the development of a complex microsystem chip, which forms the heart of an electron multi-beam mask recorder. With this mask recorder, the complex structures of current and future highly miniaturized microchips can be generated in high quality and resolution within a few hours: this makes the novel mask recorder unrivalled so far. The demand on the market is correspondingly high. Currently, IMS generates \$400 million in annual revenue from the devices. This is also noticeable at Fraunhofer ISIT: Industrial sales clearly exceed one million euros per year. The award-winning technology not only enables further miniaturization, but also goes hand in hand with outstanding economic success.



25 years of Fraunhofer ISIT

ISIT was officially inaugurated in March 1996 and celebrated its 25th anniversary in 2021; certainly a reason to celebrate, but difficult to implement in Corona times. Larger festive events during the pandemic were out of the question. Nevertheless, we have launched two special projects on the occasion of the birthday.

Lumen & Colours

On the initiative of our colleague Katja Reiter, ISIT participated in the art project Lumen & Colours of the KulturBahnhof, Itzehoe. The ISIT colleagues were called upon to submit photos for this project: 200 images from the fields of research, cleanroom and microscopy were collected, all of them small works of art.

On 5 November, the time had come: More than 200 visitors found their way to the outskirts of the city to watch this special event in the open air. The images were projected onto the huge façade of our cleanroom building by a mega projector with a tremendous light output. The impression of the pictures was astonishing, because the building façade with its wafer structure is already a work of art in its own right, and the optical fusion with the images created a completely new, interesting aesthetic.



The ISIT Birthday Dance Challenge: The Researchers Dance

The second birthday highlight was our Dance Challenge. Under the direction of dance teacher Nikolas Plett, about 30 colleagues rehearsed a dance to the music Iko Iko. For four weeks, there were practice sessions almost every day at lunchtime. Filming took place in September at various locations and, of course, with matching accessories: silicon wafers were used as well as protective suits for the cleanroom. With the video, we wanted to show that there is not only excellent research at the institute, but also fun to work with.

Within the campaign period of four weeks, we achieved video views and page views in dimensions that we had not been able to achieve with our research topics before. The Dance Challenge was not only a birthday fun, but also the most effective marketing measure we have ever initiated for the ISIT.

Editorial

New ISIT Working Group on Electronic Energy Systems at Kiel University

In order to promote such topics related to the energy transition, we have significantly strengthened our cooperation with Kiel University (CAU) and founded a joint working group on »Electronic Energy Systems«. Based at the Faculty of Engineering at Kiel University, the research group will receive a total of five million euros in funding in the first phase – half from the Fraunhofer-Gesellschaft and half from the state of Schleswig-Holstein. In doing so, we are pursuing very ambitious goals: After three years, the working group should already be largely standing on its own two feet. In the future, a sub-institute of the Fraunhofer-Gesellschaft is to be created from the working group at the site of the Faculty of Engineering. The research group »Electronic Energy Systems« is headed by Professor Marco Liserre. With three initial thematic modules - »Future-oriented power grids«, »intelligent storage technologies for electromobility« and »Semiconductors - reliable and durable« - we will advance energy transition research in Schleswig-Holstein in the working group.



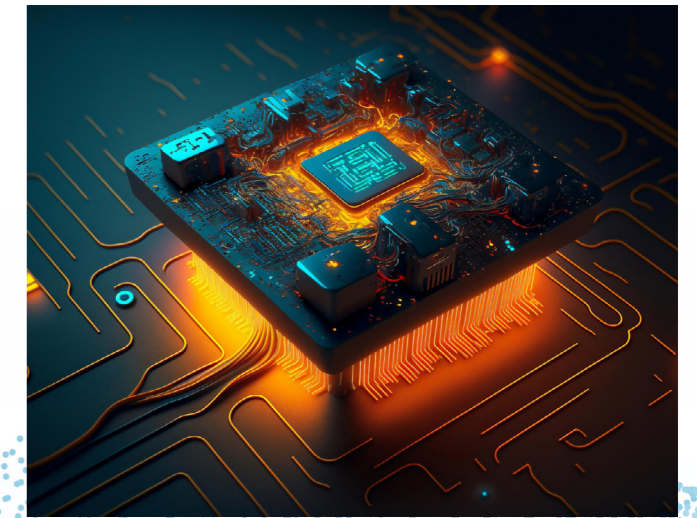
FAB-SH

The second major effort is the establishment of the Research Center for Applied Battery Technology Schleswig-Holstein (FAB-SH). The research center will be built in a former logistics building in the immediate vicinity of Fraunhofer ISIT. On 3400 m² of laboratory and office space, around 2023 employees and 30 students will be involved in the development of battery storage systems for maritime, stationary and medical technology applications as well as new production technologies for battery storage systems from 20. With unique, innovative technologies of ISIT, such as the dry coating of electrodes as well as other separator and cell technologies, we can develop, for example, high-performance cells and high-temperature accumulators whose performance is at the peak of current cell generations. Thus, Schleswig-Holstein is finally moving into the premier league of battery research with the Itzehoe site.



Honouring the best trainees

However, it was not only our experienced scientists who demonstrated their capabilities, but also young professionals who were able to score points. Artem Kormann was honoured by Deputy Prime Minister Monika Heinold as Germany's best apprentice. We are very proud of our exemplary microtechnologist with distinction.



Expansion of future topics

In 2021, ISIT made great efforts to ensure that the institute continues to be a competent partner for future topics. This year, a special focus was placed on reliable drive technologies and energy storage systems for electromobility.

Conclusion 2021

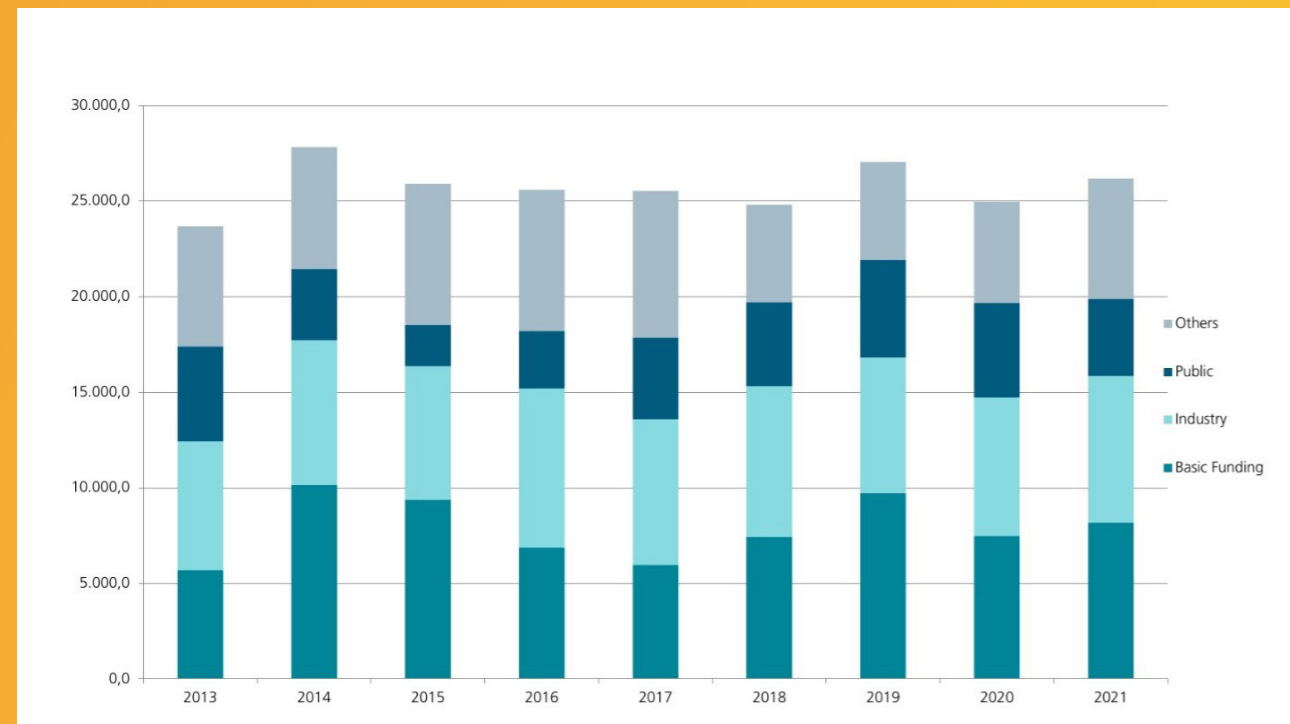
A review of the year 2021 shows that ISIT is on the right track. The organizational realignment in terms of strategy, controlling, operations and human resources is showing clear success, both economically and scientifically. We can look to the future with confidence, especially since the topics that ISIT deals with are of great topicality, especially now in Germany. Our strategic partner Vishay is starting the construction of a large 300 mm cleanroom in Itzehoe, a large battery cell factory of Northvolt with about 3000 employees is to be built in Heide and (a little further away) Intel is building a gigantic chip factory in Magdeburg. Something is happening in the north and that opens up a wide range of opportunities for us. We are well prepared to use them.

Finance, Human Resources, Organisation

Representative figures

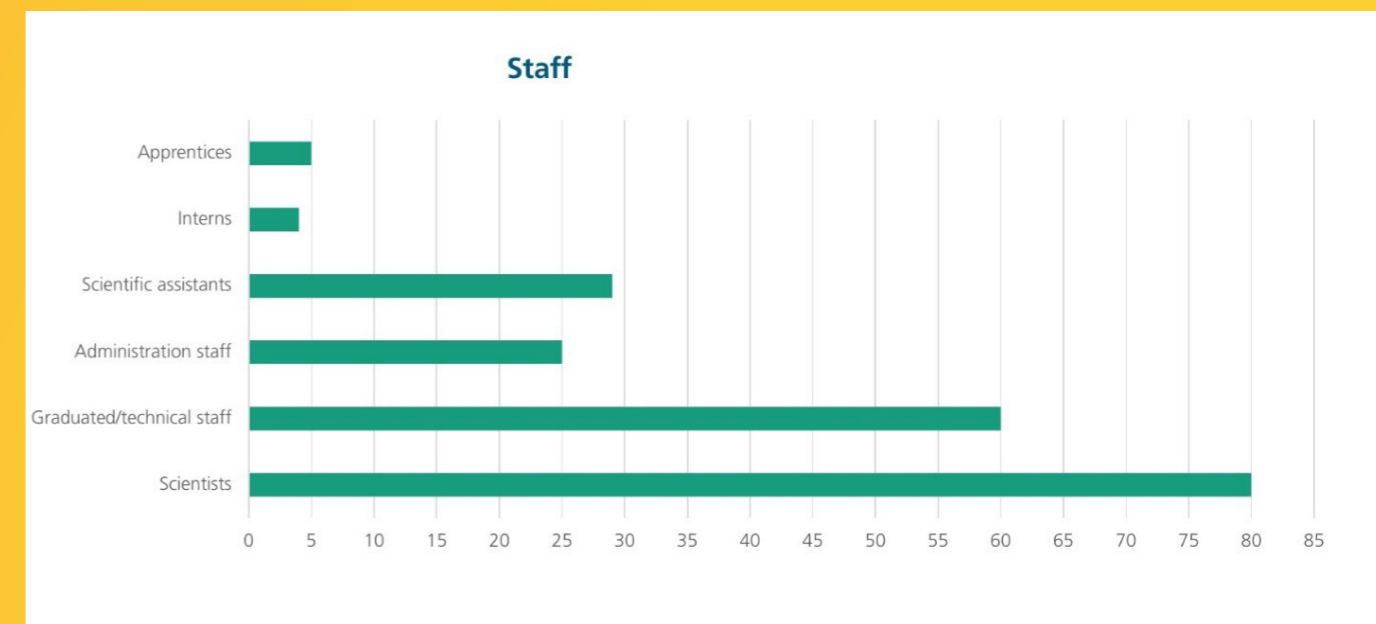
REVENUES OF FRAUNHOFER ISIT FROM 2013 TO 2021

The 2021 budget was financed by project revenues from industry/business associations/small and medium-sized enterprises in the amount of €7.674 thousand, from the federal government/project sponsors/states in the amount of €4.029 thousand and from others in the amount of €6.294 thousand. In addition, there were FhG projects and basic funding with 8.177 thousand €.

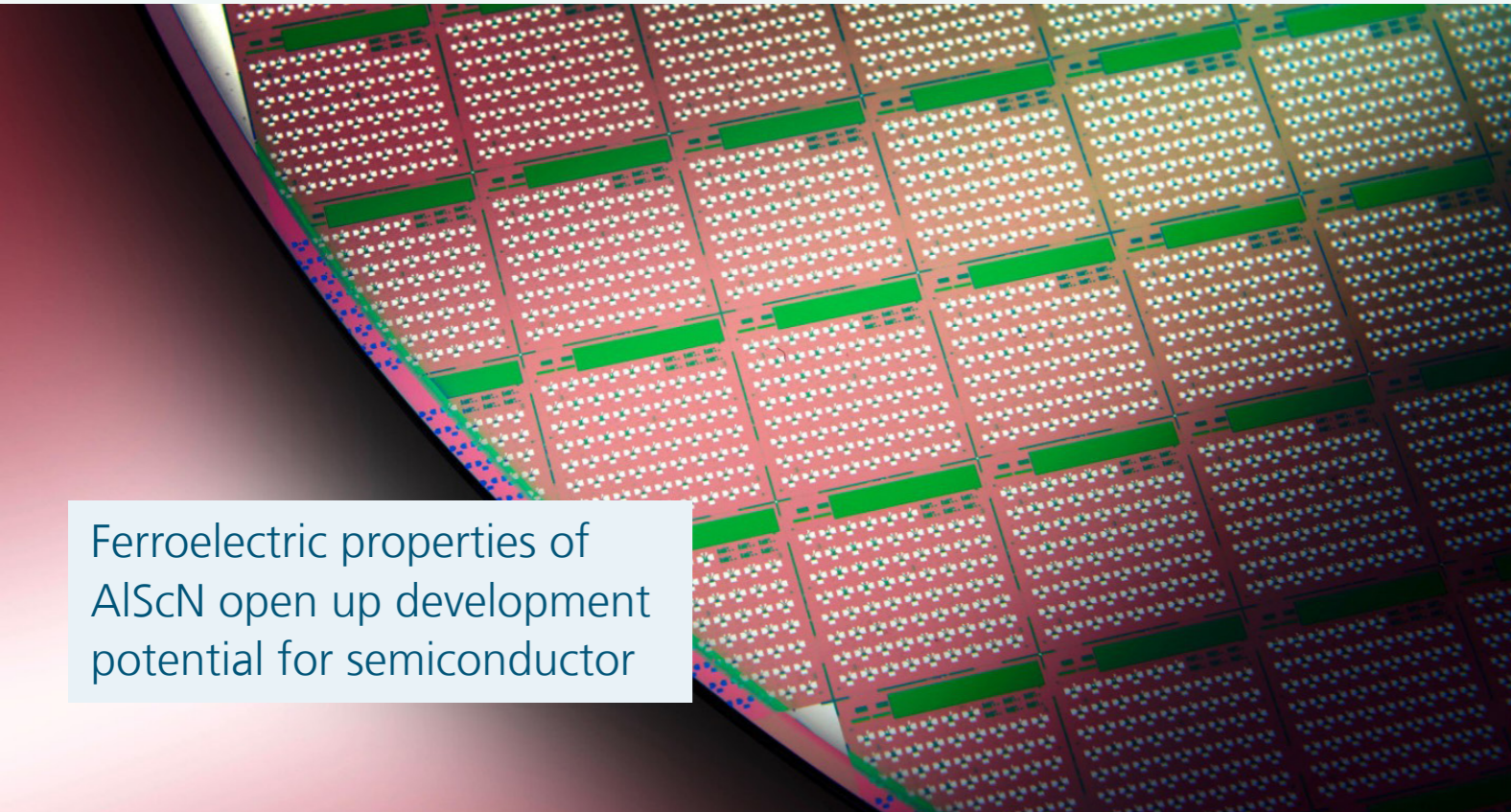


STAFF DEVELOPMENT

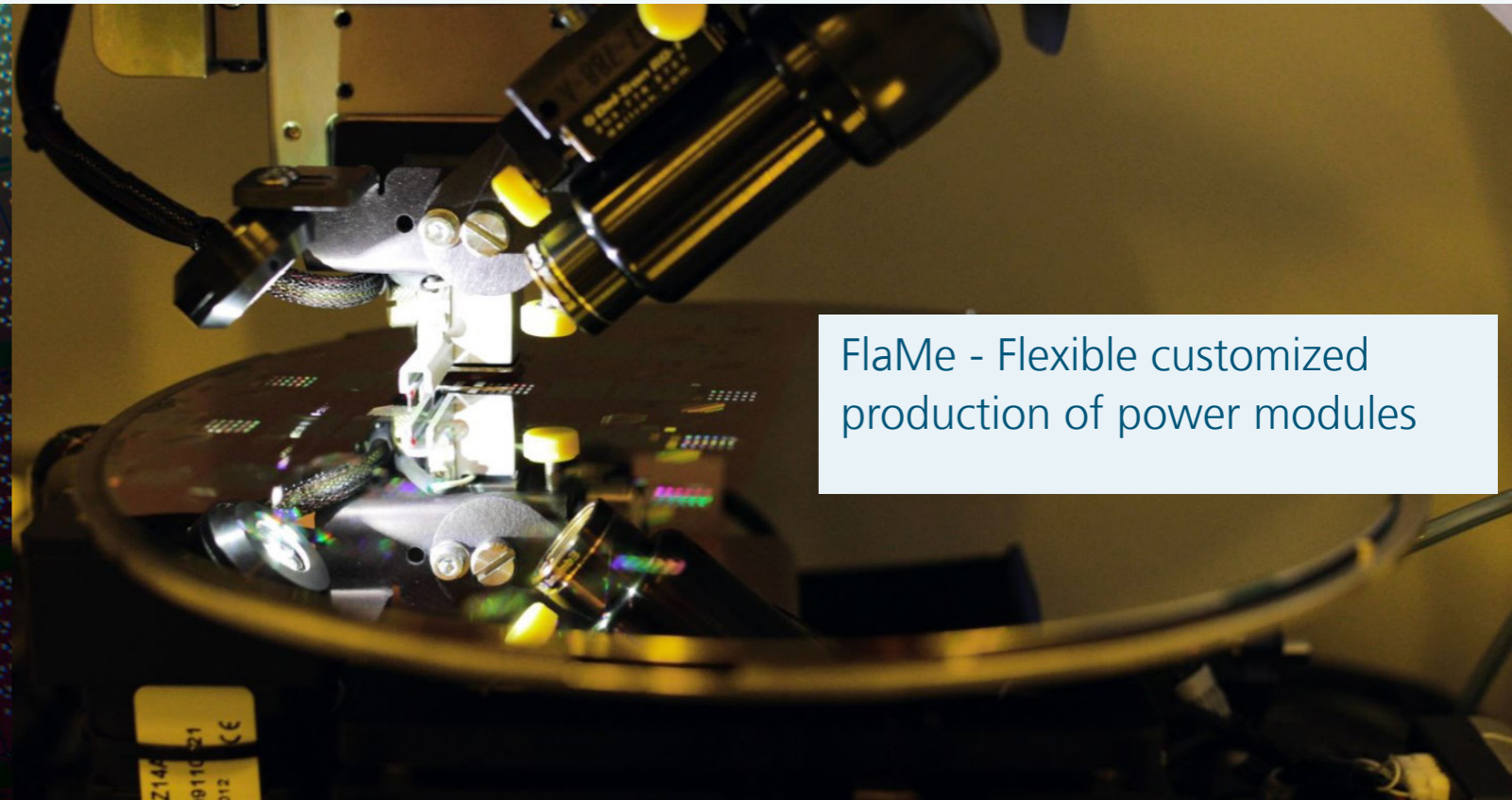
At the end of 2021, the staff consisted of 165 employees. 80 worked as scientific staff, 60 as graduate/technical staff and 25 in organization and administration. The employees were supported by 29 research assistants, 4 interns and 5 trainees.



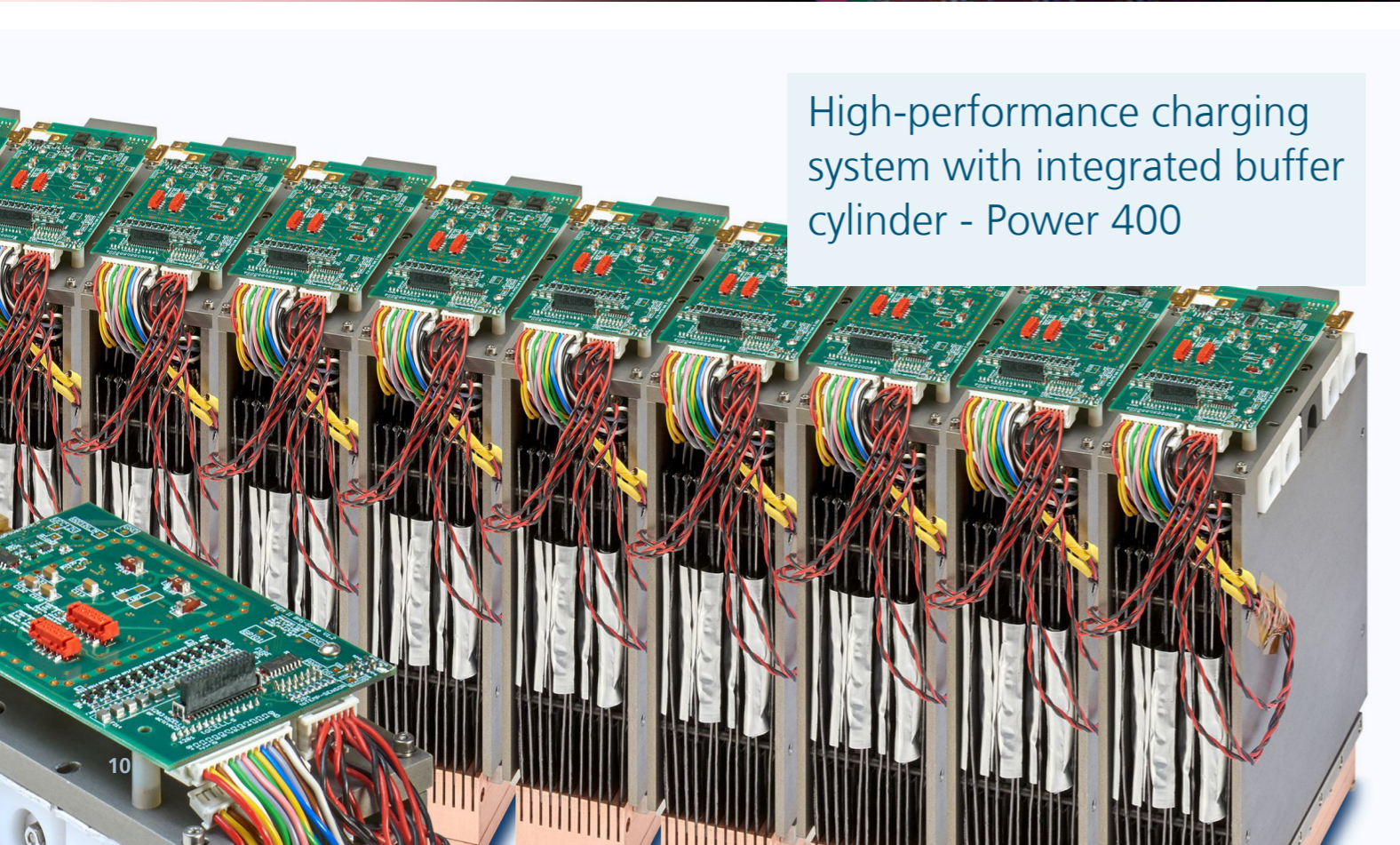
Flagship projects 2022



Ferroelectric properties of AlScN open up development potential for semiconductor



FlaMe - Flexible customized production of power modules



High-performance charging system with integrated buffer cylinder - Power 400



Electron multi-beam mask recorders for the next generation of chips

Important figures and events

Events

Webinars

- *Design, Development, and Control of Induction Motor Drive with Inverter Output LC Filter*
ISIT Webinar, March 17, 2021
- *Digital cleanroom: Virtual cleanroom tour from Fraunhofer ISIT*
ISIT Webinar, March 24, 2021
- *CMP & WET Users Group Meeting 2021*
ISIT Webinar, April 15-16, 2021
- *digital cleanroom: Virtual cleanroom tour from Fraunhofer ISIT*
ISIT Webinar, March 28, 2021
- *News from Electronics Corrosion Research - Increase the Effectiveness of Corrosion Control!*
ISIT Webinar, June 29, 2021
- *Micromechanical Ultrasound for SMEs - From Technology to Application*
ISIT Webinar, July 1, 2021
- *Battery Technologies for E-Mobility and Smart Grids*
ISIT Webinar, September 8, 2021
- *Industry Workshop »Battery Usage Concepts«*
ISIT Webinar, September 28, 2021

Face-to-face events

- *ISIT scientist Dr. Simon Fichtner awarded Hugo Geiger Prize*
17 February 2022, Itzehoe
- *Fraunhofer Prize 2021 for ISIT scientists Martin Witt, Michael Kampmann and Dr. Jacqueline Atanelov, IMS nanofabrication*
14. September 2022, Itzehoe
- *ISIT presentation at Bürgerfest: »75 Years of the State of Schleswig-Holstein«*
29. September 2022, Itzehoe
- *Lumen + Colours: Faces of a City - Interactive Design Together*
5 – 6 November 2021, ISIT, Itzehoe
- *ScienceMatch - FutureEnergies*
1 December 2021, Sparkassenarena, Kiel

Tradefairs

Tradefairs and exhibition

- *SPIE 2021*
Photonics West Exhibition, 06.–08. März 2021, Online
- *Vocatium 2021*
Fachmesse für Ausbildung+Studium, 04. Mai und 27. Mai 2021, Online
- *AzubIZ 2021*
Regionale Ausbildungsmesse, 24. September 2021, Itzehoe
- *MikroSystemTechnik Congress 2021*
Mikroelektronik, Mikrosystemtechnik und ihre Anwendungen, 08.-10. November 2021, Ludwigsburg
- *PIC - Photonic Integrated Circuits 2021*
Internationale Konferenz, 09.–11. November 2021, Brüssel, Belgien
- *Firmenkontakttag, Fachhochschule Kiel*
Norddeutschlands größte von Studierenden organisierte Jobmesse, 10. November 2021, online
- *Compamed 2021*
Schmelztiegel für High-Tech Lösungen in der Medizintechnik, 15.–18. November 2021, Düsseldorf

Teaching

Teaching assignments at universities and colleges

- *S. Gu-Stoppel*
Microtechnology and Microsystems Design, West Coast University of Applied Sciences, Heide
- *H. Kapels*
Professorship of Semiconductor Devices in Power Electronics, Faculty of Engineering, Kiel University
- *F. Lofink*
Materials of Microsystems Technology, Micro- and Nanosystem Technology, Semiconductor Technology, Faculty of Engineering, Kiel University
- *A. Müller-Groeling*
Professorship Microsystems and Technology Transfer, Faculty of Engineering, Kiel University
- *O. Schwarzelbach*
Microelectromechanical Systems (MEMS), Institute of Electrical Metrology and Signal Processing, Graz University of Technology, Austria

2021

- *U. Hofmann, M. Weiss*
Deflection device for a scanner with Lissajous scanning
DE 102011104556 B4
- *N. Laske, H.-J. Quenzer, V. Stenchly, A. Kulkarni, A. V. Schulz-Walsemann*
Process for the production of lens elements of enclosed, radiation-sensitive devices at wafer level, EP 3609688 B1
- *T. Lisec, F. Lofink*
Method for the production of a counter-rotating magnetized magnet structure
DE 102019210177 B4
- *A Ebbberg, U. Hofmann, W. Schernus, F. Senger Antenna Device*
CN ZL201710946166.6
- *T. Lisec, S. Chemnitz, B. Wagner*
Apparatus having a multitude of particles and method for manufacturing the same
IS 11,040,325 B2
- *T. Lisec, S. Chemnitz, B. Wagner*
Device with a plurality of particles, and method for producing same
CN ZL201680034082.9 JP
- *U. Hofmann, J. Jane's*
Micromechanical Resonator Arrangement
DE 102012222988 B4
- *F. Stoppel, B. Wagner*
Micromechanical piezoelectric actuators for implementing large forces and deflections
MY-187297-A
- *T. Lisec, H.-J. Quenzer*
Thermally insulated microsystem
US 11, 137, 364 B2
- *U. Hofmann, H. J. Quenzer, T. Lisec, T. v. Wantoch*
Converters for the production of secondary light from a primary light, lamps containing such converters and methods for the manufacture of converters and illuminants
CN ZL201680074539.9

Prizes

Awards

- *Artem Kormann*
Award of the Schleswig-Holstein Chamber of Industry and Commerce as Germany's best graduate of training as a microtechnologist 2021
November 18, 2021, Büdelsdorf
- *Simon Fichtner*
Hugo Geiger Prize 2021 for outstanding doctoral achievements in the field of applied research, Ferroelectric Material for Next Generation Computing
March 24, 2021, Munich
- *Michael Kampmann*
Fraunhofer Prize 2021 for Outstanding Scientific Achievements MEMS chip for an electron multi-beam mask recorder of EUV semiconductor production
May 5, 2021, Berlin, Itzehoe
- *Martin Witt*
Fraunhofer Prize 2021 for Outstanding Scientific Achievements MEMS chip for an electron multi-beam mask recorder of EUV semiconductor production
5 May 2021, Berlin, Itzehoe

Patents

Supplements 2020

- *Z. Yu, K. Hoffmann, H. Kapels*
Gleichspannungswandler
EP 3028377 B1
- *T. Lisec, F. Lofink*
Method of producing a magnetic structure
US 10,854, 223 B2
- *W. Reinert, H.J. Quenzer*
Method of producing a cap substrate, and packaged radiation-emitting device
CN ZL201480073332.0

Scientific Publications

Selected publications

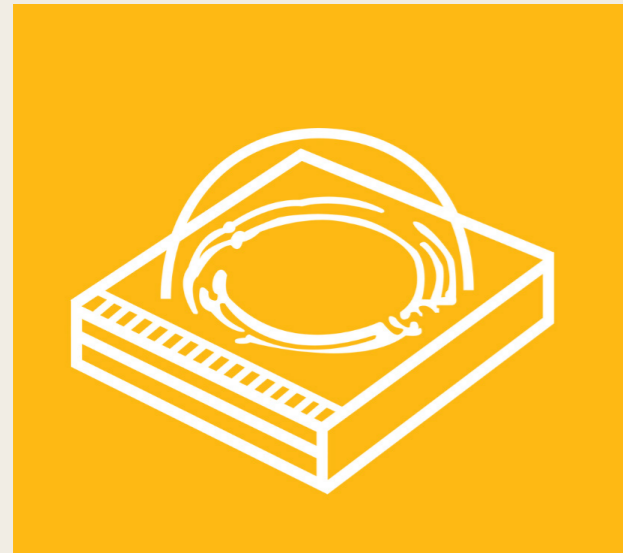
- **O. Behrmann, T. Lisek, G. Piechotta and B. Gojdka**
A microfluidic Porous Solid Phase Suitable for Mass Production. MikroSystemTechnik Congress 2021; pp. 1-4
- **T. Dankwort, E. Yasar, S. Gruenzig, B. Gojdka, S. Fichtner and F. Lofink**
Enhancing the Performance of Piezoelectric Energy Harvesters by Integrating AlScN Piezoelectric ThinFilm, MikroSystemTechnik Kongress 2021; pp. 1-3
- **T. Dankwort**
Performance of Magnetically Driven MEMS Piezoelectric Energy Harvester and its Application as a Transducer for a Near Zero-Power Wake-up. MikroSystemTechnik Congress 2021; pp. 1-4
- **B. Gojdka**
Magnetically Excited Piezoelectric Energy Harvester for Micropower Supply and Wakeup Applications. 21st International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers), 2021, pp. 455-458, doi: 10.1109/Transducers50396.2021.9495625
- **T. Knieling, S. Gu-Stoppel, J. Albers, N. Laske, F. Senger & L. Wen**
Fiber-based Frequency Modulated LiDAR with MEMS Scanning Capability for Long-range Sensing in Automotive Applications. IEEE MetroAutomotive 2021, July 7, 2021
- **C. Kostman**
Automated Filling of Dry Micron-Sized Particles into Micro Mold Pattern within Planar Substrates for the Fabrication of Powder-Based 3D Microstructures. Micromachines Volume 12, Issue 10, October 2021 Article number 1176, doi: 10.3390/mi12101176
- **J. Lähn**
Assembly of the smallest components in the SMD process. All electronics, March 2021
- **H. Schimanski**
: Advanced fault analysis as the basis for reliable electronics or how do I achieve increased reliability through improved delivery quality and manufacturing processes? Productronic 10/2021

Selected Lectures

- **L. Bertels**
REMOTE AUDIT | Basics and recommendations. Fraunhofer QM Network Meeting, April 22, 2021, online
- **H. Schimanski**
Safe Processing of Bottom Termination Components using the Example of 01005 Diodes - From Recommended Pad Design to Reliably Soldered Component IZM Working Group »System Reliability of AVT«, February 17. 2021, online
- **H. Schimanski**
Detection of Sources of Error in μ BGAs - Investigation of Causes of Errors and Strategies for Process Optimization. Technology Days PCB & Assembly 2021 08-09 June 2021, Würzburg (online), Vogel Verlag
- **H. Schimanski**
Low Temperature Soldering Application Study - SnBiX compared to SAC solder paste. Low Temperature Soldering Conference - LTS 2021, June 16, 2021, Global SMT and Packaging (online) Hans-Juergen Funke, Technical Director, Package Competence, Nexperia (Speaker) Helge Schimanski, Micro-Manufacturing Processes, Fraunhofer Institute for Silicon Technology (co-author)
- **H. Schimanski**
Investigation of the effect of ionic impurities in thin slits on realistic setups with new miniaturized devices. News from Electronics Corrosion Research, 29 June 2021 (online), GfKORR – Society for Corrosion Protection e.V.
- **H. Schimanski**
Production-ready PCB design - or - Can the developer positively influence the PCB reliability of electronic assemblies? 29th FED Conference, Bamberg, September 16-17, 2021

Master's\Bachelor's Theses

- **Minhaz Ahmed**
Characterization Of A MEMS-based Broadband Multi-modal Energy Harvester As A Near Zero Power Wake-up Device. Master's thesis, Furtwangen University, 31.7.2021
- **Syed muqurrab ali zaidi**
electrolyte optimization of li-ion batteries for porous silicon anodes. Master's thesis, Kiel University, 14.10.2021
- **Indrajeet Bajarang Jadhav**
Design and Simulation of the Termination Structure for Super-Junction Power MOSFETs. Master's thesis, Coburg University of Applied Sciences, 13.09.2021
- **Alexander Barnbrock**
Safe Current Measurement in SIR Tests at High Voltages Bachelor Thesis, Electrical Engineering and Information Technology University of Applied Sciences West Coast, Supervisor Prof. Ing. Hans-Dieter Schütte, Sebastian Puls, 10.2.2021
- **Timo Rieß**
Production and structural characterization of aluminum-scandium-nitride on epi-Pt/GaN. Master's thesis, Kiel University, 14.06.2021
- **Lisa-Marie Riggers**
Development of an employer brand for Fraunhofer ISIT – a qualitative analysis using the example of students of STEM degree programs. Bachelor Thesis, West Coast University of Applied Sciences, July 2021
- **Simon Karl Eduard Rindelaub**
Development of a tool for temperature tomography of a Li-ion pouch cell. Master's thesis, HAW Hamburg, 01.02.2021
- **Marec Timmermann**
Characterization of MEMS micromirrors for quasi-static operation and development of control electronics. Master's thesis, HAW, 06.10.2021



MEMS Application

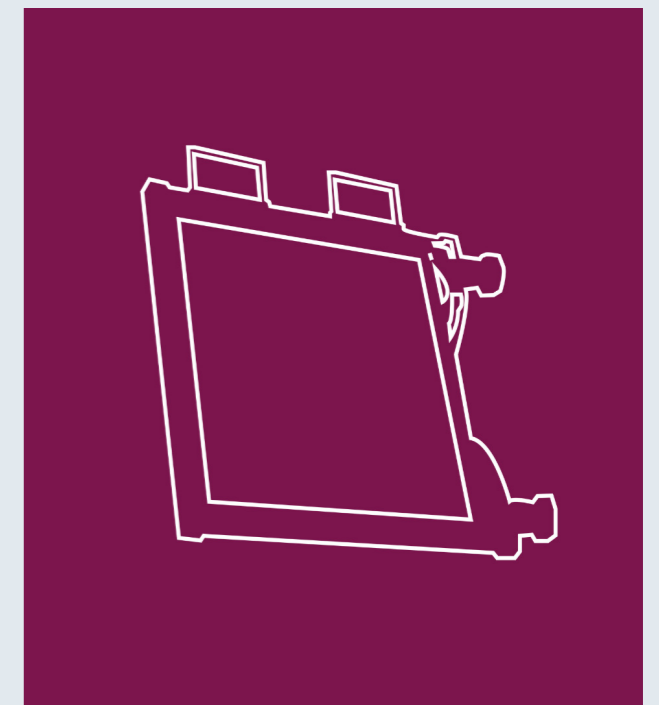
- Laboratory for the integration of porous 3D high-performance materials into components of microsystems technology and power electronics
- Appointment Project Micro-Magnetics
- Miniaturized magnetic fluidic interface for organ-on-a-chip and lab-on-a-chip
- Development of three-dimensional microstructures from low-temperature solidified porous powder packaging
- Autonomous, modular infrastructure for subsea systems
- Fabrication and Integration of Piezoelectric AlScN Thin Films for Piezo-MEMS Devices
- Collaborative project: Integration of a chip-based loudspeaker for mobile devices with miniaturized electronics and signal processing unit; Subproject: Development and production of miniaturized MEMS transducers for chip loudspeakers
- Development of MEMS speakers for in-ear headphones
- Extremely wideband current sensor with highest dynamics for highly efficient power conversion
- POPCRN Anti-Corona Program
- Ferroelectricity in ScAlN: from the discovery of the effect to disruptive devices

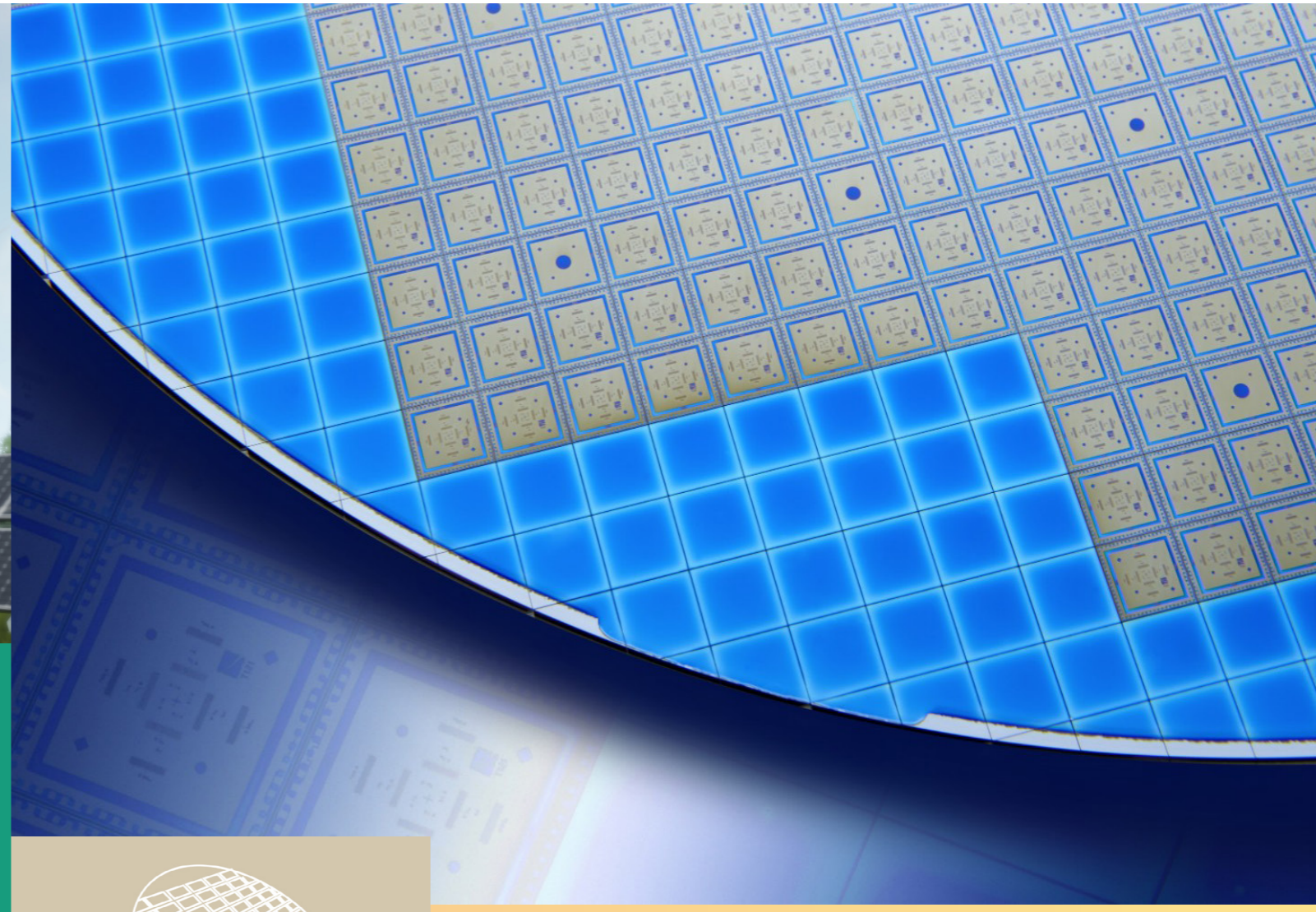
- Scandium Aluminum Nitride for Next-Generation Linear Broadband Amplifiers
- SEC Learn FLY - Sensor Edge Cloud for Federated Learning
- Surface Wave Magnetic Field Sensors
- Manufacture of magnetoelectric sensors
- MEMS Speaker Development
- Grinding to variable substrate thickness in the range of 300-400 μ m
- Feasibility on non-CMOS substrates for printhead
- SAW-based, smart, portable biosensor platform for rapid antibody detection
- Towards Zero Power Electronics
- 3D gyro, design and process development for a 3D MEMS gyro
- Fabrication of piezo-MEMS-based hermetically sealed mirror components with dome-shaped glass lids
- Cluster of Excellence Advanced Photo Sources, Ultrashort Pulse Beam Sources, and Systems Engineering for Next-Generation Precision High-Rate Structuring, Metrology, and Imaging
- CIMD Development of a rapid test system for the early and care-relevant detection of immune-mediated musculoskeletal diseases
- Large MEMS vector scanner FPA (Fine Pointing Assembly)
- Semiconductor-based quantum computing
- Development of sputtered piezoelectric AlN thin film as a functional MEMS material for civil purposes
- Compressed Sensing Supported LiDAR with Coherent Detection at Eye-Safe Wavelengths for Autonomous Driving
- Multilayer actuators for micro-optical applications
- Optoelectronic-microfluidic system for the detection of fluorescently labeled nucleic acids
- Production of an active MEMS mirror with/without dome-shaped cover
- Production of a passive MEMS mirror with dome-shaped lid
- Compressed Sensing Supported LiDAR with Coherent Detection at Eye-Safe Wavelengths for Autonomous Driving
- Functional micromirrors with custom design
- MEMS Scanner Based Laser Projection System for Maritime Augmented Reality
- Trustworthy, resource-saving information and communication technology
- Development of an adaptable, modular strategy for quality control of cell-based therapies

Battery systems

- Structure and characterization of 3 multilayer 1Ah pouch cells
- Observation of lithium ion cells by combining measurement methods to identify and quantify aging processes
- BetterBat - Evaluation of the technical and systemic suitability of battery technologies for battery-relevant applications
- Calcium Rechargeable Battery Technology
- Development of Celluno MP Cells According to Celluno R+D-P02 622/G MP-Matrix
- CObalt Free Batteries for FutuRe Automotive Applications COBRA
- Evaluation of DuPonts separator technology in 10 Ah pouch cells
- Collaborative project: Cross-sectional platform hybridization; Subproject: Processing of hybrid solid-state electrolytes and cathodes into solid-state batteries by means of dry coating processes
- FoFeBat Research Manufacturing Battery Cell Germany
- FoFeBat - Research Manufacturing Battery Cell Germany FFB
- 2nd Use Green Battery-GreenBAT²UseCell Structure and Electrochemical Characterization
- Lithium-ion cells for integration with advanced sensor technology
- Mechanical Aging Diagnostics with Strain Gauge Stiffeners, Dilation, Acoustics and Model Analysis for Lifetime Prediction
- Optimization of magnesium-sulfur batteries through innovative material development

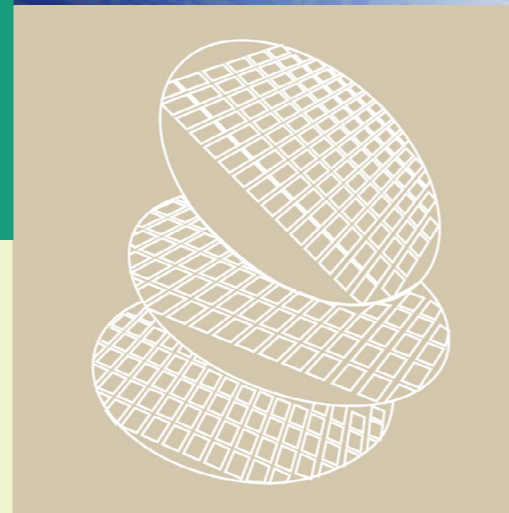
- Novel test methods for battery safety; Subproject: Elucidation of damage processes using cell-internal sensor technology
- Ecologically gentle dry coating of battery electrodes with optimized electrode structure
- High-performance charging system with integrated buffer tank
- Cost reduction and quality improvement in lithium-ion battery electrode production through quantitative, optical inline measurement technology
- Development of large-area, porous Si-film anodes for lithium/silicon NMC energy storage (SiLiNE) for industrial production.
- Simulation of battery cells and applications in storage systems





Power

- Fast converter for the conversion of renewable energy in the MW range based on SiC/Si components
- Design of mains filters for electrified trucks with overhead line supply
- Into Surface Embedded Antenna
- Fully controlled lot-size 1 manufactured Power Modules
- Semiconductor-based quantum computing
- Bearing Shield Silicon Carbide Power Electronics
- Scandium Aluminum Nitride for Next-Generation Linear Broadband Amplifiers
- SEC-learn FLY - Sensor Edge Cloud for Federated Learning
- Trusted Resource Aware Information and Communication Technology
- 3D UIS simulation and device improvement proposals for SJ MOSFETs and GaN FETs
- Subthreshold Bond-Wireless (BWL) analysis
- Improvement of chip assembly aspects towards tolerating high currents in linear mode



Micro-manufacturing process

- Investigation of the Effect of Ionic Impurities in Thin Gaps on Realistic Setups with New Miniaturized Devices
 - Wafer dicing and build up of pre-selected print head dies
- Multi-Project Wafer Run an process verification for 3D-accelerometer
 - Manufacture of Aerosol Vaporizer Chips
- Fully integrated, uncooled wafer-level FIR camera for thermal radiation
- Production of wafers with MEMS electrodes for micro-ozone generator
- Innovative mobile test system for the sustainable acceleration of SARS-COV2 virus detection and the detection of existing immunity (CoVMoTe)
 - Electrical Array Chips 8 Inch
 - Semiconductor-based quantum computing
- Development of a manufacturing process for optical thin domes with diameters of 3-5mm
- Nanofluidic biosensor for early detection of sepsis in COVID-19 patients in intensive care
 - Transfer of fabrication process for switchable e-beam mask
- Ultra-slim IR sensor chip as a universal, contactless clinical thermometer in in-ear speakers

Imprint

Editors

Claus Wacker

Layout/ Setting

Fraunhofer Institute for Silicon Technology

Photographs/Pictures

All pictures from Fraunhofer ISIT

Contact

Please contact us for further information.
We would be glad to answer your questions.

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