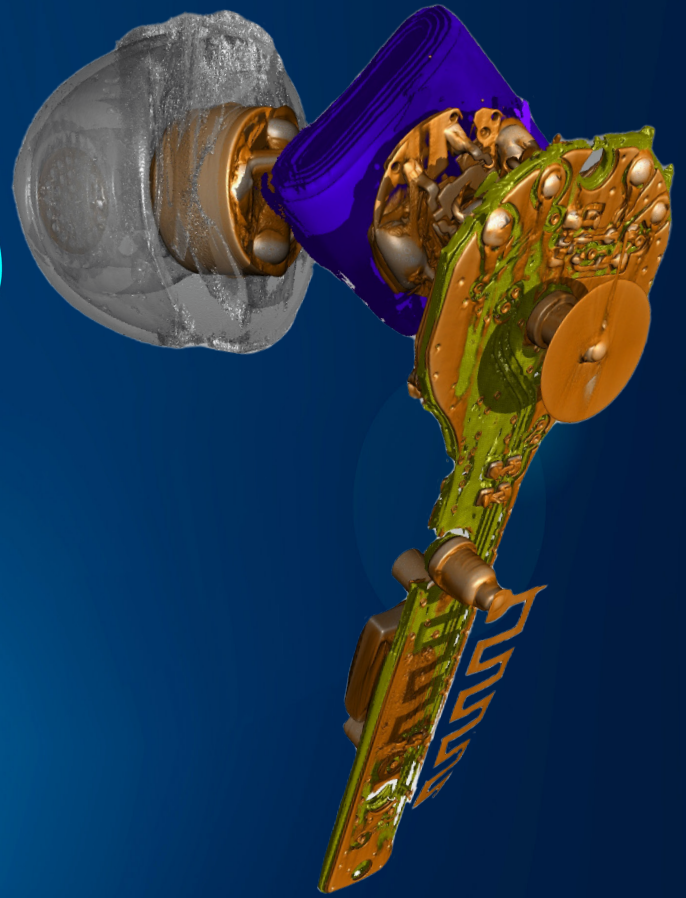




Fraunhofer
ISIT

FRAUNHOFER INSTITUTE FOR SILICON TECHNOLOGY ISIT



Annual Report 2022 Compact

Greetings

2022 – the year of a turning point

The year 2022 was marked by major changes with regard to national and international socio-political developments and a lot has also happened at Fraunhofer ISIT. In Fraunhofer ISIT's 2022 annual review, you will learn how the institute has dealt with global and national challenges and provide an overview of the important events of the past year, the central research projects as well as figures, data and facts from the institute.

Content

Editorial	4
Expansion of the ISIT working group Electronic Energy System at Kiel University	4
FAB-SH in Itzehoe	5
Vishay to build new chip factory in Itzehoe	5
Relaxed corona situation allowed numerous trade fairs and events to be held in person. . .	6
Thesis Prize of the InnoQuarter	6
Climate-neutral high-tech site Itzehoe	7
Conclusion 2022	7
Finance, Human Resources, Organisation	8
Representative figures	9
Lighthouse projects 2022.	9
Energy-saving information storage and clever switches	9
MEMS scanners for wide-field LIDAR systems	9
Energy-efficient and environmentally friendly manufacturing process for electrode foils Li-batteries	9
Optical packages for encapsulation of components at wafer level	9
Important figures and events	10
Events	10
Tradefairs	10
Teaching	10
Patents	11
Scientific publication	13
Projects	16
Imprint and Contact	18

Editorial

Dear Readers,

In July 2022 I took over the management of Fraunhofer ISIT. The change in the institute's management had become necessary because the Senate of the Fraunhofer-Gesellschaft elected my predecessor Prof. Dr. Axel Müller-Groeling as Executive Board member for Research Infrastructures and Digitalization.

I would like to express my gratitude for the trust of the Executive Board in appointing me as acting director of the institute. I am looking forward to the task that now lies ahead of me and to the good cooperation with my colleagues. I would like to continue the positive development of the last five years and the growth path taken for ISIT with energy.

I have initially taken over the management of the institute on an interim basis until a new director of Fraunhofer ISIT is finally appointed by a joint appointment committee of the Fraunhofer-Gesellschaft and Kiel University within the framework of a public call for proposals.

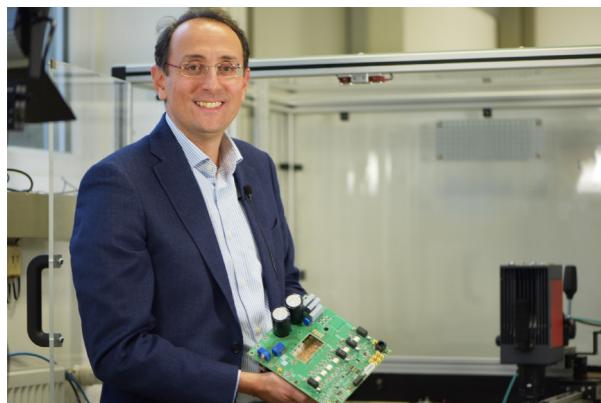
Prof. Müller-Groeling, has gained great recognition for his work at ISIT. He has made ISIT scientifically and economically efficient – with many exciting projects and promising economic prospects. Under his leadership, we have built up an excellent infrastructure in recent years and we have excellently trained colleagues. This means that we are well equipped to meet the high demands of the industry on our development work. In the near future, we would like to make greater use of ISIT's competencies to provide decisive impetus for major future topics such as quantum computing and neuromorphic data processing with new ideas, new collaborations and new research results.



Prof. Dr. Axel Müller-Groeling and Prof. Dr.-Ing. Holger Kapels

Expansion of the ISIT working group Electronic Energy System at Kiel University

It is particularly important to me to expand the cooperation with Kiel University and to ensure that ISIT has a strong branch at Kiel University. For this reason, the ISIT working group »Electronic Energy Systems« was already established at the Faculty of Engineering at Kiel University in 2021, with the prospect of becoming an ISIT sub-institute in Kiel in the near future. The group deals with future-oriented power grids, intelligent storage technologies for electromobility and reliable and durable semiconductors. The group is headed by Prof. Dr. Marco Liserre.



FAB-SH in Itzehoe

In Itzehoe, the focus will be on advancing the establishment of the Research Center for Applied Battery Technology Schleswig-Holstein (FAB-SH), which began in 2021.

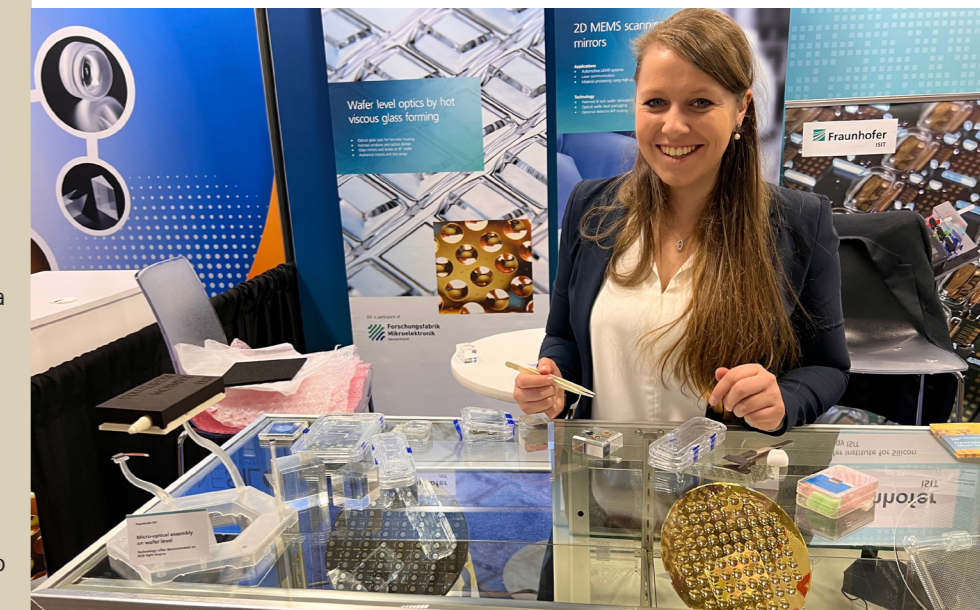
The research center will be built in a former logistics building in the immediate vicinity of Fraunhofer ISIT. Around 30 employees will work on the further development of battery storage systems for various applications and develop new production technologies for battery storage systems. The FAB-SH strives for a prominent position in the national and international research competition. The basis for this already exists at ISIT. With the dry coating of electrodes and ISIT's own separator technology, production processes have been developed and patented that represent a unique position for ISIT.

In recent years, Itzehoe has developed into a hot spot for battery research. For example, Customcells, one of our important industrial partners in the field of battery technology, is also committed to the Itzehoe site.

In the summer, the company bought a 10,000-square-meter plot of land from the city and began construction of a new office building in November. Employees are expected to move in there before the end of 2023.

Relaxed corona situation allowed numerous trade fairs and events to be held in person

Fortunately, the corona wave gradually subsided in 2022, so that restrictions could be lifted and face-to-face events became possible again. After a two-year break due to the pandemic, Microtec Nord took place at ISIT in September. The topic of the event »Intelligent Systems – Adaptive Hardware and Software« met with a great response; Around 100 participants from northern Germany discussed the areas of application of artificial intelligence. After a forced break of almost two years, Fraunhofer ISIT also presented its research and development results at numerous trade fairs in Germany and abroad: Photonics West in San Francisco, the Battery Seminar in Orlando, the Hanover Fair, Laser and Electronics in Munich and Medica/Compamed in Düsseldorf, to name just a few.



Thesis Prize of the InnoQuarter

The joint efforts of all partners at the site to attract young scientists and technicians were gratifying. There were various excursions by students to the Itzehoe Innovation and Technology Park. The thesis prize of the InnoQuarter Itzehoe was launched for the first time in 2022. The companies and institutions at the high-tech location Itzehoe held a competition for the best three theses or dissertations related to the InnoQuarter Itzehoe. With the competition, the initiators wanted to strengthen the attractiveness of Itzehoe as a location for innovation and show appreciation for the young scientists. The first prize of 3000 euros was won by Vincent Krull for his master's thesis, which he wrote at the company Oqmented, the second prize of 1500 euros was awarded to Tom-Niklas Kreutzer from ISIT for his master's thesis on the material and process development of aluminum-scandium nitride double layers and the third prize of 500 euros went to Prince Sackey. The initiators were thrilled with the level of all submitted works and want to repeat the competition in 2023.



Vishay to build new chip factory in Itzehoe

However, the most pleasing news in the past year for Itzehoe as a technology location came from our strategic partner Vishay. The chip manufacturer plans to build a new cleanroom and expand its production in Itzehoe for about 300 million euros. In the first expansion phase, an additional 150 new jobs are to be created. Above all, the company wants to expand its position in the European automotive market and reduce the automotive industry's dependence on Asian suppliers in the future. We at ISIT hope that the expansion will put our constructive research cooperation on an even broader basis.

Climate-neutral high-tech site Itzehoe

The climate crisis, which can no longer be overlooked, and the explosive rise in energy prices caused by the Ukraine war pose major challenges for ISIT and all other companies and institutions. As a first step, the companies based at the Itzehoe site have drawn up a joint greenhouse gas balance. For many partners, this is the first step on the way to reducing greenhouse gases. The project is scientifically supported by the Nordakademie Elmshorn and aims to make the Itzehoe Innovation Park climate-neutral. This is because rising energy prices, growing transparency requirements from investors and the question of the future viability of business models are generating a lively interest in corporate climate protection.

ISIT has also launched a whole series of measures in terms of climate-neutral production. For example, photovoltaic systems will be installed on various buildings and open spaces, the ventilation systems will be optimized, many motors for supply/exhaust air systems and pumps will be replaced by energy-efficient variants, the lighting will be completely converted to LED and the heating system will be converted to propane gas. For this purpose, seven charging stations for e-cars will be installed at ISIT.

In September, the Green ICT@FMD Competence Center of the Microelectronics Research Factory started its work. The Fraunhofer and Leibniz Institutes, which cooperate in the Research Fab Microelectronics Germany (FMD) - including Fraunhofer ISIT - are involved in the Green ICT@FMD and form a cross-location competence center. Green ICT @FMD aims to protect the climate with modern electronics for resource-saving information and communication technology and to contribute to reducing the CO2 footprint of digital technologies through research and development. The project, which was launched in the summer, is part of the German government's Climate Protection Programme 2030 and is funded by the Federal Ministry of Education and Research with 34 million euros. As part of this sustainable electronics project, ISIT will reduce energy consumption in the production of volatile gases and optimize the consumption of these gases in different plants.

Conclusion 2022

On the occasion of his departure from ISIT in the summer, my predecessor Prof. Axel Müller-Groeling mentioned four aspects that, in his opinion, have led to the success of ISIT in recent years. Firstly, the strength of the institute in terms of content, secondly: a resilient network of strong partners, thirdly: good research management and, finally, a performance culture of the employees, characterised by good teamwork, a constructively lived error culture and the joy of performance and success.

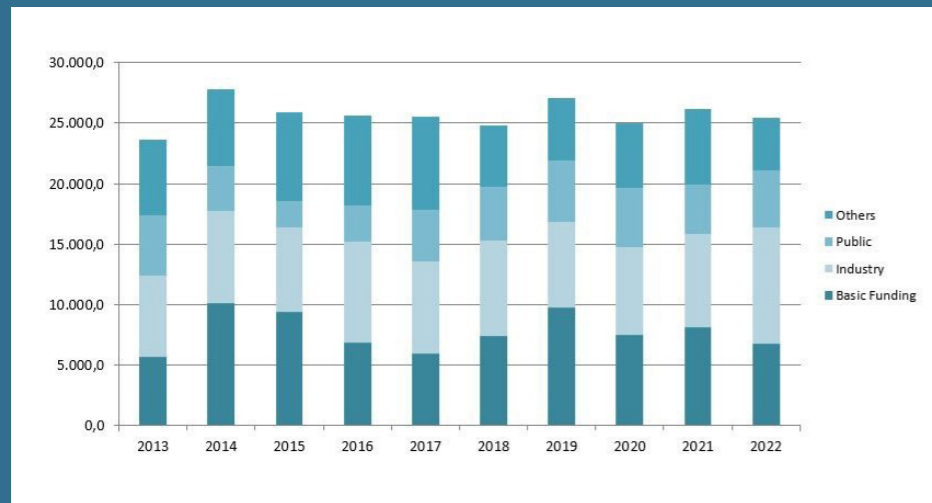
I fully agree with my predecessor in the analysis and I am sure that if we continue to maintain and develop these ingredients for success, we will master the challenges of the future just as successfully as we have done in the past.

Finance, Human Resources, Organisation

Representative figures

INCOME OF FRAUNHOFER ISIT FROM 2013 TO 2022

The 2022 budget was financed by project revenues of €9,643 thousand from industry/trade associations/small and medium-sized enterprises, €4,672 thousand from the federal government/project executing agencies/states and €4,416 thousand from others. In addition, there were FhG projects and basic funding with € 6,738 thousand.

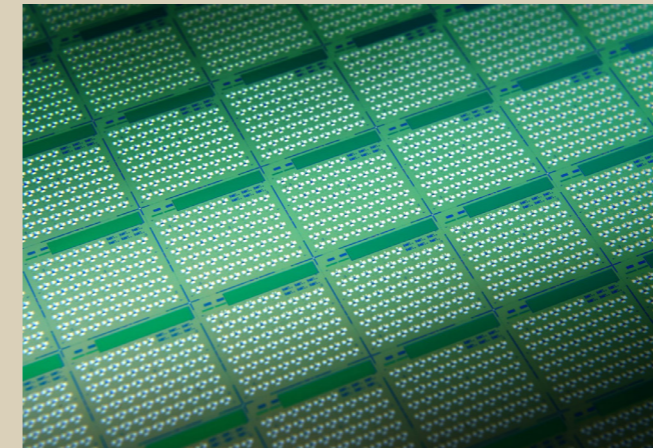


STAFF DEVELOPMENT

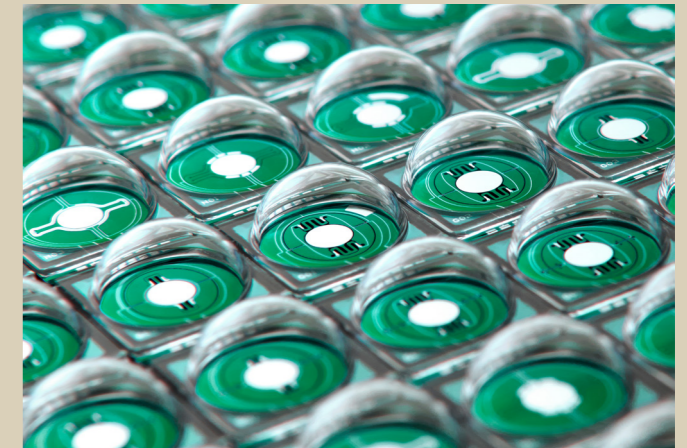
At the end of 2022, the staff consisted of 172 employees. 82 worked as scientific staff, 63 as diploma/technical staff and 27 in organisation and administration. The employees were supported by 37 research assistants, 4 interns and 5 trainees.



Flagship projects 2022



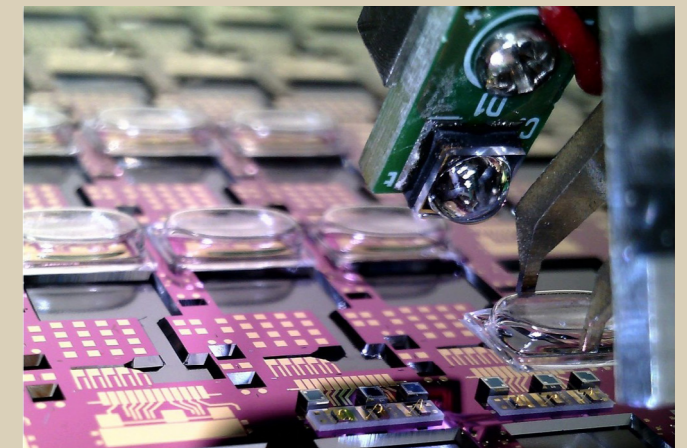
Energy-saving information storage and clever switches



MEMS scanners for wide-field LIDAR systems



Energy-efficient and environmentally friendly manufacturing process for electrode foils
Lithium-Ionen-Batterien



Optical packages for encapsulation of components at wafer level

Important figures and events

Events

Webinars

- **Fraunhofer Career Fair @ Home**
Fraunhofer-Gesellschaft Webinar, May 19. 2022

Face-to-face events

- **Opening Ceremony FAB-SH**
17 February 2022, Itzehoe
- **Smart Power - Battery Technologies 2022**
14. September 2022, Itzehoe
- **Microtec nord 2022 - Norddeutscher Mikroelektronik Tag**
29. September 2022, Itzehoe
- **Science Day Kiel 2022- Festival der Wissenschaft**
30. September 2022, Itzehoe

Tradefairs

Tradefairs and exhibition

- **SPIE 2022**
Photonics West Exhibition, 22.-27. January 2022, San Francisco
- **EES 2022**
International Trade Fair for Batteries and Energy Storage Systems, 11-13 March 2022, Munich
- **DAGA 2022**
German Annual Conference for Acoustics, 21 - 24 March 2022, Stuttgart
- **International Battery Seminar & Exhibit 2022**
International Battery Seminar, March 28 - 31 2022, Orlando, FL
- **Laser Photonics 2022**
Laser World of Photonics, 26. - 29. April 2022, München
- **SMT 2022**
Electronics Manufacturing Exhibition in Europe, 10 – 12 May 2022, Nuremberg
- **PCIM 2022**
Trade Fair and Conference for Power Electronics, Intelligent Drive Technology, Renewable Energy and Energy Management, 10 - 12 May 2022, Nuremberg
- **Hannover Messe 2022**
International platform for all technologies related to industrial transformation, 30 May - 2 June 2022, Hannover

- **Nortec 2022**
Trade Fair for Production in Northern Germany, May 31 - June 03 2022, Hamburg
- **Vocatium 2022**
Trade Fair for Training & Studies, 15 - 16 June 2022, Neumünster
- **The Battery Show Europe 2022**
Meeting Point for the Advanced Battery and H/EV Technology, Community June 28 - 30, 2022, Stuttgart
- **Gain 2022**
Annual Meeting of the German Academic International Network, 2 - 4 September 2022, Bonn
- **decarbXpo 2022**
Expo for decarbonised Industries, 20 - 22 September 2022, Düsseldorf
- **Azubiz 2022**
Day of Vocational Education and Training, 23 September 2022, Itzehoe
- **ESREF Conference Berlin 2022**
European Symposium on Reliability of Electron Devices, Failure Physics and Analysis, 26 - 29 September 2022, Berlin
- **Optatec 2022**
International Trade Fair for Optical technologies, Components and Systems, 18 - 20 October 2022, Frankfurt am Main
- **AES Convention 2022**
Largest Audio Technology Congress, October 19 - 20, 2022 / New York, October 26 - 27, 2022 / Online
- **Electronica 2022**
World's Leading Trade Fair for Electronics, November 15 - 18 2022, Munich
- **Compamed 2022**
High-tech solutions for medical technology, 14 - 17 November 2022, Düsseldorf
- **Forum Elektromobilität Schleswig-Holstein 2022**
Efficiency as a guiding principle for concepts, vehicles and infrastructure, 30 November 2022, Kiel

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**
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

Patents

Supplements 2021

- **F. Stoppel, B. Wagner**
Micromechanical Piezoelectric Actuators for Implementing Large Forces and Deflections
MY-187297-A

2022

- **Z. Yu, H. Kapels, K. Hoffmann**
Power converter circuit and method for controlling the same
EP 3563475 B1
- **T. Lisec, F. Lofink**
Method of producing a cavity having a porous structure
US 11,268,122 B2
- **B. Wagner, S. Fichtner, F. Lofink**
Ferroelectric semiconductor device with a ferroelectric storage layer having a solid solution and methods for its preparation
DE 102018212736 B4
- **F. Stoppel, F. Niekiew, B. Wagner, F. Lofink**
MEMS transducers with recesses and cantilevers
DE 102021202573 B3
- **F. Stoppel, B. Wagner, S. Gu-Stoppel**
Micromechanical Sound Transducer
US 11,350,217 B2
- **F. Lofink, D. Kaden, S. Fichtner**
Ferroelectric material, MEMS device with a ferroelectric material, MEMS device with a first MEMS device, process for fabricating a MEMS device and method for fabricating a CMOS-compatible MEMS device
JP 7090753
- **T. Lisec, H.-J. Quenzer**
Thermally insulated microsystem
EP 3523637 B1
US 11,137,364 B2
- **U. Hofmann, M. Weiß, J. Janes, F. Senger**

Imaging radiation sensor
DE 102013019560 B4

- **T. Lisec, H.-J. Quenzer, T. Reimer**
Method for manufacturing a device having a three-dimensional magnetic structure
US 11,417,448
- **N. Laske, H.-J. Quenzer, V. Stenchly, A. Kulkarni, A. V. Schulz-Walsemann**
Process for the production of lens elements and housing, radiation-sensitive components at wafer level
CN ZL 2018 8 0039832.0
- **U. Hofmann, H.-J. Quenzer, T. Lisec, T. von Wantoch**
Converters for the production of a secondary light from a primary light, illuminants incorporating such converters, and processes for producing such converters
EP 3391424 B1
- **J. Jane's**
Omnidirectional Illumination Device and Method for Scanning a Range of Solid Angles
DE 102017200692 B4
- **U. Hofmann, H.-J. Quenzer, F. Niekiew**
Micromechanical actuator device and method for its manufacture
DE 102017205047 B4
- **H.-J. Quenzer, U. Hofmann, V. Stenchly**
MEMS mirror assembly and method for the production of a MEMS mirror assembly
EP 3658974 B1
US 11,531,196 B2
CN ZL 201880049871.9
- **F. Stoppel, F. Niekiew, T. Lisec**
MEMS transducer
CN ZL 2019 1 1231343.8
- **T. Lisec, F. Lofink**
A method for producing a counter-rotating magnetized magnetic structure
JP 7189180 B2
CN ZL 2020 1 0649585.5

Scientific Publications

Selected publications

Peer-reviewed paper

- **M. Ahmed, T. Dankwort, S. Grünzig, V. Lange, B. Gojdka** Broadband Zero-Power Wakeup MEMS Device for Energy-Efficient Sensor Nodes.
- **O. Behrmann, T. Lisec, B. Gojdka** Towards Robust Thermal MEMS: Demonstration of a novel approach for Solid Thermal Isolation by Substrate-Level Integrated Porous Microstructures. MDPI Micromachines, 2022.
- **M. Bodduluri, T. Dankwort, T. Lisec, S. Grünzig, A. Khare, M. Ahmed, B. Gojdka** Fully Integrated High-Performance MEMS Energy Harvester for Mechanical and Contactless Magnetic Excitation in Resonance and at Low Frequencies. MDPI Micromachines, 2022.
- **M. Bodduluri, B. Gojdka, N. Wolff, L. Kienle, T. Lisec, F. Lofink** Investigation of wafer-level fabricated permanent micromagnets for MEMS MDPI Micromachines, 2022.
- **M. Frankenberger, J. Ophey, et al.** Improving Wetting Behavior and C-Rate Capability of Lithium-Ion Batteries by Plasma Activation. Energy Technol., 2022.
- **B. Gojdka, D. Chichon, Y. Lembrecht, M. Bodduluri, T. Lisec, M. Stahl-Offergeld, H. Höhe, F. Niekiel** Demonstration of Fully Integrable Long-Range Microposition Detection with Wafer-Level Embedded Micromagnets. MDPI Micromachines, 2022.
- **H. Grob, Y. Ekici, M. Poschemann, D. Groeneveld, T. Dankwort, J. Koenig, W. Bensch, L. Kienle** Does a Low Amount of Substituents Improve the Thermoelectric Properties of Cr₂-xMxS₃ (M = Ti, V, Sn)? Journal of Electronics Materials, 2022.
- **T. Lisec, O. Behrmann, B. Gojdka** PowderMEMS—A Generic Microfabrication Technology for Integrated Three-Dimensional Functional Microstructures. MDPI Micromachines, 2022.
- **O. Lupan, D. Santos-Carballal, N. Magariu, A. Mishara, N. Ababii, H. Krüger, N. Wolff, A. Vahl, M. Bodduluri, N. Kohlmann, L. Kienle, R. Adleung, N. de Leeuw, S. Hansen** Al₂O₃/ZnO Heterostructure-Based Sensors for Volatile Organic Compounds in Safety Applications. ACS Applied Materials Interface, 2022.
- **M. Meyns, F. Dietz, C.-S. Weinhold, H. Züge, S. Finckh, G. Gerdts** Multi-Feature Round Silicon Membrane Filters Enable Fractionation and Analysis of Small Microand Nanoplastics with Raman Spectroscopy and Nano-FTIR. Analytical Methods, 2022.
- **S. Moench, J. Meyer, A. Zukauskaitė, V. Lebedev, S. Fichtner, J. Su, F. Niekiel, T. Giese, Lars Thormählen, E. Quandt, F. Lofink** AlScN-Based SAW Magnetic Field Sensor for Isolated Closed-Loop Hysteretic Current Control of Switched-Mode Power Converters. IEEE Sensors Letters 6, 2022.
- **Y. Pascal, F. Daschner, M. Liserre, M. Höft** Intercondition Monitoring of Power Module Using S-Parameters, TDR, and TDT. Microelectronics Reliability, 2022.
- **M. Päsler, T. Lisec, H. Kapels** High Temperature Magnetic Cores Based on Powder-MEMS Technique for Integrated Inductors with Active Cooling. MDPI Micromachines, 2022.
- **T. Pereira, Y. Wei, Y. Pascal, H. A. Mantooth, M. Liserre** Self-Tuning Multiport Resonant DC/DC Converter Based on Actively-Controlled Inductors for Hybrid Storage System Integration. IEEE Transactions on Power Electronics, 2022.
- **K. Reiter, S. Wiljes, F. Engel, L. Ebinal** Lumen & Colours : Eine Reise ins Innere der Wissenschaft.
- Praktische Metallographie, Pract. Metallogr. 59 (2022) 11, Seite 684-696, 2022.

Conference papers

- **H. Schimanski, T. Fladung** Investigation of the effect of ionic impurities in thin gaps on realistic setups with new miniaturized devices. SCHWEISSEN und SCHNEIDEN Heft 7-8 2022, pages 479-484, 2022.
- **I. Titov, N. Rutschke, F. A. Kraft, M. Köpke, E. Nebling, M. Gerken** Detection of Fluorescence-Labeled DNA with In-Plane Organic Optoelectronic Devices. Biomedical Optics Express, Vol. 13, No. 12, 2022.
- **N. Wolff, Md R. Islam, L. Kirste, S. Fichtner, F. Lofink, A. Žukauskaitė, L. Kienle** 1,Al_{1-x}Sc_xN Thin Films at High Temperatures: Sc-Dependent Instability and Anomalous Thermal Expansion Micromachines, 2022.
- **T. Dankwort, S. Grünzig, M. Ahmed, A. Khare, F. Lofink, B. Gojdka** Broadband MEMS Energy Harvester with Monolithically Integrated NdFeB Magnets. EASS 2022; 11th GMM-Symposium, 1-3, 2022.
- **K. Debbadi, Y. Pascal, M. Liserre** Dv/Dt Filter Design Incorporating Machine Impedance and Voltage Slew Rate for WBG-Based Electric Drives. IECON 2022
- **J. Farias, L. Camurca, M. Langwasser, M. Liserre** An Analysis of Combining Dc Circuit Breaker and Hybrid MMC with Reduced Number of FBSM for HVdc System Protection. PEDG 2022.
- **J. Kuprat, Y. Pascal, M. Liserre** Real-Time Thermal Characterization of Power Semiconductors Using a PSO-Based Digital Twin Approach. EPE ECCE, 2022.
- **M. Meyns, F. Diets, C.-S. Weinhold, H. Züge, S. Finkh, G. Gerdts** Multi-Feature Round Silicon Membrane Filters Enable Fractionation and Spectroscopic Analysis of Small Micro- and Nanoplastics with Raman Spectroscopy and Nano-FTIR. MICRO, 2022.
- **Y. Pascal, F. Daschner, M. Liserre, M. Höft** Condition Monitoring of Power Module Using S-Parameters, TDR, and TDT. ESREF 2022.
- **T. Pereira, Y. Pascal, M. Liserre, Y. Wie, H. A. Mantooth** Multiport Resonant DC-DC Converter using Actively-Controlled Inductors for Hybrid Energy Storage System Integration. IEEE Applied Power Electronics Conference and Exposition (APEC), 2022.
- **F. Santos-Arana, Y. Pascal, J. Kuprat, M. Langwasser, K. Debbadi, M. Liserre** Optical Sensing Applied to Thermal Observers for Enhanced Reliability of Power Modules. PEDG 2022.
- **H. Shimanski** LTS - Low Temperature Soldering. 30. FED Konferenz, 2022.
- **H. Schimanski, T. Fladung** Untersuchung der Auswirkung ionischer Verunreinigungen in dünnen Spalten an realitätsnahen Aufbauten mit neuen miniaturisierten Bauelementen. 11. GMM/DVS-Fachtagung | EBL 2022.
- **H. Schimanski, T. Fladung** Investigation of the Effect of Ionic Contamination in Thin Gaps on Assemblies Close to Reality with New Miniaturized Devices. EUROCORR, 2022.
- **H. Schimanski, T. Fladung** Untersuchung der Auswirkung ionischer Verunreinigungen in dünnen Spalten an realitätsnahen Aufbauten mit neuen miniaturisierten Bauelementen. DVS Congress, 2022.

Selected lectures

- **M. Ahmed, T. Dankwort, S. Grünzig, A. Khare, B. Gojdka** Increasing the performance of versatile magneto-electric MEMS energy harvesters. Lions; Belgium, 21.09.2022
- **M. Ahmed, B. Gojdka, T. Dankwort, S. Grünzig** Zero power wake-up using MEMS-based piezoelectric energy harvester. Lions; Belgium, 22.09.2022
- **O. Behrmann** PowderMEMS for BioChips. Berlin, 10.05.2022 & Kiel, 30.06.2022
- **O. Behrmann** Micro Electronics Systems Colloquium - PowderMEMS Sensors. Itzehoe, 25.02.2022
- **O. Behrmann** PowderMEMS – Wafer-Level Integration of Porous Microstructures. Itzehoe, 22.07.2022
- **O. Behrmann, T. Lisec, E. Nebling, L. Blohm, J. Eichholz, S. Krämer, S. Schaal, N. Rutschke, B. Gojdka** A micromanufactured porous solid phase for nucleic acid purification. Lions; Belgium, 22.09.2022
- **M. Bodduluri** Micro Electronics Systems Colloquium - PowderMEMS Micromagnet. Itzehoe, 25.03.2022
- **A. Burger** Application of Sensors in Power Packages. Itzehoe, 14.09.2022
- **A. Burger** Cell-Internal Glass Fiber Sensors for In-situ Temperature Monitoring in LIB. Braunschweig, 08.11.2022
- **J. Cipo** PowderMEMS Technology– Wafer-level Integration of Porous Structures. Duisburg, 12.09.2022
- **T. Dankwort** Energy Harvestin @ ISIT. Itzehoe, 22.04.2022
- **T. Dankwort** Broadband MEMS Energy Harvester with Monolithically Integrated NdFeB Magnets. Erfurt, 11.05.2022
- **T. Dankwort** New Opportunities @ ISIT. Itzehoe, 12.05.2022
- **T. Acknowledgments** Energy harvesting and zero-power wake up for maritime applications. Rostock, 17.11.2022
- **G. Gojdka** Wafer-level Integration of Magnetic Functional Microstructures Using PowderMEMS Technology. Wilhelmshaven, 05.04.2022
- **O. Behrmann** PowderMEMS for BioChips. Berlin, 10.05.2022 & Kiel, 30.06.2022
- **O. Behrmann** Micro Electronics Systems Colloquium - PowderMEMS Sensors. Itzehoe, 25.02.2022
- **O. Behrmann** PowderMEMS – Wafer-Level Integration of Porous Microstructures. Itzehoe, 22.07.2022
- **O. Behrmann, T. Lisec, E. Nebling, L. Blohm, J. Eichholz, S. Krämer, S. Schaal, N. Rutschke, B. Gojdka** A micromanufactured porous solid phase for nucleic acid purification. Lions; Belgium, 22.09.2022
- **M. Bodduluri** Micro Electronics Systems Colloquium - PowderMEMS Micromagnet. Itzehoe, 25.03.2022
- **A. Burger** Application of Sensors in Power Packages. Itzehoe, 14.09.2022
- **A. Burger** Cell-Internal Glass Fiber Sensors for In-situ Temperature Monitoring in LIB. Braunschweig, 08.11.2022
- **J. Cipo** PowderMEMS Technology– Wafer-level Integration of Porous Structures. Duisburg, 12.09.2022

Scientific Publications

Selected lectures

- **T. Dankwort**
Energy Harvestin @ ISIT.
Itzehoe, 22.04.2022
- **T. Dankwort**
Broadband MEMS Energy Harvester with Monolithically Integrated NdFeB Magnets.
Erfurt, 11.05.2022
- **T. Dankwort**
New Opportunities @ ISIT.
Itzehoe, 12.05.2022
- **T. Acknowledgments**
Energy harvesting and zero-power wake up for maritime applications.
Rostock, 17.11.2022
- **G. Gojdka**
Wafer-level Integration of Magnetic Functional Microstructures Using PowderMEMS Technology.
Wilhelmshaven, 05.04.2022
- **G. Gojdka**
PowderMEMS micromanufacturing process for innovative microsystems
Freiburg i. Br., 19.05.2022
- **S. Gu-Stoppel**
MEMS Scanning Technology for RGB Projection
Cambridge, 03.11.2022
- **P. Hickisch**
FEM-based optimization and analysis of a piezoelectric MEMS energy harvester.
Erfurt, 11.05.2022
- **T. Lisec**
PowderMEMS - A Novel Microfabrication Technique for Integrated 3D Functional Microstructures Based on ALD.
Dresden, 30.03.2022
- **M. Mensing**
Future made in Itzehoe - battery systems, semiconductors and sensors.
Heide, 22.06.2022
- **M. Mensing**
NeuroSmart - Analog neuro-morphic accelerators that enable efficient and safe smart sensors.
Itzehoe, 29.09.2022
- **M. Meyns, F. Dietz, C.-S. Weinhöld, H. Züge, S. Finkh, G. Gerdt**
Multi-Feature Round Silicon Membrane Filters Enable Fractionation and Spectroscopic Analysis of Small Micro- and Nanoplastics with Raman Spectroscopy and Nano-FTIR.
Wertheim, 31.05.2022
- **H. Schimanski**
Production-ready PCB design.
Wertheim, 31.05.2022
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Advanced failure analysis as the basis for reliable electronics.
Wertheim, 01.06.2022
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Investigation of the effect of ionic impurities in thin gaps on realistic structures with new miniaturized components.
online, GfKORR: News from Electronics Corrosion Research, 23.06.2022.
- **H. Schimanski**
AVT - Technologies, Processes, Analytics in ISIT.
Itzehoe, 08.09.2022
- **A. Würsig**
Battery Storage Solutions for Railway Systems – Current Trends.
Kiel, 24.02.2022
- **A. Würsig**
Status and Current Developments of Energy Storage Systems for the E-mobility.
New York, 02.09.2022.
- **A. Würsig**
Current Developments on Battery Technology.
Braunschweig, 08.11.2022
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FAB-SH: The (new) Center for Battery Research in Schleswig-Holstein.
Kiel, 30.11.2022
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Lumen & Colours: A Journey into the Inner Depths of Science.
Saarbrücken, 22.09.2022
- **H. Schimanski**
Depaneling - broken assembly or reliable product?
online, FED kurz&knackig, FED RG
Stuttgart, 04.05.2022
- **H. Schimanski**
LTS - Low Temperature Soldering.
Würzburg, 24.05.2022 & Wertheim, 01.06.2022 & Hamburg, 02.06.2022 & Emden, 30.06.2022 & Fulda, 21.07.2022 & Dresden, 28.09.2022
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Building element trends.
Wertheim, 31.05.2022
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Challenge in the processing of new designs.

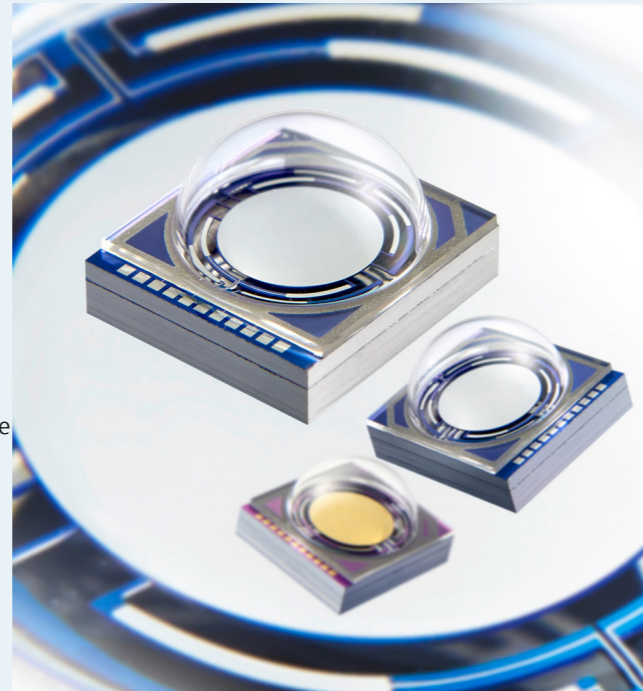
Master's/Bachelor's theses

- **Hiba Alnoury**
Research into an accelerated process for electrolyte filling of Li-ion batteries.
Master's thesis, Brandenburg University of Applied Sciences, 11.04.2022
- **Julian Bötterfähr**
Maintenance process analysis and optimization on a plasma etcher
Bachelor thesis, Kiel University of Applied Sciences, 27.07.2022
- **Nils Burmeister**
Filling of hole geometries in glass wafers with aluminum melt.
Master's thesis, TH Lübeck, 01.07.2022
- **Neha Chalgeri**
MEMS 3D Coriolis Vibratory Gyroscope Performance Analysis and Design Optimization.
Master's thesis, TUHH, 13.12.2022
- **Ankur Kumar Das**
Thermomechanical Stress Simulation for direct laser diode attach technology.
Master's thesis, Chemnitz University of Technology, 27.06.2022
- **Alexander Fritz**
Development and evaluation of a usage-based cost accounting system within a manufacturing cooperation.
Master's thesis, West Coast University of Applied Sciences, 28.02.2022
- **Soukaina Guessaf**
Modeling and optimization of an in-ear enclosure for MEMS loudspeakers using FE and lumped parameter simulations
Master's thesis, Kiel University of Applied Sciences, 21.11.2022
- **Galo Daniel Astulillo Heras**
Improvement for Li-Ion batteries SOC estimation: autonomous characterization and convergence
Master's thesis, Kiel University, 15.08.20
- **Philipp Hickisch**
FEM-based optimization and analysis of a piezoelectric MEMS energy harvester.
Bachelor thesis, University of Rostock, 04.05.2022
- **Nagashree Bangalore Jagadesh**
Development of Wafer - Level Manufacturing Process for optical components made of glass.
Master's thesis, TUHH, 02.02.2022.
- **Ioannis Kallioras**
Extension of a business intelligence tool by a roadmapping system for the analysis of strategic considerations.
Master's thesis, FH Westküste, 05.04.2022
- **Anmol Khare**
optimization of piezoelectric energy harvester under different excitation conditions.
Master's thesis, TUHH, 12.05.2022
- **Gesa Lüdemann**
Development of pouch films for lithium-ion batteries with analysis of thermoforming and sealing behavior
Master's thesis, University of Wismar, 15.12.2022
- **Yann-Felix Nientiedt**
Experimental investigation of the positioning accuracy of the overlay within an exposure process in semiconductor lithography using the example of the Canon FPA3030i5+
Bachelor thesis, FH Heide, 07.03.2022
- **Linda Nolte**
Development of a system for the conversion of wave energy by MEMS Energy Harvester.
Master's thesis, Kiel University of Applied Sciences, 19.09.2022.
- **Jacob Reusch**
Development of a pinhole-free passivation for powder-based, porous MEMS structures.
Master's thesis, Kiel University, 31.05.2022
- **Abhishek Suiya**
Construction, Realization, Simulation, and Characterization of Embedded Glass Waveguide with Beam Combiner Structure for RGB Laser Light Engine.
Master's thesis, Leibniz University Hannover, 03.03.2022
- **David Westerhoff**
Practical investigation and design of an equivalent switching model of the electrothermal instability of power MOSFETs in linear operation.
Master's thesis, Kiel University of Applied Sciences, 10.06.2022
- **Vivien Wilkens**
Women in Research - A quantitative analysis of the factors influencing the career choices of female scientists
Bachelor thesis, FH Heide, 03.08.2022

Projects

MEMS Application

- Fabrication and integration of piezoelectric AlScN thin films for piezo-MEMS devices
- MEMS mirror for LIDAR camera
- MEMS mirror for quantum-sensing
- Development of MEMS Speakers for in-ear Headphones
- Development of sputtered thin film piezoelectric AlN as a functional MEMS material
- Laboratory for the integration of porous 3D high-performance materials into components of microsystems technology and power electronics
- Extremely broadband current sensor with highest dynamics for highly efficient power conversion
- Development of a 3D endoscope based on a MEMS 3D camera for the inspection of engine components
- Development of three-dimensional microstructures from low-temperature solidified porous powder packaging
- Optoelectronic-microfluidic system for the detection of fluorescently labeled nucleic acids
- Piezo MEMS Micromirror for Augmented Reality
- Fabrication and improvement of the manufacturability of piezo-MEMS-based hermetically encapsulated mirrors for AR/VR applications
- Ferroelectricity in ScAlN: from the discovery of the effect to disruptive devices
- SPKR Push - Gen2 Loudspeaker



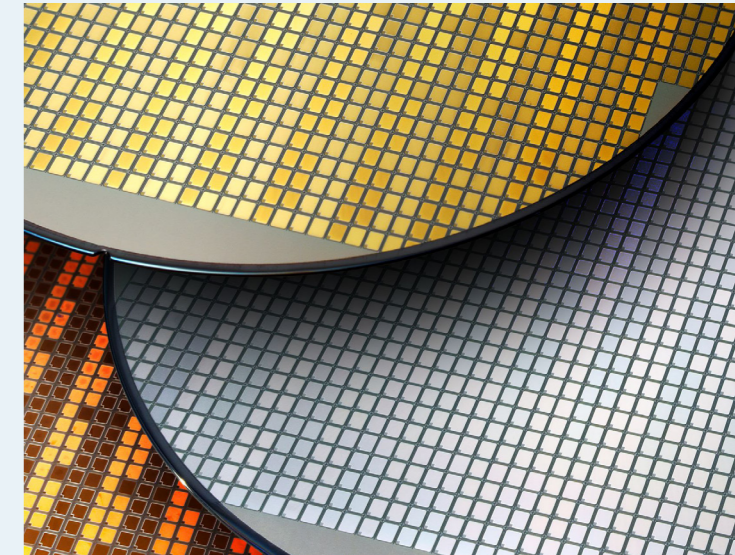
Battery systems

- BeLiMIA - Observation of lithium ion cells by combining measurement methods for the identification and quantification of aging processes
- COBRA - COalt-free Batteries for FutuRe Automotive Applications
- Self-construction of a filling plant for electrolytes
- Collaborative project: Cross-sectional platform hybridization; Sub-project: Processing of hybrid solid-state electrolytes and cathodes into solid-state batteries by means of dry coating processes
- Optimization of magnesium-sulfur batteries through innovative material development
- Collaborative project: Novel investigation methods for battery safety; Subproject: Elucidation of damage processes using cell-internal sensor technology
- High-performance charging system with integrated buffer tank
- Development of large-area, porous Si-film anodes for lithium/silicon NMC energy storage (SiLiNE) towards industrial production.
- SimBAS - Simulation of battery cells and applications in storage systems



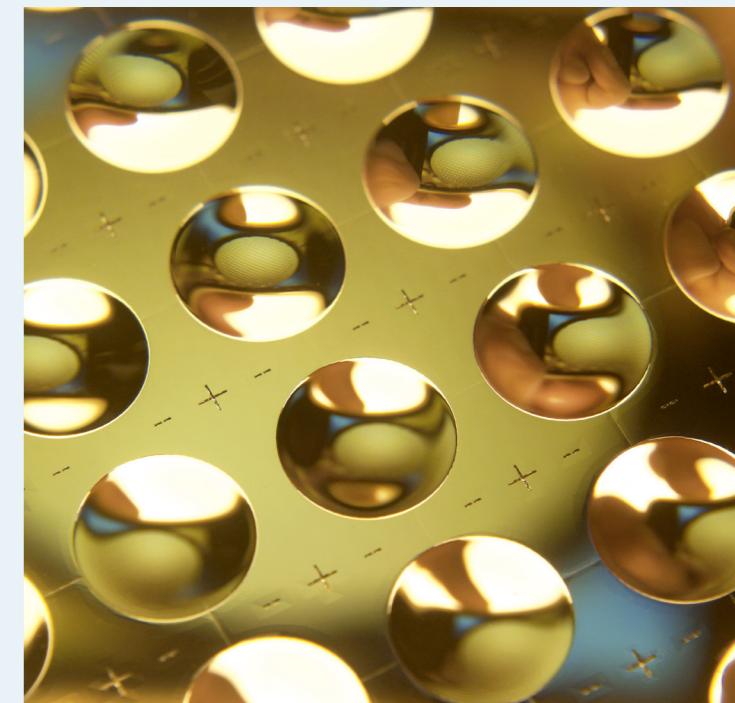
Power

- FlaMe: Flexibly adapted production of power modules
- LaSiC: Electric drive machine with silicon carbide power electronics integrated into the bearing shield
- Fraunhofer lighthouse project NeurOSmart: Analog neuromorphic accelerators that enable efficient and safe smart sensors
- SCALING: Scandium aluminum nitride for next-generation linear broadband amplifiers
- Super-HEART: a fault-tolerant and highly efficient energy hub with embedded short-term energy storage for high availability electric power delivery
- Analysis of electrically conspicuous elements by means of LOCK-IN thermography
- Development of LC-Resonator and DCDC-Converter test board



Micro-manufacturing process

- Multi-Project Wafer Run for process verification for 3D-accelerometer
- Fabrication of wafers with MEMS electrodes for micro-ozone generator
- Preparation of a feasibility study for the development of micro-optics at wafer level and its system integration
- Development of a manufacturing process for optical thin domes with diameters of 3 mm- 5 mm power modules
- Process development and build up of next generation piezoelectric printheads
- Build up of printhead dies
- Development of a manufacturing process for reflector surfaces below grating couplers for optical waveguides
- Glass-Silicon Manifold Substrate Fabrication for Glass Frit Bonding
- Development and adjustment of the existing MEMS technology to fulfill the specifications for next generation e-beam writing
- Transfer of fabrication process for a e-beam mask writer



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Christian-Albrechts-Universität zu Kiel: page 3 bottom
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