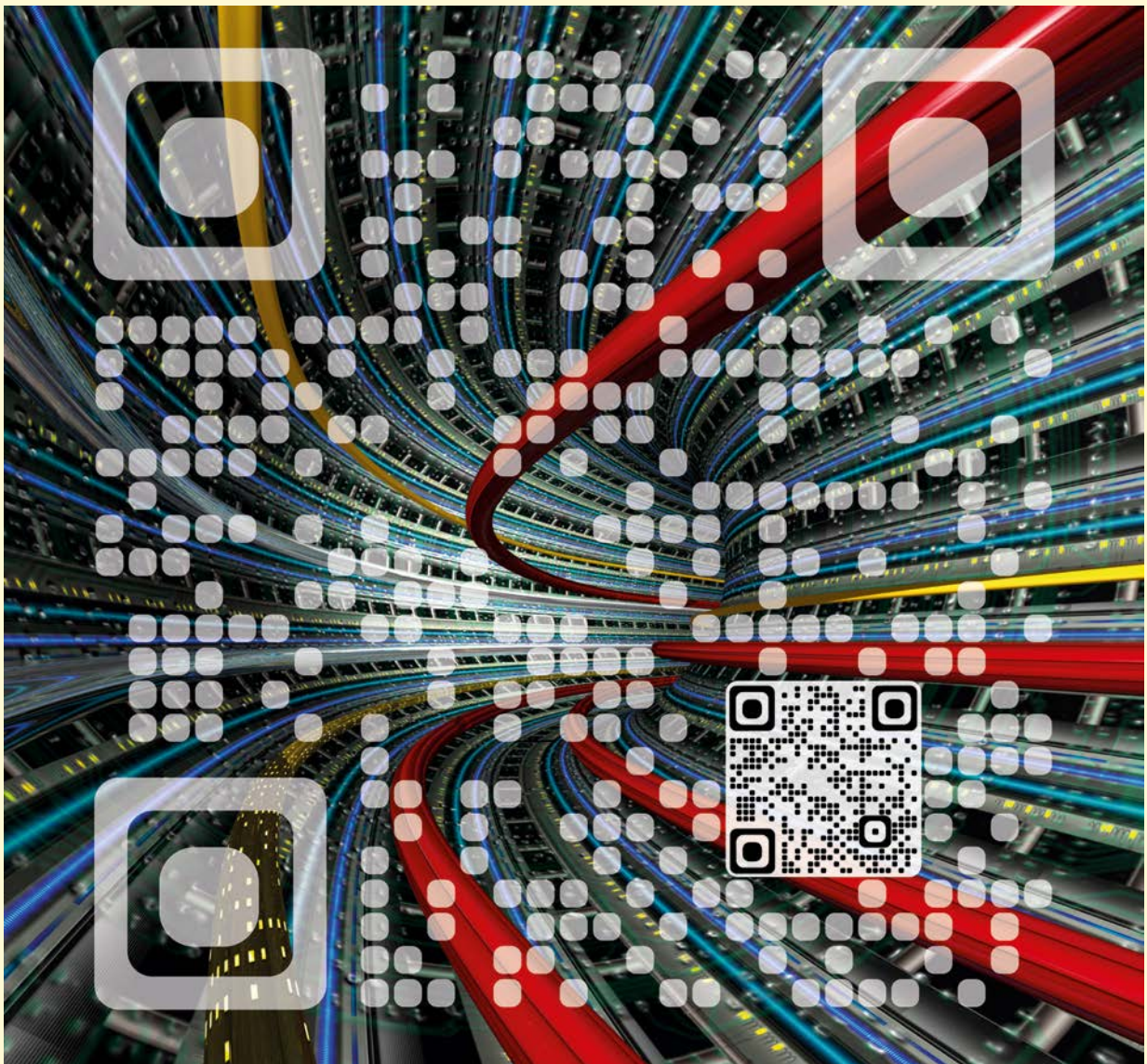


Industrial Research Institutions in Baden-Württemberg

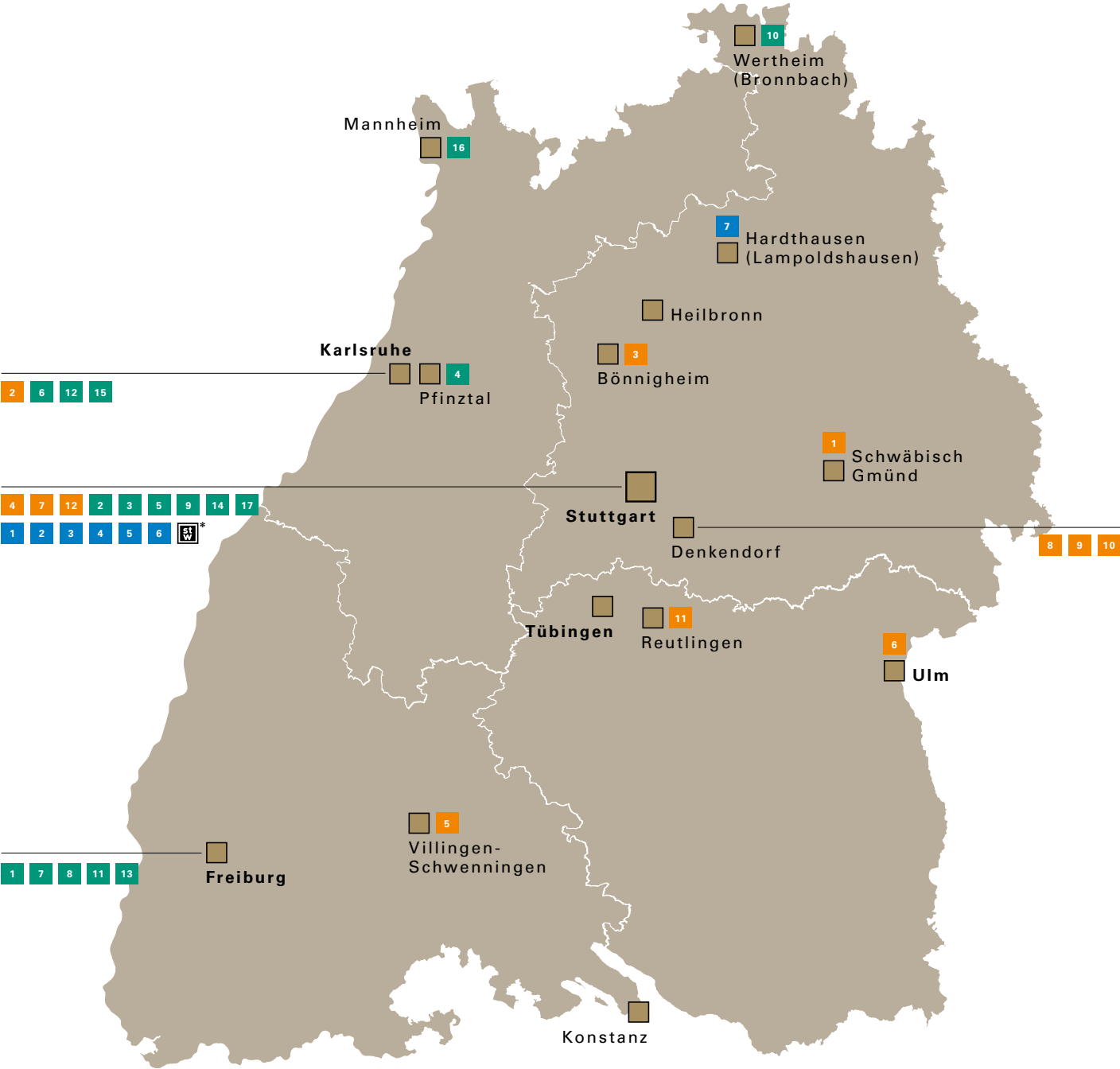
Innovation through quality workmanship







Baden-Württemberg

MINISTRY OF FINANCE AND ECONOMICS

Overview of the locations of institutes and research institutions



* Headquarter in Stuttgart, around 600 transfer institutions across the state

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Industrial research in Baden-Württemberg powerful and versatile



Industrial research is targeted towards the implementation of innovative approaches within the enterprises. Research problems are directly derived from industry requirements and the results are available for realisation in practical industry applications. Therefore, industrial research institutions make a significant contribution to economic development by combining the research and technological development of new products and production processes. At the same time they considerably contribute to the transfer of technology, which means the translation of scientific research results in added value for the economy.

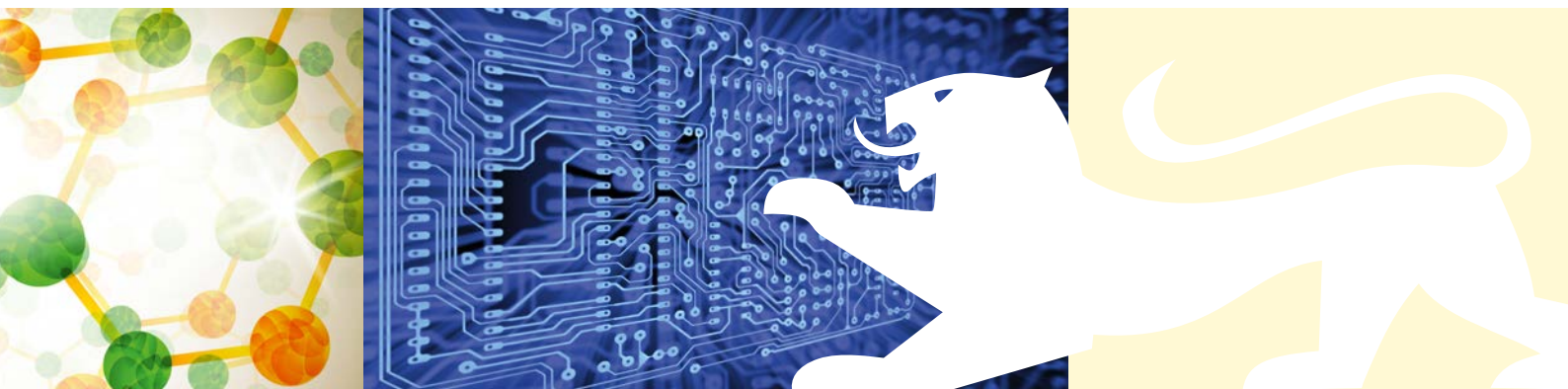
With its technology policy, the state government has been sponsoring the powerful industrial research institutions for many years.

These are:

- 12 institutes of the Innovation Alliance (innBW).
- 17 Fraunhofer organisations including 13 institutes, one branch office and 3 project groups.
- 7 institutes of the German Aerospace Center (DLR).

In addition, the almost 600 transfer centres of the Steinbeis Foundation for Economic Promotion in Baden-Württemberg are important partners in this technology transfer.

The industrial research institutions have produced a large number of ground-breaking innovations. This includes, for example, biomaterials for healing bones or web-enabled braille displays by the institutes of the Innovation Alliance, the white light emitting



diode (LED) or highly efficient solar cells by the Fraunhofer-Gesellschaft, ceramic fibre brake components, e.g. for high-speed lifts for high-rise buildings or the innovative comb-type tank for natural gas by the German Aerospace Center.

With their close industry relations the Baden-Württemberg institutes cover a wide variety of research areas. These range from production technologies to biotechnology, aerospace, information and telecommunication technology to lightweight construction, electric mobility, photonics and new materials. They cover almost all of the key technologies that are of critical importance for future technological development and thus for the competitiveness of Baden-Württemberg's industry. The research areas reflect

the wide range of industries within the state, with its huge number of small and medium-sized enterprises (SMEs). A large number of jobs are provided, for example, by the mechanical engineering, the automotive or the health industries.

In this brochure, you will find brief accounts of all the industrial research institutions in the state and also a portrait of the Steinbeis Foundation for Economic Promotion. These also include the names of contacts and details on how to obtain further information. This brochure intends to help small and medium-sized enterprises find suitable partners for cooperations to realise their innovation projects.

Innovation Alliance Baden-Württemberg (innBW)

A strong alliance for small and medium-sized enterprises

➤ We are **innovation!**



Innovation Alliance Baden-Württemberg (innBW) is an alliance of twelve industrial research institutions in Baden-Württemberg. They form an important part of the non-academic research landscape within the state. Their common goal is the transfer of knowledge to the industry and the strengthening of the state's innovative power. Support for the innBW institutes represents a key area of the state's technological policy and is an important factor of Baden-Württemberg's policy with regards to medium-sized enterprises (SMEs). The institutes closely cooperate with the state's Universities and Universities of Applied Sciences which ensures an intensive knowledge transfer from fundamental to applied research.

It is the innBW institute's goal and responsibility to accelerate the translation of research results into new products, processes and services developed by the industry. Their main target group is small and medium-sized enterprises (SMEs).

In terms of technologies, the institutes cover a broad range of disciplines: from microelectronics to micro-system technology, information technology, biotechnology and medical engineering, and even laser technology and renewable energies. With this, they make a significant contribution to the strengthening of the four growth areas of "Sustainable mobility", "Environmental technologies, renewable energies and resource efficiency", "Health and care" and "Information and communication technologies (ICT), Green IT and smart products" which are the key areas of the state government's economic policy.

With more than 1,000 employees, the innBW institutes can draw from a huge pool of competencies and expertise in the management of research and cooperation projects and so benefit from sound academic skills.

With their broad range of knowledge, their outstanding technical facilities and their transfer competence, the innBW institutes are sought-after partners for the industry, in particular for the development of high-tech products in the different subject areas.

[WWW.INNBW.DE](http://www.innbw.de)



**Research Institute for
Precious Metals and Metal
Chemistry (fem)**

Katharinenstraße 17
D-73525 Schwäbisch Gmünd
Phone +49 7171 1006-0
Fax +49 7171 1006-900
www.fem-online.de

Management:
Dr. Andreas Zielonka

Contact:
Dr. Andreas Zielonka
Phone +49 7171 1006-100
info@fem-online.de

1 Research Institute for Precious Metals and Metal Chemistry (fem)

WHO WE ARE

The Research Institute for Precious Metals and Metal Chemistry (fem) has been the only world-wide independent institute researching precious metals since 1922. Research in the fields of material science and surface technology aims to develop trend-setting solutions for the industry.

FOCUS AREAS / FIELDS OF ACTIVITY

The great variety of methods used at the fem institute allow interdisciplinary research in the field of material science and a look at the entire coating process—from material selection to pre-treatment, process selection and adjustment, material testing and layer characterisation, and surface characterisation and analyses. The fem institute is organised into five departments, each of which has specific research areas:

- **PHYSICAL METALLURGY, MATERIAL TESTING, PRECIOUS METALS RESEARCH**
New alloys and functional materials, metal curing technologies, research into casting processes, innovative production methods, joining technology and solder materials, material testing and characterisation

- **ELECTROCHEMISTRY, ELECTROPLATING, CORROSION**

Coating methods for fuel cell components, new electrolysis methods, electrode development for electrocatalysis, concepts for battery technology, new systems for energy technology, nanostructured surfaces, functionalised layer systems, new electrolyte solutions, process optimisation, simulation of deposition processes

- **LIGHT METAL SURFACE TECHNOLOGY**

Light metal materials, anodic oxidation, cleansing and pre-treatment, coatings, corrosion protection, process optimisation

- **PLASMA SURFACE TECHNOLOGY, MATERIAL PHYSICS**

PVD and PACVD layer development, plasma nitriding, wear and corrosion protection, decorative hard coatings, nanocrystalline materials, transparent plastic coatings

- **ANALYTICS**

Antimicrobial surfaces, precious metal colloids, materials recycling, control of residual soilings

The institute's service range includes material and layer characterisation, material tests, water and waste water analyses, damage events, consulting and expert opinions, quality management and contract research. For this, the institute has available comprehensive equipment with the latest devices and instruments, for example a high-resolution field emission scanning electron microscope, focused ion beam, 3D X-ray computer tomograph and X-ray diffractometer. Nearly 200 procedures and testing methods have been accredited under DIN EN ISO/IEC 17025.

TARGET GROUPS

fem's customers and partners come from all branches of the metal work industry and from all industries, from Universities, research institutions and other public institutions.



Cutting-edge research not only needs smart intellects, it also needs the best possible state-of-the-art equipment, for example focused ion beam (FIB).

FZI Research Center for Information Technology at the Karlsruhe Institute of Technology



WHO WE ARE

The FZI Research Center for Information Technology at the Karlsruhe Institute of Technology is a non-profit institution for applied research in information technology and technology transfer. Under the academic guidance of professors of different faculties, the research groups at the FZI develop concepts, software, hardware and system solutions and realise these solutions in the form of prototypes.

All areas at the FZI have been accredited under DIN EN ISO 9001:2008. The FZI headquarters are located in Karlsruhe, with a branch office in Berlin.

FOCUS AREAS / FIELDS OF ACTIVITY

The main focus of the research in the field of **ENERGY** is on the identification and utilisation of load flexibility so that consumption can be adjusted to production by using renewable sources of energy. In addition, the scientists at the FZI have been testing controllable charging processes for electric vehicles which offer great potential for future power grids.

In the field of **KNOWLEDGE AND INFORMATION SERVICES**, the FZI is involved in finding approaches for extracting knowledge from large volumes of data or from the collective intelligence of a large number of people. They also target the improvement of corporate information systems, for example by using cloud computing, including the safety mechanisms related to it for the reliable processing and use of information.

In the field of **SOFTWARE ENGINEERING**, the FZI has been working on methods and tools to create multi-platform applications, solutions for safe and reliable cloud applications and consolidating software product variations or even full product lines.

In the **HEALTH SECTOR**, the research teams at the FZI have been working on information and communication technology (ICT) that will help to improve quality of life and increase the profitability of health care institutions. Successful applications can be found, for example, in the areas of the rescue services, hospital logistics and technical assistance systems for use at home.

For efficient mobility systems, scientists from the FZI have been developing algorithms and technologies for conventional and electric vehicles in the field of **MOBILITY**, but they are also researching concepts for truly new transport systems.

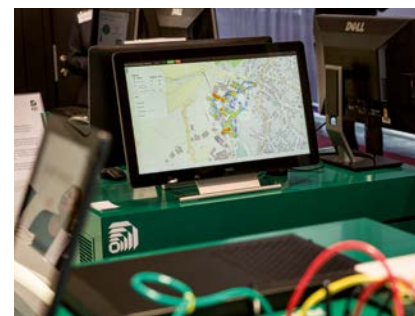
Experts in the field of **AUTOMATION AND ROBOTICS** have been working on autonomous robots for flexible production and assistance and developing concepts, methods, tools and software/hardware solutions for the development, planning, installation and safe operation of ICT automated production.

New approaches to classical issues but also to subjects such as supply-chain risks, disruption management or resilient product life cycle management are being worked out in the field of **PRODUCTION AND LOGISTICS**.

The **FZI HOUSE OF LIVING LABS** provides the opportunity for research in these fields: Equipped with the latest ICT technology and test vehicles, devices and building technology, the FZI experts develop and test new applications until they are ready for marketing, together with partners from the industry, science and society.

TARGET GROUPS

As a non-profit incorporated foundation, we work for and together with enterprises and public institutions of every size: Small enterprises and large groups, regional administrations, state, federal and EU authorities.



FZI Research Center for Information Technology at the Karlsruhe Institute of Technology

Haid-und-Neu-Str. 10-14
D-76131 Karlsruhe
Phone +49 721 9654-0
Fax +49 721 9654-909
www.fzi.de

Board:

Dipl. Wi.-Ing. Jan Wiesenberger,
Prof. Dr. Andreas Oberweis,
Prof. Dr. Ralf Reussner,
Prof. Dr.-Ing. J. Marius Zöllner

Contact:

Dipl. Wi.-Ing. Jan Wiesenberger
Phone +49 721 9654-944
wiesenberger@fzi.de



**Hohenstein Institute for
Textile Innovations (HIT)**

Schlosssteige 1
D-74357 Bönningheim
Phone +49 7143 271-0
Fax +49 7143 271-51
www.hohenstein.de

Management:
Prof. Dr. Stefan Mecheels

Contact:
Prof. Dr. Dirk Höfer
Phone +49 7143 271-0
d.hoefer@hohenstein.de

3 Hohenstein Institute for Textile Innovations (HIT)



WHO WE ARE

Here at the Hohenstein Institute for Textile Innovations (HIT), scientists focus on the industrial development of innovative textile products and applications.

FOCUS AREAS / FIELDS OF ACTIVITY

Through the close cooperation of textile engineers, chemists, health professionals, biologists and physicists, the HIT is able to develop and optimise a wide variety of products and processes for various industries.

Its involvement in national and international research networks and boards gives the HIT the opportunity to continuously extend its knowledge base and to actively shape the research landscape.

As a partner in publicly funded research projects, the Institute works on the latest scientific findings and connects these with possible applications in the industry. Its know-how also serves as the basis for market-oriented research and developments made on behalf of companies.

This is particularly true for the following areas:

- Functionalised textiles
- Smart textiles
- Medical textiles
- Hygiene and biotechnology
- Fit and workmanship
- Personal protective equipment
- Textile care
- Wear and sleep comfort
- UV protection
- Colorimetry and white metrics
- Odour analysis

TARGET GROUPS

Small and medium-sized enterprises particularly benefit from industrial solutions that are being developed by HIT's specialist teams from different disciplines. In addition to companies from the textile industry, this increasingly includes companies from the automotive, medical, investment and consumer goods industries as well.

Institute for Micro Assembly Technology, Hahn-Schickard-Gesellschaft (HSG-IMAT)

WHO WE ARE

The Institute for Micro Assembly Technology of the Hahn-Schickard-Gesellschaft (HSG-IMAT) specialises in enclosure, assembly and joining technologies for miniaturised systems on the basis of plastic components, for example moulded interconnect devices (MIDs), and has been developing new types of sensors and actuators based on these technologies. The HSG-IMAT institute is known for industry-driven application-oriented research, development and production. In cooperation with the industry, HSG-IMAT—with its application-driven research—offers a quick and flexible start with new products and technologies for small and medium-sized enterprises (SMEs). Their range of services not only includes research and development but also the rapid production of prototypes, the production of first and small series and the transfer of production technology. One of their outstanding strengths is the provision of a full-range of services including full responsibility from first idea to production. The quality management system of the HSG-IMAT has been accredited under DIN EN ISO 9001:2008.

FOCUS AREAS / FIELDS OF ACTIVITY

MID TECHNOLOGIES

- Laser MID technology (LPKF-LDS®, semi-additive)
- Chemical metal precipitation
- Hot embossing MID technology
- Printing technologies
- Alternative base materials (ceramics, thermoset material)

PLASTICS TECHNOLOGY FOR MICROCOMPONENTS

- Design
- Precision tool making
- Micro and 2K injection moulding
- Thermoset injection moulding
- Film assisted transfer moulding
- Ultra-precision machining
- Micro-optical and micro-fluid elementse

SENSORS + ACTUATORS

- Pressure sensors
- Inclination sensors
- Rotary sensors
- Capacitive sensors
- Non-contaminant pumps

PRINTED MICRO STRUCTURES

- On 2D and 3D surfaces
- Conductive track systems
- Passive components
- Chip integration
- Sensor structures
- Protective layers, masks

3D MICRO ASSEMBLY

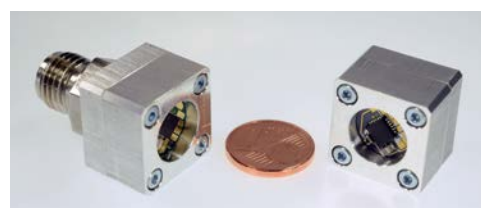
- Wire bonding technology
- Flip chip technology
- Lead-free SMD assembly (soldering, adhesive bonding)
- 3D assembly
- Precision assembly of optical ICs

MODELING + RELIABILITY

- Injection moulding simulation
- Thermomechanical simulation
- Multi-physics simulation
- Material characterisation
- Fissure and crack analyses
- Wear and ageing tests

TARGET GROUPS

Companies from the following industries: sensorics, automotive, life sciences, production and automation technology, lighting, information and communication technology



Pressure sensor on PCB and MID with enclosure



Institute for Micro Assembly Technology of the Hahn-Schickard-Gesellschaft (HSG-IMAT)

Allmandring 9 B
D-70569 Stuttgart
Phone +49 711 685-83712
Fax +49 711 685-83705
www.hsg-imat.de

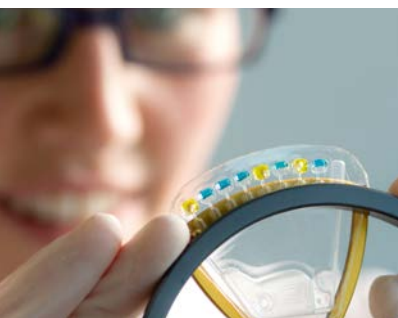
Management:

Prof. Dr. Heinz Kück

Contacts:

Dr. Wolfgang Eberhardt,
Technology department
Phone +49 711 685-83717
eberhardt@hsg-imat.de

Dr. Karl-Peter Fritz,
Devices and Systems
department
Phone +49 711 685-84792
fritz@hsg-imat.de



Institute of Microsystems and Information Technology of the Hahn-Schickard-Gesellschaft (HSG-IMIT)

Wilhelm-Schickard-Straße 10
D-78052 Villingen-Schwenningen
Phone +49 7721 943-0
Fax +49 7721 943-210
www.hsg-imit.de

Management:

Prof. Dr. Roland Zengerle
(Spokesman of the Board)
Prof. Dr. Yiannos Manoli

Contact:

Moritz Faller
Phone +49 7721 943-221
moritz.faller@hsg-imit.de

5 Institute of Microsystems and Information Technology, Hahn-Schickard-Gesellschaft (HSG-IMIT)



WHO WE ARE

The Institute of Microsystems and Information Technology of the Hahn-Schickard-Gesellschaft (HSG-IMIT) is an expert in microsystems technology and conducts industry-driven application-oriented research, and development and production. In cooperation with the industry—mainly small and medium-sized enterprises—the HSG-IMIT Institute realises innovative products and technologies. One of their outstanding strengths is the provision of a full-range of services including full responsibility from first idea to production. The quality management system of the HSG-IMIT has been accredited under DIN EN ISO 9001:2008.

FOCUS AREAS / FIELDS OF ACTIVITY

SENSOR DEVELOPMENT

- Concept and design
- Simulation
- Production
- Verification and testing

SYSTEM INTEGRATION

- Actuators
- Micro dosage
- Energy harvesting

- Sensor fusion
- Low-power electronics
- Wireless communication
- Testing systems

SENSOR AND SYSTEM PRODUCTION

- Silicon micromachining technology
- Assembly and packaging
- Process development
- Production of samples, small and medium series in accordance with DIN ISO 9001:2008.

IN-VITRO DIAGNOSIS

- Concept and design on the basis of micro-fluid platforms
- Assay development and assay integration
- Plastics engineering

TARGET GROUPS

Companies from the sectors of future technologies such as life sciences and medical engineering, sustainability, energy and environment, mobility and logistics, information and communication and the areas of mechanical engineering, automotive engineering, ventilation and air conditioning, diagnostics, aviation and safety engineering.

Institute for Laser Technology in Medicine and Measurement Technique, Ulm University (ILM)

WHO WE ARE

Founded in 1985 as a specialised institution for researching and establishing laser medicine, the Institute for Laser Technology in Medicine and Measurement Technique (ILM) now presents itself as an institute of applied optics and photonics that operates in many application areas. This wide variety becomes available through a unique range of scientific, engineering and medical competencies. It also utilises the synergies and know-how from medical and non-medical projects. The ILM's connections with the University of Ulm also allow it to offer projects for dissertations and doctoral theses.

Sophisticated research and practical developments are not at opposite ends at the ILM. Practical applications motivate research and research results form the basis for the creative development of devices.

FOCUS AREAS / FIELDS OF ACTIVITY

Their main competencies are in the optical design of devices and components, the research of optical and thermal properties of materials as a reflection of their composition and micro-structure, optical spectroscopy and the physical and biological analysis of cell and tissue effects. These competencies are used for services and the development of devices in the following areas:

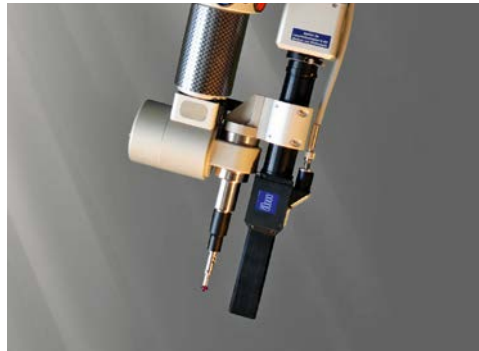
DENTAL / MEDICAL DIAGNOSTICS AND THERAPY

Development of devices and optimisation of procedures:

- For example, medical laser systems, cavity detection, intraoral measuring of teeth ("optical impression"), tissue fusion

INDUSTRIAL OPTICAL MEASUREMENT TECHNOLOGY

- 3D topology measurement
- Photothermal material analysis



3D scanner developed by the ILM, mounted to an index arm.

OPTICAL ANALYSIS FOR THE LIFE SCIENCES AND ENVIRONMENTAL SECTORS

- Probe for analysing snow profiles
- Devices for quality control in agricultural and food production

LIGHTING SYSTEMS BASED ON OPTICAL FIBRES

- For example, innovative aquarium lighting, use of sunlight

TARGET GROUPS

Due to the wide range of applications there are many opportunities for cooperation with the ILM:

■ SMALL AND MEDIUM-SIZED ENTERPRISES (SMES)

For these, the ILM often provides ideas for new products or initiates the raising of public funds.

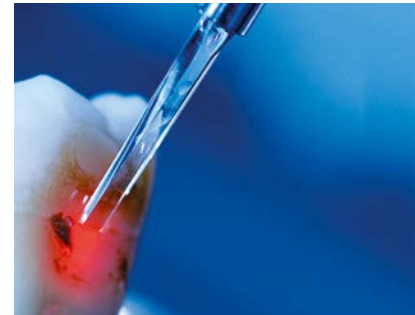
■ LARGE ENTERPRISES

Because it concentrates on its core competencies, the ILM has specific know-how that is also attractive for large corporations.

In addition to research and development services, the ILM also offers research services in the form of doctoral thesis projects at the institute.

■ COMPONENT AND SYSTEM PRODUCERS

Due to its growing network of partners, the ILM is an excellent hub where component and system producers can meet for joint projects.



Institute for Laser Technology in Medicine and Measurement Technique at the University of Ulm

Helmholtzstraße 12
D-89081 Ulm
Phone +49 731 1429-100
Fax +49 731 1429-442
www.ilm-ulm.de

Management:

Prof. Dr. Raimund Hibst

Contact:

Prof. Dr. Raimund Hibst
Phone +49 731 1429-100
raimund.hibst@ilm.uni-ulm.de



Institute of Microelectronics Stuttgart (IMS CHIPS)

Allmandring 30a
D-70569 Stuttgart
Phone +49 711 21855-0
Fax +49 711 21855-111
www.ims-chips.de

Management:

Prof. Dr.-Ing. Joachim Burghartz
Deputy:
Dr. Wolfgang Appel

Contacts:

Dr. Christine Harendt
(Silicon technology)
Phone +49 711 21855-403
harendt@ims-chips.de

Dr. Mathias Irmscher
(Nanopatterning)
Phone +49 711 21855-450
irmscher@ims-chips.de

Dr. Harald Richter
(ASICs and systems)
Phone +49 711 21855-240
richter@ims-chips.de

Markus Strobel
(Imaging sensors)
Phone +49 711 21855-280
strobel@ims-chips.de

7 Institute of Microelectronics Stuttgart (IMS CHIPS)

WHO WE ARE

The Institute of Microelectronics Stuttgart (IMS CHIPS) is involved in research, development and small series production in the areas of silicon technology, customised circuits (ASIC), nanopatterning and image sensor technology. The Institute—a non-profit incorporated foundation—sees itself as a partner of small and medium-sized enterprises (SMEs) and cooperates with internationally leading companies and sub-suppliers of the semiconductor industry.

FOCUS AREAS / FIELDS OF ACTIVITY

With its full-range CMOS microchip pilot line and modern infrastructure for nanopatterning on masks and wafer substrates, the institute is fully equipped for the production of silicon-based components by industrial standards. Laboratories for circuit development, testing and reliability testing in addition to a well-established quality assurance system complement the range. The institute has been certified in accordance with ISO 9001 and is an accredited manufacturer of microchips under QC 001002-3.

MICROELECTRONIC SYSTEMS

- Development of customised microchips (ASICs) and chip systems
- ASICs for high reliability requirements for use in space and medical engineering
- CMOS image sensors and customised camera systems with extremely high dynamic ranges (HDRC®) for medical engineering and safety monitoring in automation

- Imaging sensors for applications in thermography

SILICON TECHNOLOGY

- Certified CMOS production process for integrated circuits
- Development of production methods and production of ultra-thin microchips (Chip-film™) for flexible electronic products
- Development of customised processes
- Services for individual processes, for example epitaxy, ion implantation, oxidation, plasma etching and separation processes
- Production of wafers and chips for customised tests, measurement and calibration technology
- Add-on processes and processing of pre-processed wafers
- Packaging technology for ceramic enclosures and chip-on-board

NANOPATTERNING

- Generation of nanometre patterns on wafers and square quartz substrates by E-beam lithography
- Development of production technologies for future masks
- Production of two- and three-dimensional replication masters and nano imprint templates on Si wafers or quartz substrates
- Production of Si or Si-nitride membranes with structured absorbers such as aluminium or chromium
- Production of diffractive optical elements

TARGET GROUPS

- Users of micro electronics, in particular in small and medium-sized enterprises
- Users of complex optical components and imaging sensor technology
- Companies and research institutions as partners in publicly funded national and international projects



Vistec SB4050 E-beam writer

Institute for Textile Chemistry and Chemical Fibers Denkendorf (ITCF)



WHO WE ARE

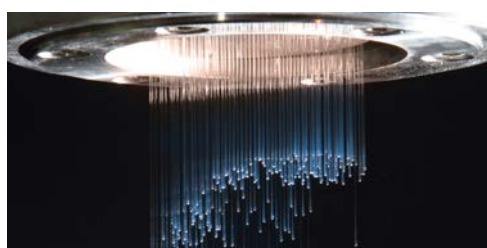
The Institute for Textile Chemistry and Chemical Fibers Denkendorf (ITCF) of the German Institutes for Textile and Fiber Research Denkendorf (DITF) is one of Europe's largest textile research centres and conducts basic and application-oriented research along the entire textile production chain. For this, the institute focuses on the development of sustainable processes and materials on the basis of synthetic and natural polymers. Among the institute's core competencies are the synthesis of (fibre) polymers, fibre production using every important spinning method, and the finishing of textiles. In 2014, the ITCF opened up the High Performance Fiber Center (HPFC) which provides the latest technologies for producing high-performance fibres. In addition, the ITCF has close academic relations with the University of Stuttgart –the director of the ITCF is also head of the University's department of macromolecular materials and fibre chemistry at the institute of polymer chemistry.

FOCUS AREAS / FIELDS OF ACTIVITY

ITCF's broad range of research can be categorised into the following three areas:

CHEMISTRY, PHYSICS AND TECHNOLOGY OF FIBRE PRODUCTION:

- Polymer synthesis up to the 20kg scale
- (Primary) spinning methods (wet spinning, dry spinning, melt spinning)
- Spinnability and fibre properties
- Structural investigations into fibres
- Fibres made of cellulose, lignin, chitin, chitosan and other biopolymers



TEXTILE FINISHING AND CHEMISTRY OF TECHNICAL TEXTILES:

- Textile finishing
- Surface modification and functionalisation
- Printing methods (traditional and digital printing)
- Coating and laminating
- Integration of functions into textiles (smart textiles)
- Cellulose and lignin chemistry

INTELLIGENT MATERIALS AND HIGH-PERFORMANCE FIBRES:

- Nanoscale materials in coatings and fibres
- Electron beam crosslinking of layers and fibres
- Carbon fibres (PAN based), but also made from alternative precursors (cellulose, lignin, polyolefin)
- Oxide and non-oxide ceramic fibres
- Functional fibres
- Composite materials, matrix polymers, fibre-based lightweight construction

TARGET GROUPS

The ITCF's expertise in chemical and material science, textile and fibre technology is interesting for both the traditional textile and fibre industry and all other industries that produce, process or use fibre-based materials, which includes such companies that deal with issues in the area of lightweight construction. The ITCF's cooperation partners are mostly large corporations, but among them are also numerous small and medium-sized enterprises, especially from the areas of textile and fibre production, aerospace technology, energy technology, automotive, medical engineering and life sciences, and also from many other industries that deal with composite materials.



Institute for Textile Chemistry and Chemical Fibers Denkendorf (ITCF)

Körschtalstr. 26
D-73770 Denkendorf
Phone +49 711 9340-101
Fax +49 711 9340-185
www.itcf-denkendorf.de

Management:

Prof. Dr. Michael R. Buchmeiser

Contact:

Dr. Bernd Clauß
Phone +49 711 9340-126
bernd.clauss@itcf-denkendorf.de
itcf-denkendorf.de



**Institute of Textile Technology
and Process Engineering
Denkendorf (ITV)**

Körschtalstraße 26
D-73770 Denkendorf
Phone +49 711 9340-0
Fax +49 711 9340-297
www.itv-denkendorf.de

Management:
Prof. Dr.-Ing. Götz T. Gresser

Contact:
Sabine Keller
Phone +49 711 9340-505
sabine.keller@itv-denkendorf.de

**9 Institute of Textile Technology and Process
Engineering Denkendorf (ITV)**



WHO WE ARE

The Institute of Textile Technology and Process Engineering (ITV) of the German Institutes for Textile and Fiber Research (DITF) is one of Europe's largest textile research centres. The ITV conducts fundamental and application-oriented research across and beyond the entire textile production chain—from raw material to final product and from idea to marketable product. Through the University's department of textile engineering, fibre-based materials and textile mechanical engineering, there are close academic connections with the University of Stuttgart.

FOCUS AREAS / FIELDS OF ACTIVITY

ITV's research focus is on the development of technical textiles for the forward-looking areas of health and medicine, mobility and traffic, environment and energy, as well as information and

communication. Production-related technology including industrial pilot plants, specialised laboratories and proprietary production and testing methods developed at ITV help to develop solutions for complex tasks from the industry.

ITV'S COMPETENCIES:

- Fibre and yarn technology
- Surface and structure technology
- Functionalisation
- Smart textiles
- Lightweight construction
- Process technology and simulation

TARGET GROUPS

Automotive/traffic, aerospace, mechanical and plant engineering, construction/architecture, energy and environmental engineering, medical engineering

Center of Management Research at the DITF Denkendorf (DITF-MR)



WHO WE ARE

Making knowledge productive—with this goal in mind, the interdisciplinary Center of Management Research of the German Institutes for Textile and Fiber Research in Denkendorf (DITF-MR) has successfully supported companies from the textile industry in the development of new products and services for more than 25 years. Among DITF-MR's core competencies are the analysis of processes and their design, modelling, implementation and control.

FOCUS AREAS / FIELDS OF ACTIVITY

DITF-MR's key applications include:

INNOVATION MANAGEMENT

- Innovation and creativity methods
- Trends, scenarios and the development of business areas
- Integration of customers into innovation processes
- Collaborative innovation in networks

DESIGN AND DEVELOPMENT

- Digital printing
- Customised product design
- Communities and open innovation
- Web 2.0 technologies



MANAGEMENT OF ADDED VALUE IN NETWORKS

- Work organisation, working time and shift models
- Process-based knowledge management
- Value adding concepts for niche markets
- Dynamic value adding networks

SUSTAINABILITY AND INTELLIGENT ENERGY MANAGEMENT

- Energy monitoring
- Life cycle assessment and energy balancing
- Resource-efficient process management

DEVELOPMENT AND ADAPTION OF MANAGEMENT METHODS AND IT-BASED TOOLS FOR THE TEXTILE INDUSTRY

- Service-orientation
- Risk, quality and environmental management
- Organisational learning and knowledge management
- Process modelling and simulation
- New business models
- Training and E-learning
- IT services

TARGET GROUPS

The research and development activities of the DITF-MR are primarily targeted at small and medium-sized enterprises (SMEs) in the textile and clothing industries. In the textile sector and for innovative applications, the DITF-MR has been widely recognised as an experienced research and development service provider. As a direct contractor or within publicly funded research projects, the DITF-MR develops individual, technical and organisational solutions together with its partners, and brings together SMEs and new methods and technologies from various disciplines.



Center of Management Research at the DITF Denkendorf (DITF-MR)

Körschtalstr. 26
D-73770 Denkendorf
Phone +49 711 9340 299
Fax +49 711 9340 415
www.ditf-mr-denkendorf.de

Management:

Prof. Dr. rer. pol., Dipl.-Ing.
Meike Tilebein

Contact:

info@ditf-mr-denkendorf.de



**NMI Natural and Medical
 Sciences Institute at the
 University of Tübingen**

Markwiesenstr. 55
 D-72770 Reutlingen
 Phone +49 7121 51530-0
 Fax +49 7121 51530-16
 www.nmi.de

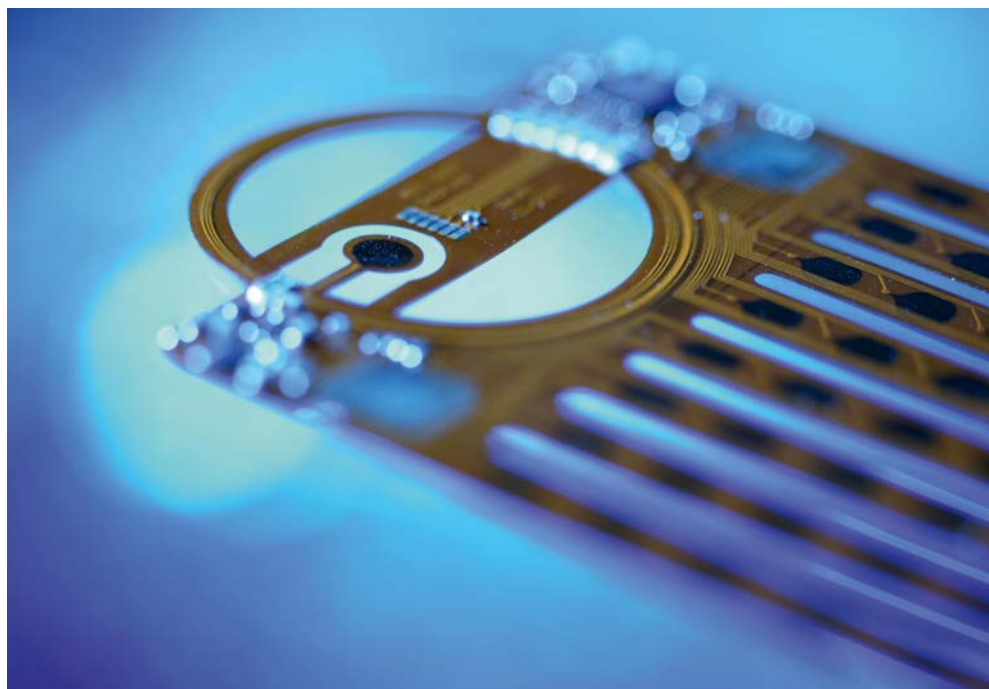
Management:

Prof. Dr. Hugo Hämmerle

Contact:

Dr. Nadja Gugeler
 Phone +49 7121 51530-842
 nadja.gugeler@nmi.de

**11 NMI Natural and Medical Sciences Institute at the
 University of Tübingen**



WHO WE ARE

The Natural and Medical Sciences Institute (NMI) conducts application-oriented research where biosciences and material sciences meet and provides a unique interdisciplinary range of competencies for its research, development and other services. The NMI is well-known even beyond the region for its business incubator concept for start-up companies in the area of bioscience and material science.

FOCUS AREAS / FIELDS OF ACTIVITY

PHARMA AND BIOTECHNOLOGY

Development of biochemical, molecular and cell-biological assays. In this respect, the NMI offers high quality customised solutions. Topics: Biomarkers and multiplex immunoassays, proteomics and bioanalysis, molecular cell biology, electrophysiology, in vivo and in vivo-like model systems

BIOMEDICAL TECHNOLOGY

Forward-looking technologies and new approaches, for example the biologisation of medical engineering
 Topics: Micromedicine and neurotechnology,

regenerative medicine and biomaterials, technologies for medical devices (optimisation, qualification and standardised testing)

SURFACE AND MATERIAL TECHNOLOGY

Material analysis and analysis of interface phenomena, structuring and functionalisation of materials and their surfaces: Microsystem technology, micro and nanoanalysis, production and testing of functional surfaces and layers, bonding systems and tests, tribology

TARGET GROUPS

Small and medium-sized enterprises (SMEs) as well as international corporations, Universities and other research institutes, state agencies with a need for research and development in the following areas:

- Health industry: Medical engineering, biotechnology and pharmaceutical industry
- Mechanical engineering, tool making and automotive

Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW)



WHO WE ARE

The Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW) is one of the leading institutes for applied research in the areas of photovoltaics, renewable fuels, energy storage, battery and fuel cell technology and energy system analysis. The goal of the institute is the development of technologies for the sustainable and climate-friendly provision of power, heat and fuels. With its three locations in Stuttgart, Ulm and Widderstall, the ZSW bridges the gap between basic academic research and industrial practice. The institute was founded in 1988 as a non-profit incorporated foundation.

FOCUS AREAS / FIELDS OF ACTIVITY

PHOTOVOLTAIC MATERIAL RESEARCH:

The focus of photovoltaic material research at the ZSW is on CIGS thin-film technologies. With its world record efficiency, the ZSW managed to reach the top position internationally in the area of CIGS. The institute also develops system components for complete photovoltaic plants and—together with partners from the industry—makes them ready for series production.

PHOTOVOLTAIC SYSTEMS:

The ZSW has been intensively working on processes to integrate photovoltaic power into the grid, an optimised utilisation of storage devices as well as generation and load management. In the “Solab” test lab, we also test the function, stability and durability of solar modules. Long-term field tests are conducted at our sites in Widderstall and Girona, Spain.

FUELS / HYDROGEN:

Since its foundation, the ZSW has researched chemical energy sources such as hydrogen or synthetic methane for storing energy and for making available CO₂ neutral fuels. Among the largest current projects are large-scale systems for the seasonal storage of green electricity (Power-to-Gas P2G®), the thermochemical conversion

of biogenic resources, fuel reformation and electrolysis.

ENERGY STORAGE IN BATTERIES AND SUPERCAPACITORS:

The Institute’s activities cover the full range—from the development of new storage materials to battery system technologies, and functional and safety tests in Europe’s largest battery research centre “eLaB”. This lab is used to research lithium-ion batteries for the decentralised storage of electric mobility. In addition, companies can test active materials, processes and plant components in a process-capable environment and develop close-to-series production methods.

FUEL CELLS:

The focus of development are high-performance fuel cells that convert hydrogen into power and heat, which are highly efficient and free from emissions. The ZSW’s activities cover all aspects of the technology: from modelling to component optimisation and integration and the demonstration of prototype systems for mobile and stationary applications.

SYSTEM ANALYSIS:

The ZSW uses scenarios to develop strategies for the energy turnaround. As contractors of the state and federal government, scientists monitor the energy turnaround and the relevant instruments for this. The ZSW further coordinates the workgroup of renewable energies statistics (AGEE-Stat) that continuously assesses progress with respect to renewable energies.

TARGET GROUPS

- State and federal government and European Commission
- Research sponsoring organisations
- Medium and large industrial enterprises



Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW)

Industriestraße 6
D-70565 Stuttgart
Phone +49 711 7870-0
Fax +49 711 7870-100
www.zsw-bw.de

Management:

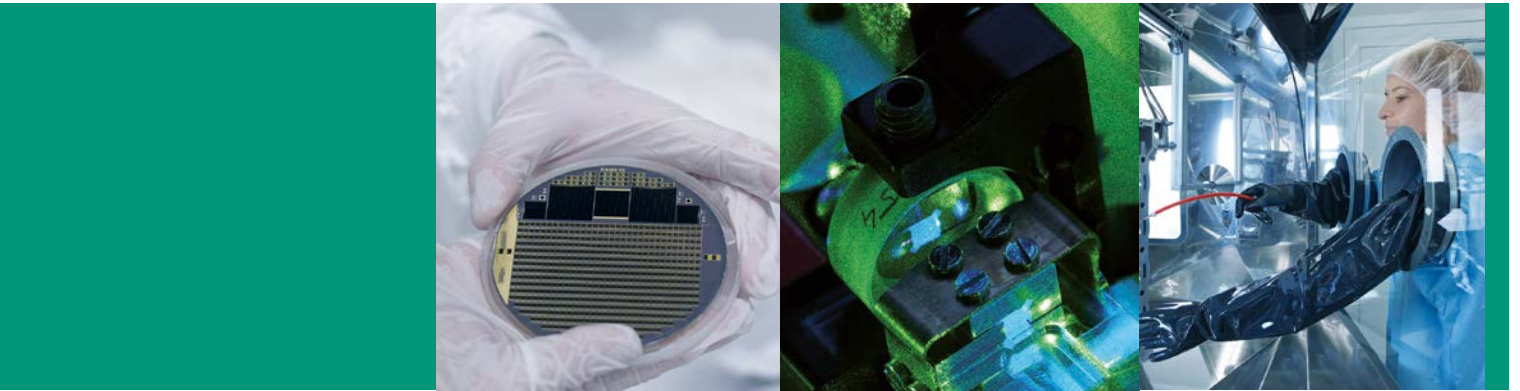
Prof. Dr. Frithjof Staiß
Prof. Dr. Werner Tillmetz
Prof. Dr. Michael Powalla

Contact:

Claudia Brusdeylins
Phone +49 711 7870-278
claudia.brusdeylins@zsw-bw.de

Fraunhofer-Gesellschaft

Largest organisation for applied research in Europe



Research on practical applications is a central task of Fraunhofer-Gesellschaft. Founded in 1949 as a non-profit research organisation, Fraunhofer-Gesellschaft currently operates 67 institutes and research institutions at locations all over Germany where it conducts application-oriented research in science and engineering areas that are relevant for the industry. By developing system and technology-oriented innovations, the Fraunhofer institutes contribute to the companies' competitiveness. More than 23,000 employees generate an annual sales volume of more than EUR 2 billion. This means that Fraunhofer-Gesellschaft is Europe's largest organisation providing research and development services.

17 research institutions are located in Baden-Württemberg. These also include the three project groups that were funded by the state government during their start-up phases: New Drive Systems (NAS), Processing Technologies in Lightweight Construction (BTL) and Automation in Medicine and Biotechnology (PAMB).

With more than 5,000 employees—approximately a fifth of the total Fraunhofer staff—Baden-Württemberg is the strongest Fraunhofer location in Germany. Six research institutions alone are located in Stuttgart; there are a further five in Freiburg and a total of three in the city of Karlsruhe.

The research spectrum of the Fraunhofer institutes ranges from production, material and surface technology to information, communication and media technology, biotechnology, solar technology and construction research. With this, the Fraunhofer research institutions cover the entire range of modern key technologies in Baden-Württemberg.

WWW.FRAUNHOFER.DE

1 Fraunhofer Institute for Applied Solid State Physics IAF

WHO WE ARE

The Fraunhofer Institute for Applied Solid State Physics IAF is among the leading research institutions world-wide in the areas of III-V semiconductors and diamonds. It develops electronic and optoelectronic components on the basis of modern semiconductor materials. The Institute's research results are used in areas such as security, energy, communication, health and mobility.

FOCUS AREAS / FIELDS OF ACTIVITY

With its research and development work, the Fraunhofer IAF covers the entire value adding chain—from material research to design, technology and circuits, and even modules and systems. The five divisions of the Institute continuously develop and advance technologies and systems and in close cooperation with companies translate their research results into marketable products.

POWER ELECTRONICS

Based on gallium nitride, we create high-performance transistors and monolithic integrated circuits. Using high electron mobility transistors, the Institute can realise power electronics for operating frequencies of 1 MHz to 100 GHz. With its development of compact robust and cost-efficient microelectronics for high power spectrums, the IAF drives the efficient use of renewable energies.

SEMICONDUCTOR LASERS AND LEDS

The Institute develops and produces infra-red semiconductor lasers as well as laser systems for wave lengths from 2 to 11 μm and allows the realisation of LEDs for the blue to ultraviolet spectral range. For this, the IAF uses its lasers to detect hazardous substances, for example to monitor fresh water or to detect explosives.

GAS AND LIQUID SENSORS

Using modern materials such as diamond, the Institute realises various micro and nanosensors. The diamond produced in-house is of the highest

quality and due to its outstanding physical properties it is suited for many different applications—for example for high-energy lenses for laser optics, as a radiation-proof detector material for X-ray light and for scalpels in ophthalmology.

HIGH-FREQUENCY ELECTRONICS

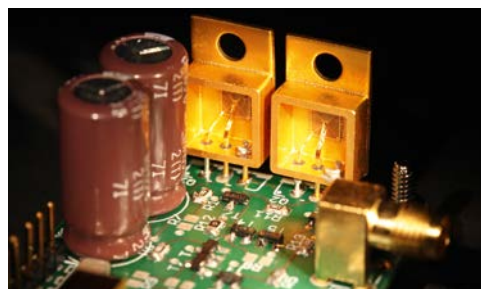
IAF's electronic integrated circuits are characterised by their high performance, with frequencies even beyond 600 GHz. With a sophisticated nanometre scale technology, it creates InAs-based monolithic integrated millimetre-wave circuits.

PHOTO DETECTORS

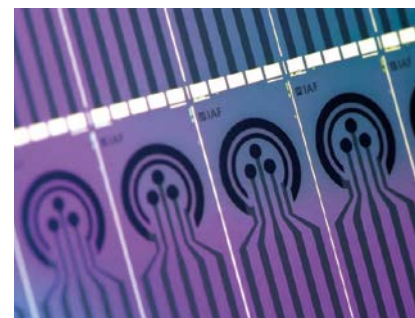
Other key research areas of the Fraunhofer Institute are detectors with a high spatial resolution and the ability to detect infrared radiation of different wave lengths at the same time and the development of detectors for the ultra-violet spectral range.

TARGET GROUPS

Producers and users of micro and optoelectronic components on the basis of compound semiconductors or diamond.



Amplifier modules based on gallium nitride allow for the designing of compact and energy-efficient voltage converters for high electric power.



Fraunhofer Institute for Applied Solid State Physics IAF

Tullastraße 72
D-79108 Freiburg
Phone +49 761 5159-0
Fax +49 761 5159-400
www.iaf.fraunhofer.de

Management:

Prof. Dr. rer. nat.
Oliver Ambacher

Contact:

Julia Roeder
Phone +49 761 5159-450
julia.roeder@iaf.fraunhofer.de



**Fraunhofer Institute for
Industrial Engineering IAO**

Nobelstraße 12
D-70569 Stuttgart
Phone +49 711 970-01
www.iao.fraunhofer.de

Management (provisional):
Prof. Dr.-Ing. Wilhelm Bauer

Contact:
Dipl.-Ing. (FH) Juliane Segedi
Phone +49 711 970-2124
presse@iao.fraunhofer.de

2 Fraunhofer Institute for Industrial Engineering IAO



WHO WE ARE

The Fraunhofer Institute for Industrial Engineering IAO has been dealing with current issues surrounding the working population. The combination of management and technological competencies ensures that economic success, the interests of employees and the social effects are all equally considered.

The work at Fraunhofer IAO is founded on the firm opinion that entrepreneurial success in times of global competition mainly means using technological potential profitably.

Through close cooperation with the Institute for Human Factors and Technology Management (IAT) of the University of Stuttgart, Fraunhofer IAO combines basic academic research with application-oriented science and business practice.

FOCUS AREAS / FIELDS OF ACTIVITY

With practical solutions, forward-looking technologies and individual strategies, Fraunhofer IAO promotes the competitiveness of enterprises, public institutions and administrations in dynamic markets and a changing working environment. The Institute particularly supports companies in the areas of organisation, qualification and technology so that they recognise the potential of innovative forms of organisation and trendsetting information and communication technologies and customise

them to their needs and use them consistently. For this, the Institute develops, realises and optimises processes, products and plants until they are ready for use and marketable in order to generate a permanent competitive edge. Customers of the Fraunhofer IAO benefit from the Institute's long-term expertise from many projects in the business areas below:

- Corporate development and work design
- Service and human resources management
- Engineering systems
- Information and communication technology
- Technology and innovation management
- Mobility and urban systems engineering

These services are complemented by a comprehensive range of qualification measures, seminars, forums and workshops as well as individual training measures. Numerous publications help to make available the knowledge and expertise of the Fraunhofer IAO for the wider public.

TARGET GROUPS

Fraunhofer IAO provides research services. The Institute's service portfolio ranges from pre-competitive and contract research to individual consulting services for companies and public institutions. Research projects are carried out in close cooperation with the sector of medium-sized enterprises or as contractors for large corporations. The Institute is involved in publicly funded research programmes of the Federal Ministry of Education and Research (BMBF) and the German Research Foundation (DFG), programmes of the European Union as well as regional programmes funded by the administration of the state of Baden-Württemberg.

WHO WE ARE

The Fraunhofer Institute for Building Physics focuses on the research, development, testing, demonstration and consulting in the field of building physics. This includes, for example, noise control and sound insulation measures in buildings, measures for boosting the energy efficiency and optimisation of lighting technology, issues of indoor climate control, hygiene, health protection and building material emissions, as well as protection against heat, moisture and the elements, the preservation of building structures and the conservation of historic monuments.

By applying integrated assessment methods, products, processes and services are analysed under ecological, social and technological aspects in order to evaluate the sustainability, sustainable optimisation and promotion of innovation processes. The research areas of building chemistry, building biology and hygiene as well as the field of concrete technology complete the Institute's service range in building physics.

The Institute's Kassel branch also supports the conventional methods of efficient energy utilisation and provides key expertise in the development of building system components. The "Systems Integration in Efficient Buildings" research team—affiliated with the department of indoor environment and based at our Nuremberg branch—works on integrated solutions for buildings. In a collaboration project between Fraunhofer IBP, the Rosenheim University of Applied Sciences and the Institute for Windows Technology ift Rosenheim, the Fraunhofer Center Building Technology in Rosenheim develops and designs innovative building concepts and optimized components for both new and existing buildings.

FOCUS AREAS / FIELDS OF ACTIVITY

Powerful laboratories and testing facilities and also the largest known outdoor testing site at the Holzkirchen location allow for complex tests with regards to building physics. Modern laboratory measurement technologies and calculation methods are used in the development processes and to optimise building products for their practical application. Studies in model rooms, in test facilities and of finished objects are conducted to test components and full systems in terms of building physics for both new buildings and reconstruction projects. Fraunhofer IBP is approved by the German building inspection authorities to test, monitor and certify building materials and building designs in Germany and Europe. Four test laboratories of the Institute are accredited by the Deutsche Akkreditierungsstelle GmbH (DAkkS) under DIN EN/ISO/IEC 17025.

The motto of "Building on knowledge" represents the basis of the research and development activities and includes academic teaching which is covered by the professorships at the departments of building physics at the TUM in Munich and the University of Stuttgart. The post-grad qualification programmes "Climate – Culture – Building" and "People Inside" involve fundamental research in climate adapted construction and the interaction between rooms and people.

TARGET GROUPS

Fraunhofer IBP cooperates with partners from the industry with respect to the launching of new environmentally friendly building materials, components and systems. The Institute's traditional customers are mainly companies from the construction industry, from mechanical and plant engineering, contractors, architects, planners and authorities, and public and private construction-related research institutions. The cross-sectoral application of our competencies in the area of building physics allows the inclusion of partners from the automotive and aerospace industries.



Fraunhofer Institute for Building Physics IBP

Nobelstr. 12
D-70569 Stuttgart
Phone +49 711 970-00
Fax +49 711 970-3395
www.ibp.fraunhofer.de

Management:

Prof. Dr.-Ing.
Klaus Peter Sedlbauer

Contact:

Dipl.-Journ. Janis Patrick Eitner
Head of corporate communications
Phone +49 8024 643-203
info@ibp.fraunhofer.de


**Fraunhofer Institute for
Chemical Technology ICT**

Joseph-von-Fraunhofer-Str. 7
D-76327 Pfinztal
Phone +49 721 4640-0
Fax +49 721 4640-111
www.ict.fraunhofer.de

Management:
Prof. Dr.-Ing. Peter Elsner

Contact:
Dr. Stefan Tröster
Phone +49 721 4640-392
stefan.troester@ict.fraunhofer.de
ict.fraunhofer.de

4 Fraunhofer Institute for Chemical Technology ICT

WHO WE ARE

The Fraunhofer Institute for Chemical Technology ICT in Pfinztal near Karlsruhe works on solutions that mainly target industrial applications. Developments are supported from the initial idea to fundamental research, application-oriented research and the realisation of customised pilot level applications.

These solutions can be found in applications in the following sectors:

- Automotive and transport
- Energy and environment
- Chemistry and process engineering
- Defence, safety and security

CORE COMPETENCIES OF FRAUNHOFER ICT

POLYMER ENGINEERING

- Polymer and additive synthesis
- Polymer treatment (process technology, twin-screw extruder, compounds)
- Polymer processing (dispersion, functionalisation, particle and extrusion foams, direct processes, foam injection moulding, local reinforcement, long fibre reinforced components, preform and high-pressure infusion strategies)
- Microwaves and plasmas
- Online process monitoring
- Recycling

CHEMICAL ENGINEERING

- Continuous process control and microprocess engineering
- Chemical products made from renewable materials
- Risk-prone and high-pressure processes
- Separation methods
- Process analysis and process control
- Particle technology, formulation, compounding

ENERGY SYSTEMS

- Development of materials for electrochemical energy storage devices and converters, thermal storage, chemical energy storage

- Design and characterisation of battery storage systems (Li-Ion, Redox-Flow), direct alcohol fuel cell systems, thermal storage

ENVIRONMENTAL ENGINEERING

- Biorefinery processes (downstreaming / filtration, bioeconomy)
- Development of customised endurance tests for sustainability (biopolymers, biogas)
- Life Cycle Assessment (LCA); eco-design
- Energy-efficient processes (latent heat storage systems, insulation material made of Nawaro)
- Resource efficiency
- Environmental simulation

EXPLOSIVES ENGINEERING

- Research and development of new substances, processing methods and applications in the area of explosives
- Goals: The improvement of performance, lower vulnerability, sustainable raw material base, long life time, cost-efficient production
- Process chain: From raw material to prototype (rocket fuels, barrel-type weapon propellant, explosives, pyrotechnical blends)

TARGET GROUPS

Fraunhofer ICT provides its research and development services to companies from the automotive, chemical and pharmaceutical, plastic processing, safety and security, defence and aerospace industries. The Institute is available for both publicly funded cooperation projects (at national or European level) and direct bilateral contract research. It also supports project partners (especially small and medium-sized enterprises (SMEs)) by joint applications and project management services.



In this two-stage demonstration plant, warehouse biowaste—fruit and vegetables—is used to generate biogas. After purification, biomethane is used as a fuel for vehicles operated by compressed natural gas.

WHO WE ARE

The Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB develops and optimises processes and products in the fields of medicine, pharmaceuticals, chemistry, environment and energy. One of our strengths is that we offer a full-range of solutions from laboratory scale to pilot plant.

FOCUS AREAS / FIELDS OF ACTIVITY

The Institute combines academic quality and professional know-how in the fields of interfacial engineering and materials science, molecular biotechnology, physical process technology, environmental biotechnology and bioprocess engineering, and cell systems—always with a view to achieving profitability and sustainability. Customers benefit from the constructive cross-discipline cooperation at Fraunhofer IGB that opens up new approaches in areas such as medical engineering, nanotechnology, industrial biotechnology or environmental technology.

MEDICINE

- Regenerative medicine
- Diagnostics
- Medical engineering

PHARMACEUTICS

- Drug screening and validation
- Development and production of active ingredients
- Formulation

CHEMICALS

- Biobased chemicals and materials
- Functional surfaces and materials
- Process intensification and integration

ENVIRONMENT

- Recovery of secondary raw materials
- * Improvement of resource efficiency
- * Water treatment

ENERGY

- Sustainable energy conversion
- Energy efficiency through process optimisation
- Energy storage

TARGET GROUPS

In addition to public institutions, the customers of Fraunhofer IGB include industrial enterprises from the biotechnology, pharmaceutical, medical and medical engineering, food, chemical and environmental technology industries and from plant engineering.



Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB

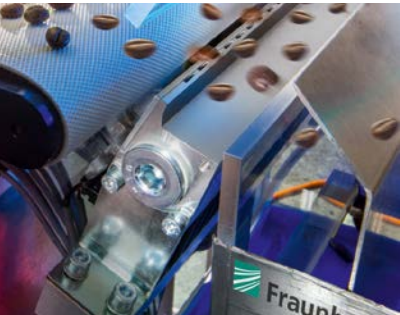
Nobelstraße 12
D-70569 Stuttgart
Phone +49 711 970-4401
Fax +49 711 970-4200
www.igb.fraunhofer.de

Management:

Prof. Dr. Thomas Hirth

Contact:

Dr. Claudia Vorbeck
Phone +49 711 970-4031
claudia.vorbeck@igb.fraunhofer.de



Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB

Karlsruhe site

Fraunhoferstraße 1
D-76131 Karlsruhe
Phone +49 721 6091-0
Fax +49 721 6091-413
www.iosb.fraunhofer.de

Management:

Prof. Dr.-Ing. habil.
Jürgen Beyerer

Contact:

Dipl.-Ing. Sibylle Wirth
Phone +49 721 6091-300
sibylle.wirth@iosb.fraunhofer.de

6 Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB



The SmartControlRoom—a sensitive room that “thinks” and reacts to gestures—is the workplace of the future.

WHO WE ARE

The Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB researches and develops multi-sensor systems that help humans to observe their environment and assists with their interactions. This starts with the generation and automated analysis of aerial photographs and satellite images, for example of disaster areas, and includes sorting and the quality control processes of bulk goods such as coffee beans or minerals. Fraunhofer IOSB assists the Ministry of Defence by acting as a technological consultant and supplies systems for reconnaissance and command.

If a situation becomes too speedy for humans, too dangerous or if access is impossible, for example under water or in contaminated areas, mobile robots can be used to carry sensors to survey a current situation. Transparent and interactive video systems provide more protection and safety. All these systems are connected by the latest information technology systems for which the Institute also develops and offers cyber security solutions.

Fraunhofer IOSB further develops software for the planning, control and operation of industrial production processes. It has highly sophisticated web technology available for managing information in complex database systems. This includes, for example, the collection of environmental data or energy management data as well as their intelligent combination and analysis.

FOCUS AREAS / FIELDS OF ACTIVITY

- Automation
- Inspection and visual examinations
- Energy, water and environment
- Civil safety and security
- Defence

TARGET GROUPS

Whether they come from the industry, small and medium-sized enterprises (SMEs) or industry associations—Fraunhofer IOSB intends to sustainably improve Baden-Württemberg’s attractiveness as an industrial location in cooperation with them.

Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut EMI

WHO WE ARE

The Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI with locations in Freiburg, Efringen-Kirchen and Kandern examines high-speed processes within a broad speed range, usually between 10 and 10,000 m/s. The Institute deals with impact, shock and penetration phenomena across different disciplines and materials by conducting experiments and simulations.

As an institute of the Fraunhofer-Gesellschaft, its main focus is on applied research and close cooperation with the industry. As part of an excellent network of research institutions, Fraunhofer EMI is a competent partner for the industry both nationally and internationally.

FOCUS AREAS / FIELDS OF ACTIVITY

SPACE:

- Hypervelocity impact experiments
- Protection of spacecraft against meteorites / space debris
- Software to calculate the probability of satellite failures
- Examination of options for defence against asteroid impact
- Geoscience studies on the impact of meteorites and crater research
- Development of microsatellites and their potential for use in disaster events

DEFENCE:

- Development, testing and analysis of protection technology for land, air and sea-based platforms
- Personal protective equipment
- Missile defence in simulations and experiments
- Provision of analysis and consulting skills for ministries and security agencies

SECURITY:

- Risk and resilience analysis and evaluation of critical infrastructures and other relevant socio-technological systems
- Development of academic engineering solutions to improve the resilience of security-critical / vulnerable systems, from high-rise buildings to tunnels and airports
- Protective and reinforcement concepts for buildings to reduce damage in the case of impact events
- Sensor technology for evaluating damage events on buildings or tunnels
- Security research at national and international level

TRANSPORT:

- Crash centre to improve vehicle safety: Component and vehicle crash test facility
- Characterisation and numerical modelling of modern materials and components to improve crash safety in transport
- Standardised, non-destructive and destructive test methods
- Micro and nanostructure analysis methods
- Numerical simulation of crash events

TARGET GROUPS

Automotive industry and suppliers, aerospace industry, enterprises in the security and defence industries, authorities in the area of internal and external security, small and medium-sized enterprises



Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut EMI

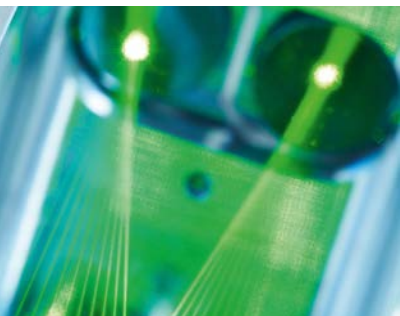
Eckerstraße 4
D-79104 Freiburg
Phone +49 761 2714-0
Fax: +49 761 2714-400
www.emi.fraunhofer.de

Management:

Prof. Klaus Thoma

Contact:

Birgit Bindnagel, Press and
Public Relations
Phone +49 761 2714-366
birgit.bindnagel@emi.fraunhofer.de



**Fraunhofer Institute for
Physical Measurement
Techniques IPM**

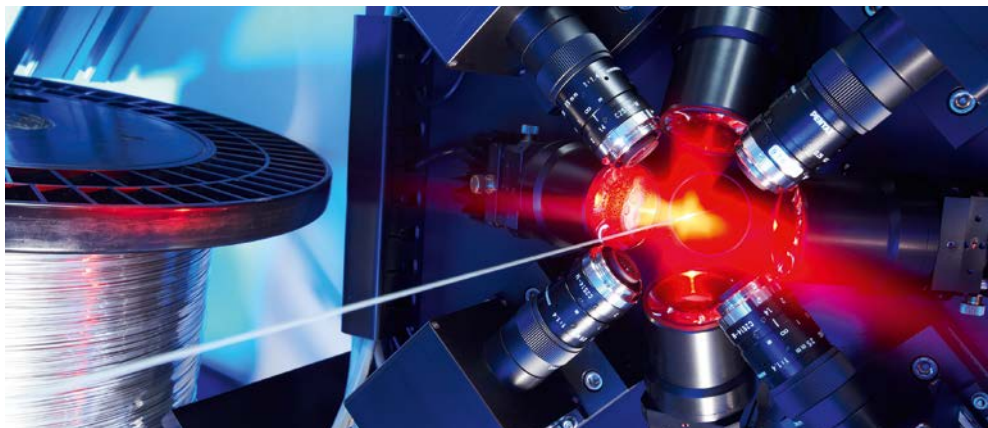
Heidenhofstr. 8
D-79110 Freiburg
Phone +49 761 8857-0
Fax +49 761 8857-224
www.ipm.fraunhofer.com

Management:
Prof. Dr. Karsten Buse

Contact:
Holger Kock
Phone +49 761 8857-129
holger.kock@ipm.fraunhofer.de

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Fraunhofer Institute for Physical Measurement Techniques IPM



The WIRE-AOI wire inspection system produces approximately 40,000 analysed images per second with its four cameras. This allows quality control for the entire wire surface in real-time.

WHO WE ARE

The Fraunhofer Institute for Physical Measurement Techniques IPM develops customised measurement techniques, systems and materials for the industry.

FOCUS AREAS / FIELDS OF ACTIVITY

The Institute has many years of experience in working with optical technologies and functional material and this forms the basis for the high-tech solutions in its five divisions:

■ PRODUCTION CONTROL

For production control, Fraunhofer IPM develops optical systems and imaging procedures that can be used to analyse surfaces and 3D structures in production and to control processes. These systems measure so quickly and so precisely that little defects or impurities can be detected even with extremely high production rates.

■ MATERIALS CHARACTERISATION AND TESTING

The Institute develops measurement systems for materials characterisation and testing on the basis of terahertz and microwaves. This terahertz know-how can also be used to characterise the behaviour of materials in very rapidly alternating fields (for example for electro-optical modulators).

■ OBJECT AND SHAPE DETECTION

Fraunhofer IPM develops laser scanners and custom-tailored lighting and camera systems for quick and precise three-dimensional geometry and position detection of objects in the environment—also from moving platforms.

■ GAS AND PROCESS TECHNOLOGY

Among others, the Institute's competencies in the areas of gas and process technology include laser spectroscopic methods for gas analysis, energy efficient gas sensors, particle measurement for respirable dust analysis, process measurement technology and the characterisation of laser materials.

■ ENERGY SYSTEMS

Convert lost heat energy into power—this issue is researched by the IPM using thermoelectric methods. This involves material research, the development of thermoelectric modules and their simulation and also thermoelectric measurement technology.

TARGET GROUPS

here are hardly any production companies that can do without sophisticated measurement technology. Measurement means control and optimisation. Fraunhofer IPM develops customised solutions for the industry—from small sensors to complex ready-to-use systems.



The "CoWeldRob" welding robot assistant guarantees consistent high quality welding results by automatic programme generation and process control.

WHO WE ARE

The Fraunhofer Institute for Manufacturing Engineering and Automation IPA was founded in 1959. It is one of the largest institutes of the Fraunhofer-Gesellschaft.

FOCUS AREAS / FIELDS OF ACTIVITY

The Institute is organised into 14 specialist departments operating in the fields of corporate organisation, surface engineering, automation and process technology. Its R&D activities focus on organisational and technological issues in the area of production. In its research and development projects it intends to identify and utilise the automation and rationalisation potential in companies in order to retain or improve the competitiveness of and jobs in these companies through improved, more cost-efficient and environmentally friendly production processes and products.

LIGHTHOUSE PROJECTS:

S-TEC, ARENA2036, FastStorage BW, M2OLIE
Focus: Industry 4.0

TARGET GROUPS

Fraunhofer IPA has accepted the challenge and current topics and identified five future-oriented industries for its research and development activities. Five divisions are working on these topics across all departments:

- Automotive
- Machinery and equipment industry
- Electronics and microsystems
- Power industry
- Medical engineering and biotechnology

This results in synergies and allows Fraunhofer IPA to perfectly adjust itself to the needs of its customers from the industry.



Fraunhofer Institute for Manufacturing Engineering and Automation IPA

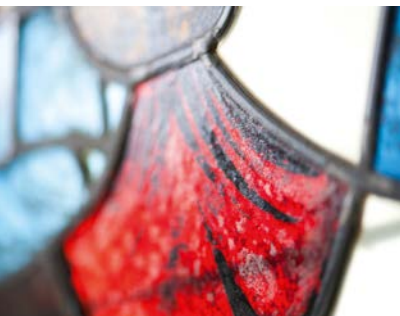
Nobelstraße 12
D-70569 Stuttgart
Phone +49 711 970-1611
Fax +49 711 970-1400
www.ipa.fraunhofer.de

Management:

Prof. Dr.-Ing.
Thomas Bauernhansl

Contact:

Fred Nemitz
Phone +49 711 970-1611
fred.nemitz@ipa.fraunhofer.de



**Fraunhofer Institute for
Silicate Research ISC
Bronnbach Branch**

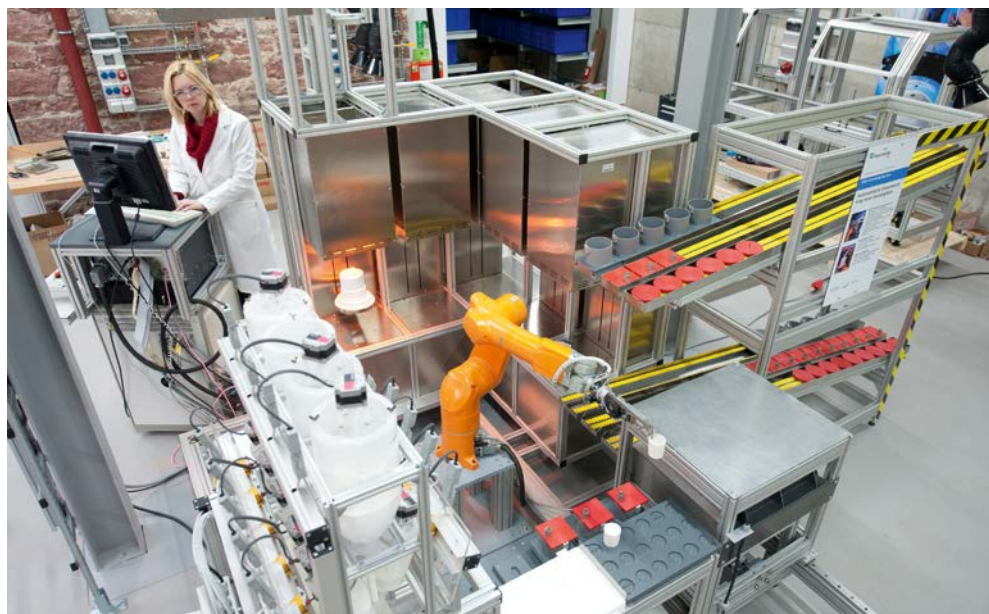
Bronnbach 28
D-97877 Wertheim
Phone: +49 9342 9221-701
Fax: +49 9342 9221-799
www.isc.fraunhofer.de

Management:
Dr. Andreas Diegeler

Contacts:
Dr. Andreas Diegeler (Certified
Center of Device Development,
Test Centre)
andreas.diegeler@isc.fraunhofer.de

Sabrina Rota (International
Convention Center for Cultural
Heritage Preservation IZKK)
sabrina.rota@isc.fraunhofer.de

**10 Fraunhofer Institute for Silicate Research ISC
Bronnbach Branch**



WHO WE ARE

The Fraunhofer Institute for Silicate Research ISC develops and optimises non-metallic materials for a wide variety of applications in energy generation and storage, for protection against environmental influences or health care. The institute deals with the issues of material-based product development and quality assurance in production.

Fraunhofer ISC has operated a branch office in Bronnbach near Wertheim in the Tauber Valley since 1995. This is where the research and development activities of Fraunhofer ISC with regards to the protection of cultural heritage and valuable historic objects are concentrated, at the International Convention Center for Cultural Heritage Preservation IZKK. The IZKK organises seminars, training courses and conventions for an international audience to make available the latest scientific findings regarding the preservation of historical objects.

FOCUS AREAS / FIELDS OF ACTIVITY

CENTER OF DEVICE DEVELOPMENT

The Institute's focus is on the development of research devices and customised plants. The

Center of Device Development is certified under DIN EN ISO 9001:2008.

- Prototypes and pilot plants for the manufacture and processing of new materials (e.g. glass)
- Thermo-optical measurement systems for quality control and in-situ characterisation of materials under treatment with heat.
- Special devices for adjustment and calibration in volumetry for fluid media

TEST CENTRE

- Mechanical material tests
- Instrumental analysis
- Environmental stability tests, environmental simulation

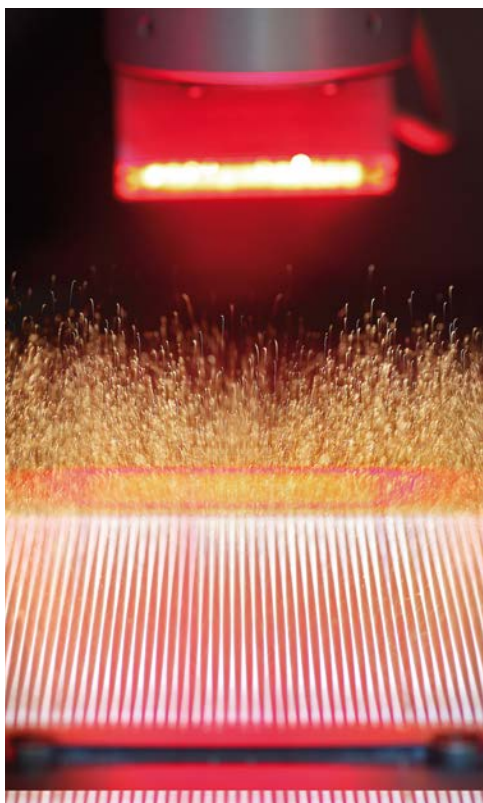
TARGET GROUPS

- Small and medium-sized enterprises, large corporations
- Academic workgroups
- Public institutions, museums, heritage preservation offices
- Restoration companies

WHO WE ARE

The Fraunhofer Institute for Solar Energy Systems has committed to a sustainable, profitable, safe and socially fair energy supply system. It provides the technical requirements for an efficient and environmentally friendly supply of energy in industrialised as well as in emerging and developing countries. The central aspects of research range from topics such as energy efficiency, to energy generation, energy distribution and energy storage.

In addition to fundamental research, the Institute is involved in the development of production technologies and prototypes as well as the manufacture of demo plants. Fraunhofer ISE plans, consults, tests and provides know-how and technical equipment. The Institute also provides calibration, measurement and testing services.



An interesting variation of a new type of solar concept is back-contact solar cells. In this case, the entire metal work is on the backside. A highly efficient laser boring method is used to produce several thousand vias each second.

FOCUS AREAS / FIELDS OF ACTIVITY

Fraunhofer ISE has been certified under DIN EN ISO 9001:2008 since March 2001. It conducts applied research for the development of new technologies, processes and solutions in twelve industry-driven fields of work:

- Energy efficient buildings
- Silicon photovoltaics
- III-V and concentrator photovoltaics
- Dye, organic and novel solar cells
- Photovoltaic modules and power plants
- Hydrogen and fuel cell technology
- Solar thermal technology
- System integration and grids—electricity, heat, gas
- Energy efficient power electronics
- Zero-emission mobility
- Storage technologies
- Energy system analysis

The Institute uses the latest scientific methods and findings from eleven fields of expertise for its research and development activities:

- Materials research
- Semiconductor technology
- Surface technology
- Optics and photonics
- Systems technology
- Electrical engineering and controls technology
- Information and communication technology
- Process technology
- Production technology
- Measuring, testing, monitoring
- Modelling and simulation

TARGET GROUPS

The partners awarding contracts to Fraunhofer ISE are production and service companies—manufacturers of products such as solar panels or modules, material producers and plant manufacturers—as well as public institutions and authorities.



Fraunhofer Institute for Solar Energy Systems ISE

Heidenhofstraße 2
 D-79110 Freiburg
 Phone +49 761 4588-0
 Fax +49 761 4588-9000
www.ise.fraunhofer.de

Management:

Prof. Dr. Eicke R. Weber

Contact:

Karin Schneider M. A.
 Phone +49 761 4588-5150
info@ise.fraunhofer.de


**Fraunhofer Institute for
Systems and Innovation
Research ISI**

Breslauer Straße 48
 D-76139 Karlsruhe
 Phone +49 721 6809-0
 Fax +49 721 689152
www.isi.fraunhofer.de

Management:
 Univ.-Prof. Dr.
 Marion A. Weissenberger-Eibl

Contact:
 Anne-Catherine Jung
 Phone +49 721 6809-100
presse@isi.fraunhofer.de

12 Fraunhofer Institute for Systems and Innovation Research ISI

WHO WE ARE

The Fraunhofer Institute for Systems and Innovation Research ISI analyses the development and also the effects of innovations. It researches the short- and long-term developments of innovation processes and the social effects of new technologies and services. On this basis, Fraunhofer ISI makes recommendations for actions and offers perspectives to its customers from the industry, politics and science for their important decisions. The Institute's expertise has its roots in sound scientific competence and its interdisciplinary and systematic research approach.

FOCUS AREAS / FIELDS OF ACTIVITY

Fraunhofer ISI examines the scientific, economic, ecological, social, organisational, legal and political conditions for the development of innovations and their effects. Research takes place in seven Competence Centres (CC):

- CC Energy Policy and Energy Markets examines how the political and institutional framework of sustainable energy systems can be designed, developed and evaluated.
- CC Energy Technologies and Energy Systems analyses innovative energy technologies and their contributions to a sustainable energy system from a strategic perspective.
- CC Foresight develops methods to identify and analyse long-term developments in society, industry and technology.
- CC Industrial and Service Innovations researches the potential of technical and organisational innovations with respect to successful production processes in Germany and Europe.
- CC Sustainability and Infrastructure Systems analyses the requirements and options for the reduction of emissions, the improvement of resource efficiency and the sustainability of infrastructure systems.

- CC Emerging Technologies analyses the potential, effects and requirements of new technologies and develops options for activities.
- CC Policy and Regions examines the functions and the changes of research and innovation systems.

The services of Fraunhofer ISI include:

- Comparative analyses of innovation systems at national, sectoral and technological levels
- Foresee technologies and create scenarios and roadmaps of future technological developments
- Investigation of the institutional and regulatory contexts of innovations
- Analysis of the diffusion processes of innovations
- Evaluation of innovations and their potential from economic, societal and ecological perspectives
- Assessment of innovation-related policy options as well as the chances of success and acceptance in the market
- Advising industrial stakeholders and policy-makers on the introduction and implementation of innovative solutions

TARGET GROUPS

Customers of Fraunhofer ISI are production and service companies as well as public institutions and authorities. The assessment of the potential and limits of technological, organisational or institutional innovations by Fraunhofer ISI helps the decision-makers in industry, science and politics to make their strategic decisions and supports them in their efforts to create a favourable environment for innovations.

Fraunhofer Institute for Mechanics of Materials IWM

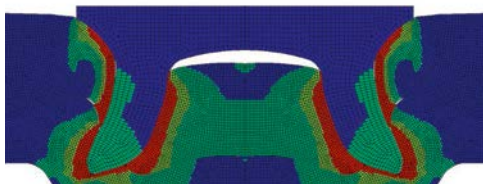
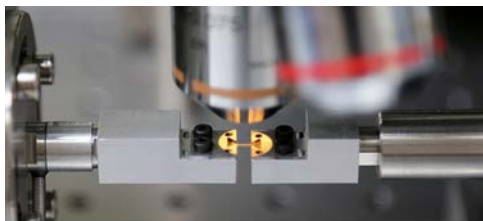
WHO WE ARE

The Fraunhofer Institute for Mechanics of Materials IWM acts as a provider of ideas and innovations and as a problem solver for the industry and public institutions, with respect to the reliability, safety, durability and functionality of components and systems. It works out sustainable and resource efficient solutions for the optimised utilisation of material properties, for new component functions and innovative production methods.

FOCUS AREAS / FIELDS OF ACTIVITY

Research at Fraunhofer IWM intends to find intelligent ways to use materials.

- It helps to control mechanisms and processes in materials and material systems by evaluating and describing them through the use of models. In this way IWM identifies performance and efficiency reserves in technological systems.
- The Institute determines materials, drills down to their atomic structures and influences interactions. The Institute is thus able to modify material properties for the required new functions.
- It thoroughly understands material systems and production processes and translates them into reliable products and technologies. This is how IWM realises competition-critical innovations together with partners from science and industry.



MATERIAL DESIGN

Multi-scale, experimental and simulatory design of materials for multifunctional applications (Functional coated materials, micro and mesomechanics, material modelling)

PRODUCTION PROCESSES

Efficient and innovative production processes for functional components with exact contours and defined property profiles (Powder and fluid systems, forming processes, machining methods and glass forming)

COMPONENT SAFETY, LIGHTWEIGHT

CONSTRUCTION

Qualification of materials and components for mobility, energy, mechanical and plant engineering (Safety and durability analyses, crash assessment, join connections, composite materials)

MATERIAL ASSESSMENT, LIFETIME

CONCEPTS

Reliable systems for energy conversion and storage (Arrangement models, durability forecasts, material models, hydrogen embrittlement, damage analyses)

TRIBOLOGY

Reduction of friction and wear protection for bearings, seals and drive systems (Microtribology, tribological simulations, technical ceramics, lubricants, tribological coatings)

TARGET GROUPS

Fraunhofer IWM works with different materials for companies from all industries and sectors and for public institutions. Customers are producers and users of heavy-duty materials and components that would like to push the limits of their systems or to realise new functionalities.



Fraunhofer Institute for Mechanics of Materials IWM

Wöhlerstraße 11
D-79108 Freiburg
Phone +49 761 5142-0
www.iwm.fraunhofer.de

Management:

Prof. Dr. Peter Gumbsch

Contact:

Thomas Götz
Phone +49 761 5142-153
thomas.goetz@iwm.fraunhofer.de
iwm.fraunhofer.de



Fraunhofer Information Center for Planning and Building IRB

Nobelstraße 12
D-70569 Stuttgart
Phone: +49 711-970-2500
www.irb.fraunhofer.de
www.baufachinformation.de

Management:
Dipl.-Ing. Thomas H. Morszeck

Contact:
Dipl.-Ing. Klaus Probst
Phone: +49 711-970-2617
Klaus.Probst@irb.fraunhofer.de

14 Fraunhofer Information Center for Planning and Building IRB

WHO WE ARE

The Fraunhofer Information Center for Planning and Building IRB is the key institution in Germany for the national and international transfer of construction knowledge. It explores technical, planning and industry-related specialist knowledge from research and practice in all areas of construction and makes it available to the wider public in this sector.

FIELDS OF ACTIVITY

Transfer of technical knowledge in the area of construction and planning, especially in the fields of:

- Construction Materials | Building Physics | Building Services
- Building Pathology | Building Maintenance | Historic Monument Conservation
- Architecture | Interior Design
- Building Design | Building Construction
- Civil and Structural Engineering
- Waste | Soil | Water
- Construction Industries | Construction Management
- Planning and Building Law | Construction Contract Law
- Urban and Spatial Planning | Housing

FOCUS AREAS

By extracting and providing specialist construction knowledge, Fraunhofer IRB promotes the improvement of construction and planning work and improves the technical skills of all parties involved in the planning and construction business. It helps to avoid repeat or faulty developments in research and practice, makes important contributions to the promotion of innovations by German SMEs and supports the international transfer of specialist construction knowledge.

ONE-TO-ONE KNOWLEDGE TRANSFER

Qualified employees (architects, engineers) with excellent knowledge of all opportunities in information management work out individual solutions with respect to information issues in the areas of planning and construction.

They conduct research and studies on behalf of customers and offer support in the use of databases, procure technical literature, market information and statistics and analyse them, and conduct studies on resources and markets, and create reports, portals and databases.

The Institute's publication service assists researchers and scientists when they publish their results.

DATABASES

Fraunhofer IRB designs and maintains full-text, literature references, research and address databases that help its users from the industry, the education sector or research to quickly find and apply technical information with respect to planning and construction.

PUBLISHER

By publishing specialist books and research reports, Fraunhofer IRB makes an important contribution to the transfer of knowledge into practice. There are more than 4,000 research reports, approximately 500 specialist books and four technical magazines for the construction sector and about 700 publications from the research areas of Fraunhofer-Gesellschaft.

LIBRARY AND FREE ONLINE RESEARCH

More than 160,000 specialist books, research reports, regulatory approvals, standards and guidelines are available in the public library. There are more than 2,000 magazines.

The website www.baufachinformation.de makes it easy to search for the complete German language literature on construction. Fraunhofer IRB will also procure special magazines upon customer request and offers a copy service for magazine articles.

TARGET GROUPS

- Scientists, researchers and research sponsors
- Civil engineers, architects, building experts
- Developers, craftsmen, producers of building products, monument conservators
- Urban, regional and state planners

Fraunhofer Project Group New Drive Systems NAS



Drive-train test stand of Project Group New Drive Systems (NAS)

WHO WE ARE

The drive systems of future vehicles and an independent and sustainable energy supply for our society are some of the current and essential challenges in the area of science and technology. Because of this, the Fraunhofer Project Group New Drive Systems NAS has constantly been working on application-oriented research projects and conducting pre-series product development projects with regards to stationary and mobile drive and energy systems.

FOCUS AREAS / FIELDS OF ACTIVITY

The research and development work within the NAS project group is organised into four areas:

■ HYBRID POWER-TRAINS AND ELECTRIC MOBILITY

Measures for the optimisation and improvement in efficiency of hybrid or electric-only drive systems. These research activities can basically be classified into the categories of energy storage, power electronics, thermal management and the development of operational strategies for boosting efficiency.

■ CONVENTIONAL POWER-TRAINS

Improvement measures for conventional combustion engines or slightly electrified drive topologies. Modification of mechanical components and their properties to minimise friction (e.g.

valve trains, low-friction layers). Improvement of combustion processes (e.g. HCCI). Subsystems to utilise residual heat, e.g. ORC systems or turbo generators.

■ STATIONARY DRIVE SYSTEMS AND HEAT RECOVERY

Concept, design and examination of mini and micro block heat and power plants with an output capacity of up to 5 kW for use in single family homes. Development of heat storage systems that allow for the storage of waste heat, e.g. across seasons, and feed it back into the heating system when needed.

■ LIGHTWEIGHT CONSTRUCTION IN THE POWER-TRAIN

Options to increase efficiency by reducing weight in moving and non-moving components in conventional and electrified power-trains. Use of light metal, composite and ceramic materials.

TARGET GROUPS

The Project Group New Drive Systems is a competent research and development partner in the above fields and, among other services, offers the following:

- Services for production companies
- Partnering in publicly funded projects (state, federal state and EU)



Fraunhofer Project Group New Drive Systems NAS

Rintheimer Querallee 2
(Geb. 70. 16)
D-76131 Karlsruhe
Phone +49 721 915038-10
Fax: +49 721 915038-810
www.ict.fraunhofer.de
www.iwm.fraunhofer.de

Management:

Dr.-Ing. Hans-Peter Kollmeier

Contact:

Dr. Ing. Lars Fredrik Berg
Phone +49 721 915038-14
berg@ict.fraunhofer.de



**Project Group for
Automation in Medicine and
Biotechnology PAMB**

Theodor-Kutzer-Ufer 1-3
D-68167 Mannheim
Phone: +49 621 17207-156
Fax: +49 621 17207-900
pamb.ipa.fraunhofer.de

Management:
Dr. Jan Stallkamp

Contact:
Axel Storz
Phone: +49 621 17207-366
axel.storz@ipa.fraunhofer.de

16 Fraunhofer Project Group for Automation in Medicine and Biotechnology PAMB

WHO WE ARE

The Project Group for Automation in Medicine and Biotechnology PAMB at the Medical Faculty of the University of Heidelberg in Mannheim was established to explore the automation potential in the fields of medicine and biotechnology. It is the first known institution with such a focus that conducts research in the field of automation in a clinical-academic environment and that offers development services.

FOCUS AREAS / FIELDS OF ACTIVITY

Automation in medicine and biotechnology requires the integration of individual technologies and functions into a system. With its clinical and industry partners, PAMB develops components and creates automation solutions for production and laboratories as well as for diagnostic and therapeutic applications in the intervention room. The site enables "customised" innovations and provides the right environment for practical clinic-driven developments and the evaluation of medical devices.

■ BIOPROCESS ENGINEERING

PAMB supplies innovative lab automation solutions in the form of modules, devices and systems for research and production. One core competence is the conversion of manual into automated processes. In addition, the technical focus is on magnetic systems, medical sample processing and automation-oriented design.

■ MEDICAL-TECHNICAL ASSISTANCE SYSTEMS

The institute develops instruments, devices and systems for use in and around the intervention room. One key area is the development of robots and manipulators for diagnosis and intervention and the relevant subsystems, e.g. hydraulic drive systems.

■ OPTICAL BIOMEASUREMENT TECHNOLOGY

PAMB develops optical measurement solutions with a focus on multispectral imaging in diagnoses and therapy. In addition, it creates solutions for controlling automated bioprocesses.

■ INFORMATION SYSTEMS FOR BIOSCIENCES

The PAMB project group deals with solutions for an information technology network between the lab and operating room and between man and machine. It develops and designs IT platforms and (user) interfaces as the key to mastering complex tasks, effectiveness and efficiency.

■ CONTROL SYSTEMS IN MEDICAL ENGINEERING

The Institute develops control systems for complex medical engineering systems, e.g. for robots or implants. PAMB realises control systems for bioprocess laboratory devices and systems. Simulation systems, for example HIL (Hardware in the Loop), are used to reduce the development risks and costs.

TARGET GROUPS

The PAMB project group targets clinical users and producers of products in the fields of medical and bioprocess engineering. The Institute is also willing to support companies to get a foot in the medical engineering market.



Raised signal-to-noise-ratio by concentrating the magnetic beads on a laser spot using oscillating magnetic fields.

Fraunhofer Project Group for Processing Technologies in Lightweight Construction BTL

WHO WE ARE

Energy and resource efficiency are the keywords in today's production technology. The Fraunhofer Institute for Manufacturing Engineering and Automation IPA and the Institute for Machine Tools (IfW) at the University of Stuttgart have recognised this trend early and together established the Fraunhofer Project Group for Processing Technologies in Lightweight Construction BTL in 2012.

The project group's research and development work deals with two aspects: It targets lightweight construction solutions and technologies in production engineering and at the same time manufacturing technology and automation solutions for the production and machining of lightweight materials.

FOCUS AREAS / FIELDS OF ACTIVITY

PROCESSING TECHNOLOGIES

In order to profitably transfer the promising potential of lightweight construction to high-volume series, it is necessary to significantly reduce the process costs for machining lightweight materials.

CORE COMPETENCIES IN THE AREA OF CHIPPING SYSTEMS

In addition to tool optimisation and operating life analyses by experimental testing, the project group has specific technical know-how in the following areas:

- Coating technologies for tools
- Measurement and assessment of machining quality
- Minimum lubrication / analysis of cutting fluids
- Suction technology
- Ultrasonic machining
- Determination of suitable machining parameters
- Machining simulations

All these areas are also extended to applications with robot systems.

STRUCTURAL LIGHTWEIGHT CONSTRUCTION

In the area of structural lightweight construction, functionality is considered the primary requirement for a structure in lightweight design.

CORE COMPETENCIES IN THE AREA OF DESIGN

- Concept development
- Methodical development and design
- Material-based design (fibre-reinforced plastic, high speed steel, sandwich, light metal, etc.)
- Joining technologies for lightweight constructions
- Development and design of modern energy-efficient machine components and machine systems
- Structural development and optimisation of existing structures
- Integration of material systems adapted for improved insulation and damping
- Improvement of ergonomics through minimisation of the weight of production equipment

TARGET GROUPS

The term lightweight construction technology covers a wide variety of solutions for many different products and industries. The BTL target groups range from architecture to sports equipment, wind power plants and even aircraft engineering and the automotive industry. In addition to simply saving material, the priority with moving objects—from aircrafts to automobiles or the slides of machine tools—is increased acceleration and speed or the saving of energy.



Fraunhofer Project Group for Processing Technologies in Lightweight Construction BTL

Holzgartenstr. 17
D-70174 Stuttgart
Phone +49 711 970-1535
Fax +49 711 970-7171535
www.ipa.fraunhofer.de

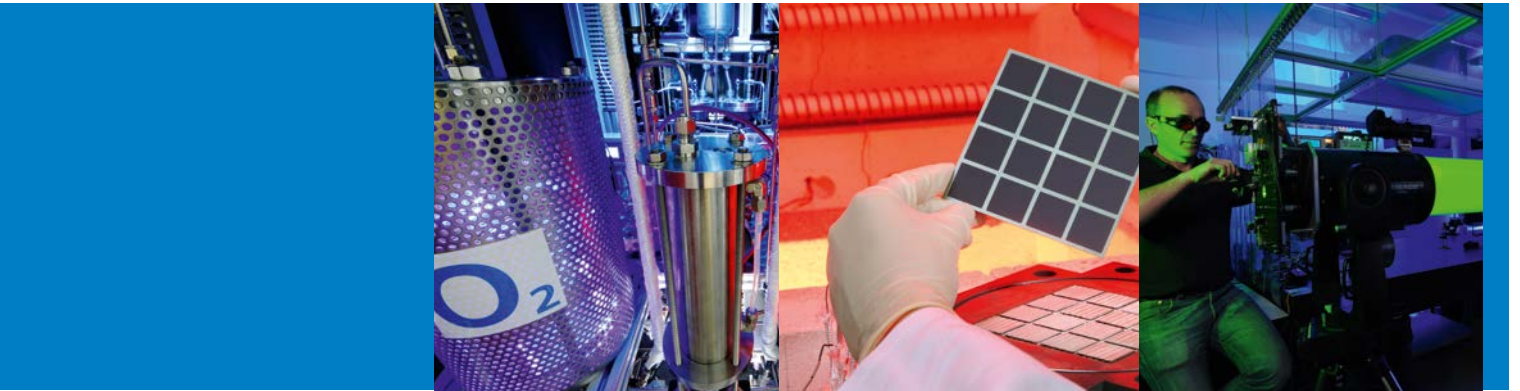
Management:

Dr. Marco Schneider

Contact:

Dr. Marco Schneider
Phone +49 711 970-1535
marco.schneider@ipa.fraunhofer.de
ipa.fraunhofer.de

German Aerospace Center (DLR) Cutting-edge research in Baden-Württemberg



In cooperation with the industry and public institutions, at national and international level, the German Aerospace Center (DLR) conducts cutting-edge research in the areas of aviation, space, energy, transport and safety.

The headquarters are located in Cologne, with 16 locations in Germany, two of which are located in Baden-Württemberg. At the two locations in Stuttgart and Lampoldshausen approximately 1,000 employees work in seven research institutes.

The DLR researches the earth and the solar system; it provides knowledge on how to conserve the environment and develops environmentally friendly technologies for energy supply, mobility, communication and safety. Its portfolio ranges from basic research to the development of products for the future. It operates large-scale research facilities, e.g. for its own projects but also as a service provider for partners in the industry. In addition, it acts as a consultant for politics and

supports science talents. With its DLR_School_Lab project “Out of school and ... into the lab!” and programmes for students, for example Helmholtz-Allianz DLR@Uni-Stuttgart, the DLR intends to attract younger generations.

The division of Technology Marketing within the DLR brings together research and industry. This is where the responsibilities for a cross-industry transfer of the DLR technologies are combined. Together with the institutes and industry partners who are included in the process as early as possible, the DLR translates research results into practicable technologies, examines markets and trends, develops innovative ideas, ensures competitive advantages by protecting proprietary rights, enters into an agreement about marketing the DLR technologies and supports DLR spin-offs.

WWW.DLR.DE



Preparations for testing a new type of propeller brake made of heavy-duty ceramic in a computer tomograph.

WHO WE ARE

The DLR Institute of Structures and Design develops high-performance structures for the aerospace, automotive and energy management industries. Its focus here is on ceramic fibre, polymer and hybrid composite materials.

FOCUS AREAS / FIELDS OF ACTIVITY

At the Stuttgart location, the Institute works on projects along the entire process chain—from raw material to production technology.

STRUCTURAL INTEGRITY

One key area is numerical and experimental examinations regarding the stability of highly stressed supporting structures under crash events or shock impacts. The structural concepts for aircrafts, automobiles or trains derived from this are to maximise the safety of passengers.

COMPONENT DESIGN AND MANUFACTURING TECHNOLOGIES

For the aeroplanes of the future, the Institute has been developing new lightweight construction concepts for the wings, fuselage, tail unit and drive components on the basis of fibre-reinforced plastic. The goal is to increase the performance of a structure with lower weight and to ensure profitable production.

AUTOMATION AND QUALITY ASSURANCE IN PRODUCTION ENGINEERING

Automated production of components made of carbon fibre reinforced plastic (CFRP) for the aerospace industry is another key area. Important research topics are the automated creation of preforms, process-integrated quality assurance and the relevant mechatronics and robotics technology.

CERAMIC COMPOSITES

Researchers at the DLR are developing methods and materials to produce lightweight ceramic structures for applications in the aerospace and energy management industries that may resist high thermal and mechanical stress. This includes all areas from material development to prototype production.

AEROSPACE SYSTEM INTEGRATION

The department is developing designs and components for space propulsion systems and thermal protection systems for re-entry. This work includes everything from structural developments to test stand and real flight tests.

TARGET GROUPS

The Institute targets the industry, research and education.



DLR Institute of Structures and Design

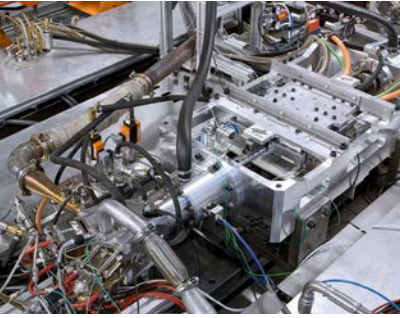
Pfaffenwaldring 38-40
D-70569 Stuttgart
Phone +49 711 6862-444
Fax +49 711 6862-227
www.dlr.de/bt

Management:

Prof. Dr.-Ing. Heinz Voggenreiter

Contact:

Nicole Waibel
Phone +49 711 6862-8182
Nicole.Waibel@dlr.de



**DLR Institute of
Vehicle Concepts**

Pfaffenwaldring 38-40
 D-70569 Stuttgart
 Phone +49 711 6862-255
 Fax +49 711 6862-258
www.dlr.de/fk

Management:
 Prof. Dr.-Ing. Horst E. Friedrich

Contact:
 Kristiane Schuster
 Phone +49 711 6862-256
Kristiane.Schuster@dlr.de

2 DLR Institute of Vehicle Concepts



Transport researchers of the DLR are testing innovative lightweight structures in the component crash test facility.

WHO WE ARE

The DLR Institute of Vehicle Concepts is a system institute. It works on and coordinates transport-relevant research issues with a view to new vehicle concepts and vehicle technologies. The Institute's fields of activity address the development of future technology systems for sustainable, safe and affordable vehicle generation on the road and on rails.

FOCUS AREAS / FIELDS OF ACTIVITY

ALTERNATIVE ENERGY CONVERSION

SYSTEMS

Some of its key priorities are the optimisation of the conversion process of chemical into electrical energy (serial hybrids / range extenders), the secondary use of energy (thermoelectric systems) and the bidirectional conversion of electrical into mechanical energy (electric drive systems).

ENERGY CONCEPTS FOR VEHICLES

The focus is on examining and developing innovative vehicle energy architectures. The researchers at the DLR together with their partners in the industry jointly work on reducing the energy consumption of future vehicle concepts for road and rail.

LIGHTWEIGHT CONSTRUCTION AND HYBRIDS

With the goal to make future vehicle structures lighter, safer and more resource-friendly, this research area reflects the entire (preliminary) development chain: It combines concept, design and simulation skills and options for the production and testing of demonstrators and their integration into vehicles.

VEHICLE SYSTEMS AND

TECHNOLOGY EVALUATION

The DLR researchers identify, analyse and create future vehicle concepts for road and rail transport under the aspects of technology, economy, society and environment.

TARGET GROUPS

Business, industry, research, universities, associations

DLR Institute of Solar Research

Department of point focussing systems



Deutsches Zentrum
für Luft- und Raumfahrt



At the Jülich solar tower, which is DLR's solar thermal test plant, the Institute tests and develops technologies for solar tower power plants.

WHO WE ARE

The DLR Institute of solar research develops concentrating solar systems to produce heat, power and fuels for a sustainable energy supply. The focus of these research activities are solar thermal power plants that concentrate solar radiation and convert it into heat.

FOCUS AREAS / FIELDS OF ACTIVITY

At the Stuttgart location, DLR solar researchers are mainly working on the development of point focussing and line focussing systems—in close cooperation with the neighbouring DLR Institute of Engineering Thermodynamics.

POINT FOCUSING SYSTEMS

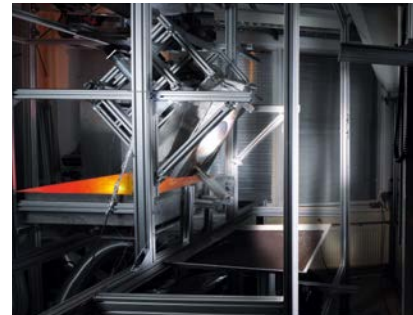
At the centre of the research work are solar tower power plants. The goal is to reduce the cost of power generation in order to provide solar power at a competitive price in the medium-term. For this, the Institute has for example been developing efficient receiver technologies for extremely high temperatures and radiation flux densities and has been designing and optimising full-range systems for complete power plants.

LINE FOCUSING SYSTEMS

Because this is a commercially established technology, research activities focus on the improvement of individual processes and components and the exploration of new applications—for example in the area of industrial process heat or combined heat and power technology. In addition, research involves alternative heat transfer mediums such as steam or salt in order to increase process temperatures and the efficiency of the processes within power plants.

TARGET GROUPS

The DLR Institute of Solar Research intends to bridge the gap between basic research and large-scale realisation and application in the industry. Its customer base includes public institutions and authorities, national and international institutions and also German and international partners in the industry.



DLR Institute of Solar Research
— Department of point focusing systems

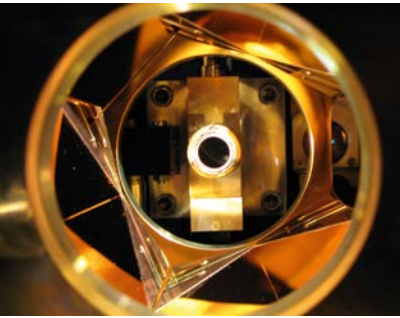
Pfaffenwaldring 38-40
D-70569 Stuttgart
Phone +49 711 6862-602
Fax +49 711 6862-3213
www.dlr.de/sf

Management:

Dr.-Ing. Reiner Buck,
Head of point focussing
systems department

Contact:

Tamara Schmutz
Phone +49 711 6862-8020
tamara.schmutz@dlr.de



**DLR Institute of
Technical Physics**

Pfaffenwaldring 38-40
D-70569 Stuttgart
Phone +49 711 6862-773
Fax +49 711 6862-8093
www.dlr.de/tp

Management:
PD Dr. Adolf Giesen

Contact:
Melanie Haupts
Phone +49 711 6862-773
Melanie.Haupts@dlr.de

4 DLR Institute of Technical Physics



DLR researchers intend to use laser-based methods to determine the flight paths of space debris as precisely as possible in the future.

WHO WE ARE

The DLR Institute of Technical Physics develops laser systems for the aerospace industry and for the areas of security and defence. Researchers are working on methods for the following: detecting space debris, remote laser detectors for hazardous substances, laser propulsion for space travel and laser effectors.

FOCUS AREAS / FIELDS OF ACTIVITY

LASER-BASED DETECTION OF SPACE DEBRIS

Space debris is a serious risk in space travel. In order to prevent collisions with satellites by controlled redirection manoeuvres, DLR researchers are working on a laser-based method to precisely determine the flight paths of debris.

**REMOTE DETECTION OF HAZARDOUS
SUBSTANCES**

The Institute has been working on methods for the laser-based remote detection that are used for identifying chemical, biological and explosive hazardous substances from a safe distance. In

crises, this can be used to take countermeasures at an early stage to minimise the risks for the population and rescuers.

LASER PROPULSION

For highly precise position control and position stabilisation of satellites or satellite groups in the orbit, the Institute designs and tests laser-based micro thrusters.

LONG RANGE LASER EFFECTORS

The Institute develops radiation sources for laser applications over long distances of many kilometres. These laser effectors must meet specific requirements and can be used in an extremely wide variety of applications.

TARGET GROUPS

Laser manufacturers, enterprises working with optical technologies, companies in the areas of security and defence.

WHO WE ARE

The focus of the DLR Institute of Engineering Thermodynamics are renewable energies and the energy systems of the future, with research projects on efficient and resource-friendly energy storage systems and energy conversion technologies. The project portfolio ranges from theoretical studies to fundamental research in the lab and the operation of pilot plants which are accompanied by system-analytical studies.

FOCUS AREAS / FIELDS OF ACTIVITY**SYSTEM ANALYSIS AND TECHNOLOGY****ASSESSMENT**

The analysis and assessment of different technologies is the first priority for a sustainable energy supply. On this basis, the researchers from DLR develop scenarios for the affordable, safe and environmentally friendly energy system of the future.

THERMAL PROCESS TECHNOLOGY

Increasing the efficiency of processes in energy engineering is a key factor for saving fuel and protecting the environment. For this, the energy researchers have been developing components, methods and system technologies for thermal and chemical energy storage systems, thermal management and fuel recycling.

ELECTROCHEMICAL ENERGY TECHNOLOGY

Whether for electric mobility or stationary energy supply—the importance of batteries, fuel cells and electrolyzers is constantly increasing. The Institute has been researching the areas of cell design, production procedures and diagnostics and even system optimisation and demonstration in order to optimise efficiency, operating life, safety and costs.

COMPUTATIONAL ELECTROCHEMISTRY

Computer-based models can help to better understand the processes within batteries and fuel cells. For this, the DLR researchers have examined a broad range of physical, chemical and fluid mechanical



System for examining high-temperature heat storage tanks that drive the utilisation of renewable energy and provide for higher degrees of efficiency in industrial processes.

processes and translate them into mathematical formulas and models.

TARGET GROUPS

- Industrial enterprises:
 - Automotive industry and suppliers
 - Aerospace industry and suppliers
 - Producers and users of fuel cell technology, electrolysis and storage technology
- Utility companies
- Municipalities, state and federal authorities
- International associations
- Politics
- Science

**DLR Institute of Engineering Thermodynamics**

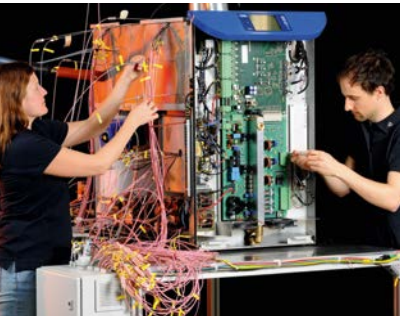
Pfaffenwaldring 38-40
D-70569 Stuttgart
Phone +49 711 6862-359
Fax +49 711 6862-712
www.dlr.de/tt

Management:

Prof. Dr. André Thess

Contact:

Sabine Winterfeld
Phone +49 711 6862-513
sabine.winterfeld@dlr.de



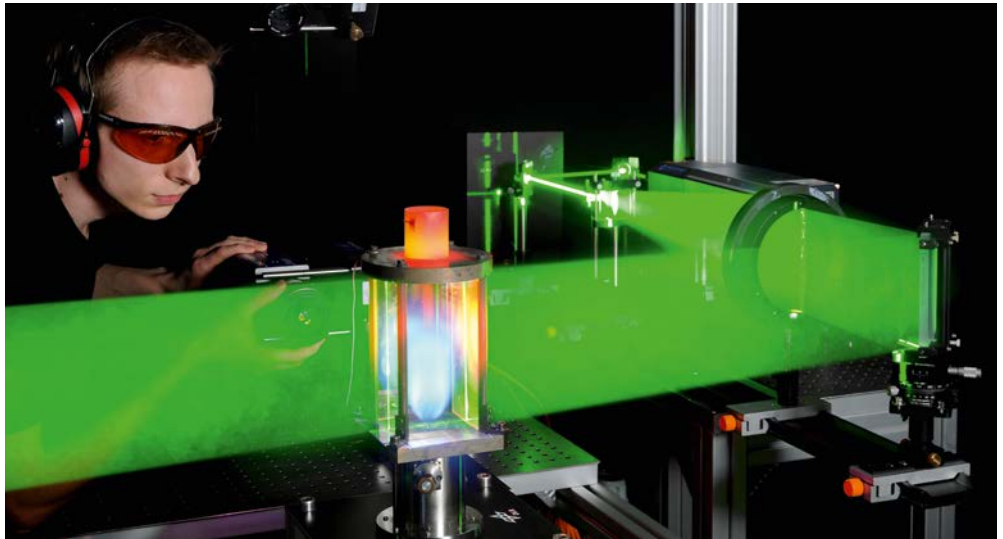
**DLR Institute of
Combustion Technology**

Pfaffenwaldring 38-40
D-70569 Stuttgart
Phone +49 711 6862-308
Fax +49 711 6862-578
www.dlr.de/vt

Management:
Prof. Dr.-Ing. Manfred Aigner

Contact:
Anneliese Bonfert
Phone +49 711 6862-308
Verbrennungstechnik@dlr.de

6 DLR Institute of Combustion Technology



Laser-based measurement of the flow field in a model gas turbine combustion chamber

WHO WE ARE

The DLR Institute of Combustion Technology has been working on the issues of combustion in the gas turbines of power plants and jet engines as well as on new concepts for decentralised energy generation. Its goals are to increase the reliability of combustion processes, to reduce emissions and to make available new alternative fuels.

FOCUS AREAS / FIELDS OF ACTIVITY

The Institute tries to achieve a more resource-friendly and environmental energy supply by utilising its interdisciplinary competencies in the areas of numerical simulation, chemical kinetics and combustion diagnostics. Lab and industry-scale test stands bridge the gap between science and the application of new technologies.

- Innovative decentralised energy supply using combined heat and power on the basis of micro gas turbine technology
- Hybrid power plant: Combination of micro gas turbine and high-temperature fuel cell
- Development and application of laser measurement technology for a detailed examination of basic and application-oriented combustion processes

- Further development of the FLOX[®] burner concept for low-emission load and fuel-flexible gas turbines
- Development and application of numerical tools in the design of gas turbine combustion chambers
- Chemical kinetic examinations of conventional and alternative fuels for aviation and the development of reaction mechanisms for numerical simulations
- Further development of gasification processes for the use of biomass in small and large power plants
- Mass spectrometer examinations with chemical-reactive gases to validate models and determine emission characteristics

TARGET GROUPS

- Industrial enterprises in the areas of energy, aviation and transport
- Research institutions in Germany and abroad
- Producers of alternative fuels
- Utility companies



WHO WE ARE

The DLR Institute of Space Propulsion has some unique competencies in Europe in the area of the development and operation of rocket propulsion test stands and has become an important partner in the European space industry over the past 50 years.

FOCUS AREAS / FIELDS OF ACTIVITY

The Institute develops and tests space propulsion systems within the European ARIANE programme. The unlimited use of satellite data for telecommunication, navigation, weather and disaster forecasts are a central point here in order to ensure competitive and independent European access to space.

- Planning, construction and operation of tests stands for space propulsion systems on behalf of the European Space Agency (ESA) and in cooperation with the European space industry.
- Development and operation of height simulation systems for upper stage engines and loads during operation, with unique competencies in Europe in this research area
- Operation of propulsion test stands to develop propulsion systems until they are ready for use
- Tests for the use of ceramic fibre materials for rocket combustion chambers
- Development and application of laser-optical measurement methods for high-temperature gas flows
- Examination of combustion processes in liquid rocket engines and air-breathing propulsions for future space transport systems with respect to the
 - injection of fuel components,
 - the mixing and combustion of fuel components,
 - the expansion of hot gases in the nozzle and
 - thermal stress for combustion chamber structures.

With its Technology Transfer Centre (TTZ) at the Lampoldshausen location, the DLR provides a forum mainly for regional enterprises to transfer research results to the industry. By an efficient transfer of knowledge and technological developments from the aerospace sector to industrial production, research can generate economic growth. This is what the TTZ intends with its seminars, congresses and symposia. Many of the issues raised by the Institute during the course of basic research are interesting for other branches of industry as well (for example the research results in the area of “green” fuels for rocket engines).

TARGET GROUPS

- Scientists and experts
- Industrial enterprises, including small and medium-sized enterprises
- Industry associations
- Schools and Universities
- Regional and supra-regional politics



DLR Institute of Space Propulsion

Langer Grund
D-74239 Hardthausen
Phone +49 6298 28-0
www.dlr.de/la

Management:

Prof. Dr.-Ing. Stefan Schlechtriem

Contact:

Dr. Simone Scheps
German Aerospace Center (DLR)
Communications, Lampoldshausen
Phone +49 6298 28-201
simone.scheps@dlr.de

Steinbeis Foundation



The hallmark of the Steinbeis Foundation is the entrepreneurial and responsible transfer of knowledge and technologies. The core of the Steinbeis system is its transfer enterprises and about 600 of the almost 1,000 Steinbeis enterprises and partners are located in our home state of Baden-Württemberg. With its decentralised structure, these enterprises act independently within the Steinbeis Foundation. 6,000 experts contribute their know-how to the organisation and develop customised solutions for customers, irrespective of the size of the business.

The service range not only includes research and develops services but also consulting and expert opinions as well as training in all technical and management areas. Through its services, Steinbeis promotes effective and efficient collaboration and interaction between science and industry and among

companies. This broadens the customer's competencies and adds value for all involved partners.

Ferdinand von Steinbeis—after whom the organisation was named and the foundation that represents the umbrella organisation—recognised as early as in the 19th century, when he was the head of the central office of trade and commerce of the state of Württemberg, what is still just as valid today: Cooperative or dual training guarantees that theoretical knowledge is competently applied in practice from the start; the transfer of knowledge between companies and the exchange of experiences is beneficial for the economy and for all partners involved in such cooperations. With its versatile activities as a promoter of economic development, von Steinbeis laid the corner stone for the transfer of technology that is still being realised in the Steinbeis Foundation today.



Steinbeis Foundation

Haus der Wirtschaft
Willi-Bleicher-Str. 19
D-70174 Stuttgart
Phone +49 711 1839-5
Fax +49 711 1839-700
stw@steinbeis.de
www.steinbeis-bw.de

Board:

Prof. Dr. Michael Auer (President),
Dipl.-Kfm. Manfred Mattulat

The goal of all Steinbeis projects is the successful transfer of knowledge and technologies to recognised industrial applications. Steinbeis partners are resources of knowledge and technologies, e.g.

Universities of Applied Sciences, Universities, and research institutions and enterprises. The Steinbeis Foundation benefits from the potential of these resources and translates this knowledge and the technologies directly or indirectly according to the rules of the markets.

The focus of the projects varies: from translating pre-competitive academic R&D findings into real marketable products and services to market and transfer-oriented contract and development research, to consulting, assessment and training and even skill-oriented training services.

Steinbeis does not depend on sponsorship from the state. The transfer companies act independently in the market and are funded by customer projects.

The transfer potential is constantly extended by the establishment of new Steinbeis enterprises. Each Steinbeis enterprise is managed as “an enterprise within the Steinbeis enterprise”. The managers of these enterprises act independently within the central Steinbeis framework and in direct and trusting contact with their customers.

WWW.STEINBEIS-BW.DE

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Ministry of Finance and Economics
Baden-Württemberg
Neues Schloss, Schlossplatz 4
D-70173 Stuttgart
Phone +49 711 123-0
Fax +49 711 123-4791
poststelle@mfw.bwl.de
www.mfw.baden-wuerttemberg.de

EDITORS

Ministry of Finance and Economics
Baden-Württemberg
Department of Industry and Technology Policy

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freelance project gmbh
Silberburgstraße 112
D-70176 Stuttgart
www.freelance-project.de

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Print versions may be ordered from:

Ministry of Finance and Economics
Baden-Württemberg
Press and publicity work
Neues Schloss, Schlossplatz 4
D-70173 Stuttgart
Fax +49 711 123-4804
pressestelle@mfw.bwl.de

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