



**GRAND
CHALLENGES**

*REQUIRE VALUE ADDED
SOLUTIONS*

MATERIALS AND PROCESSING EXPERTISE BY FRAUNHOFER ISC

» MATERIALS MEET ...

The Fraunhofer Institute for Silicate Research ISC, headed by Prof. Dr. Gerhard Sextl, is one of the most important centers in Bavaria for material-based research and development in the fields of energy, environment and health.

Around 500 employees make essential material-, process- and product-based contributions to solving major global challenges such as the consequences of climate change, environmental pollution, excessive use of resources, the energy transition and population growth with their research and development.

The focus is on fast and solution-oriented processing of our customers' questions. Expertise in materials science, many years of experience in material development and processing, know-how in industrial applications and in the up-scaling of production and process technologies down to pilot scale, as well as high-performance analyses create the prerequisites for this.

The institute includes the Fraunhofer Center for High-Temperature Materials and Design HTL in Bayreuth, the Project Group Materials Recycling and Resource Strategies IWKS in Alzenau and Hanau,

the Fraunhofer Application Centers for »Textile Fiber Ceramics« at Hof-Münchberg University and »Resource Efficiency« at the University of Applied Sciences Aschaffenburg.

GRAND CHALLENGES, E.G.

- » Reduction of packaging waste by bioORMOCER®s,
- » Future energy storage,
- » Closing recyclable material cycles – innovative recycling and substitution,
- » Optimization of combustion processes for effective reduction of CO₂ and NO_x,
- » Cell-based 3D-models for reliable testing of active substances and simultaneous reduction of animal testing.



... ENERGY

... ADAPTIVE SYSTEMS

... CLEAN ENVIRONMENT

... BIOMEDICINE

... RESOURCES

THE INSTITUTE



Fraunhofer ISC stands for material development, manufacturing and processing methods as well as analyses. Its focus is on glass, hybrid polymers, smart materials and materials also based on renewable raw materials.



The Fraunhofer IWKS project group stands for resource strategies, the substitution of critical raw materials and the development of innovative recycling technologies. Its focus is on sustainable use of resources.



The Fraunhofer Center HTL stands for the development of materials resistant to high temperatures and energy-optimized thermal processes. Its focus is on materials such as ceramics and fiber composites (CMC).



The Fraunhofer Translational Center for Regenerative Therapies TLZ-RT develops new cell-based tissue models and test systems, scalable production processes and biological vascularized implants – for the efficient translation of research into application.



The Fraunhofer Resource Efficiency Application Center – a cooperation between the Fraunhofer Gesellschaft and the Aschaffenburg University of Applied Sciences – deals with issues relating to resource-efficient production and products as well as recycling-friendly design.



The Application Center for Textile Fiber Ceramics – a cooperation between the Fraunhofer Gesellschaft and Hof University of Applied Sciences – transfers textile processing techniques such as weaving, braiding, knitting or fleece production to ceramic fibers for the production of innovative ceramic composites.

» WHY YOU SHOULD

Since 1926, Fraunhofer ISC has been working successfully on behalf of the sector to solve material-based issues. Not only large companies, but also a large number of small and medium-sized companies are among our customers and development partners.

From consulting and analysis of production defects to completely new material and processing approaches, Fraunhofer ISC supports the improvement of established products and processes as well as the development of new products and processes.

Combined with a powerful network of outstanding research and development partners within and outside the Fraunhofer Gesellschaft, we can also solve issues that exceed our own expertise in material and process development.



COME TO US

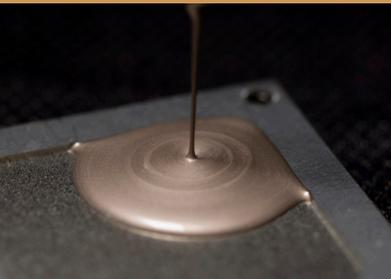
- » Through our research we contribute to the sustainable development of an ecologically sound environment, and an economically successful and socially balanced world. We are strongly committed to this responsibility.
- » We promote a well-balanced combination of excellent research and application-oriented development. This unique characteristic motivates us and achieves added value for our partners.
- » We understand our clients and know their challenges of tomorrow. Together, we develop integrated solutions for their long-term success.
- » We cooperate with the world's best in science and business. This strengthens our own innovative capacity and that of the German and European economy.
- » We emphasize the great variety and interdisciplinary cooperation of our institutes. Trusting collaboration and team working promote synergies and enhance our performance.
- » Our success relies on the knowledge and enthusiasm of our employees for applied research. Fraunhofer offers its staff excellent work conditions paired with a high degree of autonomy.

VALUE
ADDED
SOLUTIONS

» MATERIAL

As the leading materials research institute, the Fraunhofer ISC develops innovative, functional and sustainable materials for industry-related applications. Our focus is on glass, glass ceramics, ceramics, plastics – especially hybrid polymers – as well as sol-gel materials, smart materials and materials for biomedicine.

- » Hybrid polymers(ORMOCER[®]s, bioORMOCER[®]s) on a sol-gel basis
- » Ceramic materials | high temperature materials (CMC) | inorganic sol-gel materials
- » Biocompatible | biodegradable | bioactive | bio-based materials
- » 3D tissue models | organoids
- » Battery material
- » Magnetic materials
- » Specialty glass
- » Smart materials
- » Particles | dispersions | supraparticles
- » Multifunctional coating systems
- » Silicones
- » Sol-gel materials



VALUE
ADDED
SOLUTIONS

» PROCESSING

The Fraunhofer ISC has state-of-the-art equipment and process technologies available for modification, refinement, functionalization, pilot production or up-scaling of materials. Used processes are cost-, energy- and resource-efficient, from laboratory scale to pilot production. In addition, the institute advises on the optimization of processes and procedures.

- » Additive processing: 2D | 3D printing | 2PP
- » Coating processes
- » Lacquer production
- » Electrode and cell production
- » Inorganic fiber production and processing
- » Biofabrication of cellbased implants
- » Preclinical testing | GMP near
- » Recycling processes | separation and sorting technology
- » Specialty glass development and processing
- » Particle technology
- » Optimization of high-temperature thermal processing
- » Measuring methodology | device development and construction
- » Textile ceramics processing
- » Metallurgical processes



VALUE
ADDED
SOLUTIONS

» ANALYSIS

In material and process development, precise characterization and comprehensive analysis are important fundamentals. Fraunhofer ISC has excellent equipment at its disposal to carry out analyses for a wide variety of problems. The material expertise enables analysis results to be interpreted and obtained as application oriented and practicable solutions. Our analysis experts support and advise with their many years of experience and meticulous approach.

» FROM THE ATOM TO THE PRODUCT «

- » State-of-the-art artefact-free preparation
- » Battery and cell testing
- » Bioanalysis
- » Surface and layer analysis
- » Microstructure and interfacial analysis
- » Damage analysis
- » Thermal analysis
- » Environmental analysis
- » Material analysis
- » Chemical analysis



» SUBJECT AREAS

Together with its customers and partners from research and industry, the institute is working on new resource-saving product solutions with high added value and, for this purpose, offers a technical infrastructure equipped with industry-specific features.

STRATEGIC SUBJECT AREAS

ENERGY – energy efficiency of high-temperature processes, development of battery and magnet materials

BIOMEDICINE – cell based implants, 3D tissue and disease models, scaffolds, stem cell process technology, theranostics

RESOURCES – recycling technologies, substitution of critical materials, resource strategies

CLEAN ENVIRONMENT – biobased, biocompatible, and biodegradable functional materials, biobased resources

ADAPTIVE SYSTEMS – sensors and actuators, optical and electronical functional materials, process engineering, materials with switchable properties



» YOUR PARTNER

FRAUNHOFER ISC

At the Fraunhofer ISC headquarter in Würzburg, Germany, material solutions for the future topics of energy, biomedicine, clean environment and adaptive systems are developed. This is based on the unique combination of material, processing, application and analytical know-how of the interdisciplinary team. Digitization and biological transformation are essential cross-sectional working priorities. Regarding resource efficiency, energy efficiency and sustainability, the Fraunhofer ISC focuses its developments on the use of renewable and environmentally friendly raw materials and recycling technologies.

MATERIALS CHEMISTRY/ APPLICATION TECHNOLOGY

In the expertise clusters of **Materials Chemistry and Application Technology**, the focus is on material optimization, efficient manufacturing processes and their adaptation to the needs of various industry sectors. Chemical material synthesis is the basis for the entire material development. The institute is a leader in the development of bio-based and biodegradable functional materials. Process development from laboratory to pilot production is the second important pillar. The focus lies on scalable synthesis processes and production-related manufacturing and processing methods.

ANALYSIS AND DEVICE DEVELOPMENT

With the **Center for Applied Analyses** accredited, according to DIN EN ISO IEC 17025, and the DIN EN ISO 9001:2008 certified Center of Device Development CeDeD, competent partners are available for the development and production accompanying analysis as well as the development and construction of special and research equipment.

CULTURAL HERITAGE PROTECTION

The International Convention Center for Cultural Heritage Preservation IZKK contributes results of current material research to the restoration and conservation of art objects.

BIOMEDICINE

The **Fraunhofer Translational Center for Regenerative Therapies** of the Fraunhofer ISC develops new cell-based tissue models and test systems, scalable production processes and biological vascularized implants up to prototypes. Supported by the Project Center for Stem Cell Process Engineering and in cooperation with partners from medical technology, biotechnology and the pharmaceutical industry, GMP-compliant implementation and combination of results from current materials research and tissue engineering for regenerative medicine in preclinical and clinical applications is being worked on.

BATTERY DEVELOPMENT

The **Fraunhofer Research and Development Center Electromobility Bavaria** focuses on battery materials and concepts for efficient stationary and mobile energy storage. In cooperation with the sector, electrode materials, electrolytes and other cell components as well as processes for their manufacture and processing are developed up to pilot scale. The focus is on optimization of established battery systems and forward-looking material and process concepts for solid-state batteries, as well as the testing of components and batteries.

SMART MATERIALS

Adaptive systems and smart materials enable new designs, intuitively learnable operating concepts and simplified mechatronic and adaptronic applications. The central task of the **Center Smart Materials** is to harness the extraordinary application potential of electrically and magnetically controllable materials for the sector. Development examples range from smart control elements with haptic feedback, textile-integrated sensors for optimized workplace ergonomics or patient monitoring and environmentally friendly generation of electricity with elastomer generators.



Using state-of-the-art 3D printing technology, the Fraunhofer Center HTL develops and produces customized metal and ceramic components with complex geometries and high size accuracy.

» CENTER HTL

The Fraunhofer Center for High-Temperature Materials and Design HTL develops materials and components as well as measurement and simulation methods for high-temperature applications. Important applications are in energy, drive and heat technology.

Currently, the Center HTL has about 100 employees at its two locations in Bayreuth and Würzburg. More than 2000 square meters of high-quality laboratory and pilot plant space are available. In addition, the Fraunhofer Application Center for Textile Fiber Ceramics at the Münchberg site is part of the Center HTL.

In the business unit Thermoprocess Technology, the focus is on improving the quality and increasing the material and energy efficiency of industrial heating processes. In the business segment CMC, the Center HTL covers the entire manufacturing chain from fiber development to textile processing, matrix construction, finishing, joining and coating.

WORK GROUPS

- » Ceramic
- » Polymer-Ceramic
- » Composite Materials Technology

WORK TEAMS

- » Simulation
- » Material Testing
- » Fiber Development

CORE EXPERTISE

- » High temperature characterization of materials and components with thermo-optical measuring systems (TOM)
- » Optimization of high-temperature processes by in-situ measurements and computer simulation
- » Development of high-temperature materials from ceramics, metal-ceramic composites and CMCs
- » Development of high temperature components and systems



The Fraunhofer project group IWKS develops innovative recycling solutions for maximum recovery of raw materials – e.g. from lithium ion batteries.



» PROJECT GROUP IWKS

The Fraunhofer Project Group IWKS creates the prerequisites to secure the supply of raw materials to our sector in the long term and thus to maintain a leading position in high technology in the future. To this end, innovative separation, sorting, processing and substitution options are being researched together with industrial partners and strategies for the sustainable use of valuable resources are being developed.

EXPERT NETWORK RESOURCES

The close networking of the business units enables research approaches along the entire value chain.

Project partners are thus optimally supported in their individual tasks.

In addition, the Fraunhofer Project Group IWKS can draw on the expertise of the parent company Fraunhofer ISC as well as on a Fraunhofer-wide network of experts and universities with the corresponding research area.

Furthermore, the Application Center for Resource Efficiency at the Aschaffenburg University of Applied Sciences is associated with the Project Group IWKS. This comprehensive competence network enables outstanding consulting services.

BUSINESS AREAS

- » Secondary Materials
- » Functional Materials

AREAS OF EXPERTISE

- » Analysis
- » Biogenic Systems
- » Energy Materials
- » Cycle Management
- » Magnetic Materials
- » Urban Mining

»KEEP IN TOUCH

Fraunhofer Institute for Silicate Research ISC

Director Prof. Dr. Gerhard Sextl
Neunerplatz 2 | 97082 Würzburg
Phone +49 931 4100-0
Email: info@isc.fraunhofer.de
www.isc.fraunhofer.de



newsletter of Fraunhofer ISC

Adress of further locations

Fraunhofer Translational Center for Regenerative Therapies TLZ-RT

Director PD Dr. Marco Metzger
Röntgenring 11 | 97070 Würzburg
Phone +49 931 31-86739

Fraunhofer ISC – Branch Office Bronnbach

Director Dr. Andreas Diegeler
Bronnbach 28 | 97877 Wertheim-Bronnbach
Phone +49 9342 9221-701



Fraunhofer ISC in motion

Fraunhofer Center for High-Temperature Materials and Design HTL

Director PD Dr. Friedrich Raether

Gottlieb-Keim-Str. 62 | 95448 Bayreuth

Phone +49 921 78510-935

Email: htl.info@isc.fraunhofer.de

www.htl.fraunhofer.de

Fraunhofer Project Group Materials Recycling and Resource Strategies IWKS

Director Prof. Dr. Anke Weidenkaff

Associate Director Prof. Dr. Rudolf Stauber

Brentanostrasse 2a | 63755 Alzenau

Phone +49 6023 32039-801

Email: iwks.info@isc.fraunhofer.de

www.iwks.fraunhofer.de

also in

Industriepark Hanau-Wolfgang (until the end of the year 2019)

Rodenbacher Chaussee 4 | 63457 Hanau

(from 2020 Aschaffener Straße 121 | 63457 Hanau)

