

# FRAUNHOFER IKTS IN PROFILE

## PORTRAIT

The Fraunhofer Institute for Ceramic Technologies and Systems IKTS covers the field of advanced ceramics from basic preliminary research through to the entire range of applications. Superbly equipped laboratories and technical facilities covering 30,000 m<sup>2</sup> of useable space have been set up for this purpose at the sites in Dresden and Hermsdorf.

Based on comprehensive materials expertise in advanced ceramic materials, the institute's development work covers the entire value creation chain, all the way to prototype production. Fraunhofer IKTS forms a triad of materials, technology and systems expertise, which is enhanced by the highest level of extensive materials diagnostics. Chemists, physicists, materials scientists and engineers work together on an interdisciplinary basis at IKTS. All tasks are supported by highly skilled technicians.

The focus is placed on manufacturers and especially existing and potential users of ceramics as project partners and customers. Fraunhofer IKTS operates in eight market-oriented divisions in order to demonstrate and qualify ceramic technologies and components for new industries, new product ideas, new markets outside the traditional areas of use. These include Mechanical and Automotive Engineering, Electronics and Microsystems, Energy, Environmental and Process Engineering, Bio- and Medical Technology, Optics, as well as both the conventional Materials and Processes and Materials and Process Analysis as overall interdisciplinary offers. The institute is therefore available as a competent consulting partner and starting point for all ceramics-related issues: a real "one stop shop" for ceramics.

Among our unique areas of expertise, we offer:

### **End-to-end production lines: from starting materials to prototypes**

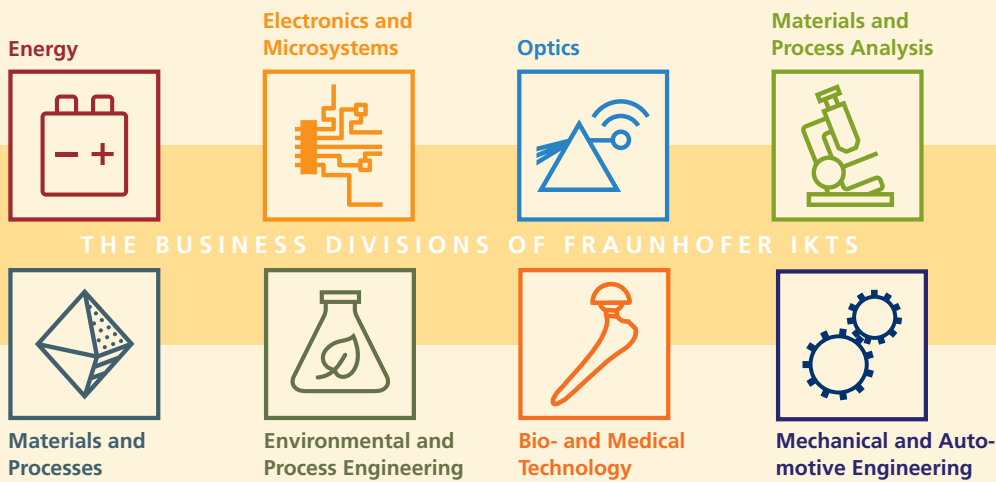
For any class of ceramic materials, we have access to all the standard processes of raw materials preparation, forming, heat treatment and finish processing. Where it makes sense, the institute can even conduct phase synthesis. In functional ceramics, we hold a particular core competency in paste and film technology. Multiple clean rooms and low-contamination production areas are kept at the ready, among other things, for multilayer ceramics and highly purified oxide ceramics lines of technology.

### **Multi-scale development**

Fraunhofer IKTS can convert developments from the lab into the technical standard. There is industrially suited equipment and machinery of the latest designs available for all relevant lines of technology, in order for partners and customers to realize the prototypes and pilot-production series needed for market launch, to develop production processes, and to implement quality processes. Thus, residual cost risks and time to market can be minimized.

### **Synergies between materials and technologies**

The combination of differing technology platforms, of functional and structural ceramics for example, allows for multifunctional components and systems that intelligently exploit ceramic properties. This enables the production of innovative products with markedly added value at low cost.



### Competent analysis and quality assessment

High-performance analysis and quality control are a decisive factor for market acceptance of products, especially in ceramic production processes. Since we understand materials as well as ceramic production processes at a fundamental level, while at the same time master the drafting and integration of complex physical testing systems, we can offer our customers unique solutions for materials issues in production and quality monitoring.

### Network creator

We are currently associated with over 450 national and international partners in our ongoing projects. In addition, Fraunhofer IKTS is active in numerous alliances and networks. Within the Fraunhofer-Gesellschaft, for example, we work with the Fraunhofer Group for Materials and Components. Furthermore, Fraunhofer IKTS serves as the spokesperson for the Fraunhofer AdvanCer Alliance, which consists of four institutes that specialize specifically in ceramics. We are in a position to support the development of networks that are needed to develop successful processes, and also to convey and to integrate expertise that goes beyond our own abilities. Our efforts on the front lines of research are based on a wealth of experience and knowledge acquired over many years, which is geared toward our partners' interests.

### Standardized management for sustainable quality assurance

Quality, traceability, transparency and sustainability: to us, these are our most important tools for setting ourselves apart from the competition. The IKTS therefore administers a standardized management system per DIN EN ISO 9001, as well as an environmental management system in accordance with DIN EN ISO 14001. Furthermore, each site of the institute is certified according to additional guidelines, including the German Medical Devices Act, and is regularly subjected to a variety of industrial audits.

# CORE COMPETENCIES OF FRAUNHOFER IKTS

## MATERIALS AND SEMI-FINISHED PARTS

### STRUCTURAL CERAMICS

- Oxide ceramics
- Non-oxide ceramics
- Hard metals and cermets
- Powders and suspensions
- Polymer ceramics
- Fiber composites
- Composite materials
- Ceramic foams

### FUNCTIONAL CERAMICS

- Non-conducting materials
- Dielectrics
- Semiconductors
- Ion conductors
- Magnets
- Pastes and tapes
- Solders, brazes and glass sealings
- Precursor-based inks and nanoinks
- Composites

### ENVIRONMENTAL AND PROCESS ENGINEERING

- Substrates**
  - Granulates
  - Plates
  - Tubes
  - Capillaries
  - Hollow fibers
  - Honeycombs
  - Foams
- Membranes and filters**
  - Oxides, non-oxides
  - Zeolites, carbon
  - MOF, ZIF, composites
  - Ion and mixed conductors
- Catalysts**
  - Oxides
  - Metals, CNT

### RAW MATERIAL AND PROCESS ANALYSIS, MATERIALS DIAGNOSTICS, NON-DESTRUCTIVE EVALUATION

- Analysis and evaluation of raw materials**
  - Analysis of particles, suspensions and granulates
  - Chemical analysis
- In-process characterization in ceramic technology**
  - Characterization
  - Process simulation and design
  - Quality management

- Characterized materials**
  - Steel, non-ferrous metals
  - Ceramics, concrete
  - Materials of semiconductor industry
  - Plastics, composite materials (GFRP und CFRP)
  - Biomaterials and tissues

### Process design, process monitoring

## TECHNOLOGY

## COMPONENTS AND SYSTEMS

### Powder technology

#### Shaping

Heat treatment and sintering

Final machining

Precursor technology

### Fiber technology

Additive manufacturing

Pilot production and upscaling

Coating technology

Joining technology

### Thick-film technology

#### Multilayer

- HTCC, LTCC

Aerosol and inkjet-printing

### Thin-film technology

Electrochemical machining

Galvanics

### Materials separation

- Filtration, pervaporation
- Vapor permeation
- Gas separation
- Membrane extraction
- Membrane distillation
- Electromembrane processes

Catalysis

### Biomass technology

- Preparation
- Conversion

Photocatalysis

Chemical process engineering

### Component design

Prototype production

Wear-resistant components

Tools

System definition and plant development

Modeling and simulation

Design and prototype production

### Samples and prototypes

- Membranes, filters
- Membrane modules
- Membrane plants

#### Filtration tests

- Laboratory, pilot, field
- Piloting

### Optical components

Optical components

Heating systems

Medical device technology and implants

Filters

Validation/ CE marking

Test stand construction

Support in field tests

### Modeling and simulation

- Materials transport
- Heat transport
- Reaction

Reactor development

Plant design

### Material and component characterization

- Microstructure and phases
- Mechanical and physical properties
- High-temperature properties
- Corrosion

### Component and system behavior

- Damage analysis
- Failure mechanisms
- Measurement and simulation of component behavior
- Testing in accordance with certified and non-certified standards

### Technologies

- Micro- and nanoanalytics
- Ultrasound testing
- High-frequency eddy current
- Optical methods
- X-ray methods

### Components, systems and services

- Sensors and sensor networks
- Testing heads and systems
- Structural health monitoring
- Data analysis and simulation
- Biomedical sensor systems
- Testing in accordance with certified and non-certified standards

Component behavior, reliability analysis, lifetime and quality management, calibration