



**NAME : FRAUNHOFER INSTITUTE FOR CERAMIC TECHNOLOGIES AND SYSTEMS**

**COUNTRY : GERMANY**

**Profile :**

The scientific field of the Fraunhofer IKTS is focussed on the development and application of modern high performance ceramic materials, on the development of industrial powder metallurgical technologies in order to produce these materials and on the manufacturing of prototypical components.

Structural ceramics, functional ceramics and cermets set up the priorities with emphasis on innovative complex systems. The R&D products of the institute find applications in the field of microelectronics/microsystems technology, mechanical engineering and construction of plants, car manufacturing, toolmaking and medical technology, aerospace and astronautics, transport, energy, metallurgy, measuring technology and ecology.

The R&D process follows all the stages of product development, from production of the materials to the development and optimization of the structure/property relationships through to the application/system integration stage. Closed technological lines enable R&D in an industrial oriented scale from raw materials up to ready-to-use prototypes. Modern equipment and comprehensive experience in process and product characterization provide a high quality assurance.

The institute has a permanent staff of about 160. More than 9200 m<sup>2</sup> of laboratories, offices and technical facilities with advanced equipment are available.

**Expertise on following materials :**

- oxide ceramics
- nonoxide ceramics
- hard metals/cermets
- nano ceramics
- powders for coating techniques
- nonoxide precursor ceramics
- biogenic materials
- porous ceramics
- foam ceramics
- dielectrics, ferroelectrics, piezoceramics
- perovskites
- electrodes
- ionic conductors (high- and low temperature)
- resistor- and conductor materials
- glasses
- sol-gel
- pastes
- slurries

**Actual research domains concerning materials technology / Competences :****- Structural Ceramics, Hard Metals/Cermets, Special Materials**

The most important material systems used for modern high-performance ceramics that are mainly subjected to mechanical stresses are alumina and zirconia, silicon and aluminium nitride, and carbides and borides based on synthetic raw materials.

Dense and porous monolithic ceramics, composites and coatings on the basis of oxide materials for structural applications. Development of new materials and technologies within the framework of processing - resulting microstructures - basic properties - technical performance.

The carbide ceramics team develops materials as:

- sintered ceramic (pressure less sintered, hot pressed, gas pressure assisted sintering and HIP)
- reaction bonded ceramics
- Composites based on carbides
- Ceramics with graded structures
- Ceramics with controlled porosity

Most expertise exists in the field of silicon carbide, boron carbide and titanium carbide.

Development, optimization, production and testing of tool materials and tools based on the hard metals WC-TiC-TaC-VC-Cr<sub>3</sub>C<sub>2</sub>-MeC-(Co,Ni,Fe) und Cermets (Ti,Mo,W,Ta) C<sub>x</sub>N<sub>y</sub>-(Ni,Co,Fe) and the cermets (Ti,Mo,W,Ta)C<sub>x</sub>N<sub>y</sub>-(Ni,Co,Fe), ranging from the production and testing of the hard metal starting powders through the optimization of the powder metallurgical process and the fabrication of components to the testing and assessment of cutting materials and tools.

New production technologies and materials with specific functions are being tested for new applications. IKTS Dresden develops application-oriented solutions for materials, processing techniques and prototypical components jointly with its cooperation partners and is involved in systems development.

**- Functional Ceramics****o Microsystems**

The main competence of the group Microsystems is the development and manufacture of pastes for microelectronic applications.

The pastes are deposited on suitable substrates. Functional elements as resistors for microwave applications, modules or systems (LTCC, sensors and actuators) are established.

An essential component of the pastes is glass. The group has more than 20 years experience on this field. Glasses for the joining technology were successfully developed.

**o Energy Systems**

Functional layers / devices / systems were developed converting chemical or light energy into current or heat.

Actual researches concern the development of SOFC-stacks as well as Ag/Zn-batteries.

For the PEMFC an electrode paste was developed resulting in a higher long term stability

of PEMFC-stacks. Currently this competence is used for the manufacturing of micro-PEMFCs.

With  $\text{TiO}_2$  -pastes resp. -layers of the IKTS dye solar cells was manufactured by ABB with an efficiency of 14% (1993).

### ○ Dielectrical Components

The IKTS deals with the complete added value chain of piezoelectric components – synthesis of piezoelectric materials, adaptation of materials and technologies for certain applications, and basic investigations for advanced applications. These investigations are accompanied by characterization of the functionality and structural properties.

### - Process Characterization

Development-relevant process characterization and property evaluation of materials and components

#### Methods

- Powder and suspension characterization
- Thermal analysis
- X-ray diffractometry
- Ceramography
- Mechanical properties
- IT
- Environmental technology
- Environmental analysis and environmental process technology

#### Specialization

- Characteristic data and parameters for the development of materials, technologies and methods. Measurement and characterization methods on a nanometer scale or at high temperatures.

The Thermoanalytical Laboratory and the Laboratory for Particle and Suspension Characterization at the Fraunhofer IKTS met the DIN EN 45 001 standards and were accredited in 1994 and July, 1997, respectively, by the German Accreditation Bureau for Chemistry (DACH).

### - Environmental Engineering

Fields of activity of this department are wastewater and sludge treatment, ultrasonic disintegration, particle technology, conditioning, solid-liquid-separation, sludge characterization, and recycling of process wastewater in ceramic production.

#### **Available research infrastructure :**

Scientists at Fraunhofer IKTS in Dresden cooperate in networks and alliances dedicated to various themes in order to improve ties with other experts and to be able to provide customers with coordinated joint services.



## European Network of Materials Research Centres

The Fraunhofer-Institut für Keramische Technologien und Sinterwerkstoffe IKTS is member of the following associations:

- Nanotechnology Center of Excellence for “Ultrathin Functional Layers”
  - Silicon Saxony
  - “TransNanoPowder Information and Consulting Center”
  - “NanoMat” – Interregional Network for Materials Used in Nanotechnology
  - Gesellschaft für Wissens- und Technologietransfer der TU Dresden mbH
  - BioMeT Dresden Network
  - Meeting of Refractory Experts Freiberg e. V. (MORE)
  - Arbeitsgemeinschaft Elektrochemischer Forschungsinstitutionen e. V. (AGEF)
  - Förderkreis Abgasnachbehandlungstechnologien für Dieselmotoren e. V. (FAD)
  - European Powder Metallurgy Association (EPMA)
  - Europäische Forschungsgesellschaft für Blechverarbeitung e. V. (EFB)
  - Gemeinschaft für Thermisches Spritzen e. V.
  - Deutsche Keramische Gesellschaft e. V. (DKG)
  - Deutsche Gesellschaft für Materialkunde e. V. (DGM)
  - DECHEMA – Gesellschaft für Chemische Technik und Biotechnologie e. V.
  - Forschungsvereinigung Schweißen und verwandte Verfahren e. V. des DVS
  - Materialforschungsverbund Dresden e. V. (MFD)
- 
- Fraunhofer Alliance Materials and Components
  - Fraunhofer Alliance for High-Performance Ceramics
  - “Ceramics Meeting Point” in Dresden
  - Fraunhofer Adaptronics Alliance
  - Fraunhofer Nanotechnology Alliance
  - Fraunhofer Energy Alliance
  - Fraunhofer “AdvanCer” Demonstration Center
  - Fraunhofer “ZEUS” Demonstration Center for Cutting and Forming Tools
  - Fraunhofer Alliance for Rapid Prototyping
  - Fraunhofer DiaCer Alliance
  - Fraunhofer Sensor Network

**Coordinate address :** Fraunhofer Institut für Keramische Technologien und Systeme  
Winterbergstr. 28  
D-01277 Dresden  
Germany

**URL :** <http://www.ikts.fhg.de>

**Contact persons :**

**Name :** Dr. Tassilo Moritz  
**Function :** Scientific Collaborator  
**Tel. :** +49(0)351/2553-747  
**Fax :** +49(0)351/2554-197  
**e-mail :** [Tassilo.Moritz@ikts.fraunhofer.de](mailto:Tassilo.Moritz@ikts.fraunhofer.de)