

COOPERATION IN GROUPS, ALLIANCES AND NETWORKS

ANNUAL REPORT 2016/17

Membership in Fraunhofer Groups, Alliances and Networks

Scientists at Fraunhofer IKTS are active in numerous thematically oriented networks, alliances and groups. Therefore, our customers benefit from having a coordinated range of joint services available to them.

AMA Association for Sensors and Measurement	Competence Network on Optical Technologies (Optonet)	European Powder Metallurgy Association (EPMA)
American Ceramic Society (ACerS)	Cool Silicon	European Rail Innovation Center
Association Competence Center for Aerospace and Space Technology Saxony/Thuringia (LRT)	DECHEMA – Society for Chemical Engineering and Biotechnology	European Research Association for Sheet Metal Working (EFB)
Association for Manufacturing Technology and Development (GFE)	Deutsche Glastechnische Gesellschaft (DGG)	European Society of Thin Films (EFDS)
Association of Electrochemical Research Institutes (AGEF)	DIN – German Institute for Standardization	Expert Group on Ceramic Injection Molding in the German Ceramic Society
Association of German Engineers (VDI)	Deutsche Keramische Gesellschaft (DKG / German Ceramic Society)	Expert Group on High-Temperature Sensing Technology in the German Society for Materials Science
Association of the Thuringian Economy	DKG/DGM Community Committee	Fraunhofer Adaptronics Alliance
Association of Thermal Spraying (GTS)	DRESDEN concept	Fraunhofer Additive Manufacturing Alliance
biosaxony	Dresden Fraunhofer Cluster Nanoanalysis	Fraunhofer AdvanCer Alliance
Carbon Composites (CCeV)	Dresdner Gesprächskreis der Wirtschaft und der Wissenschaft	Fraunhofer Battery Alliance
Ceramics Meeting Point Dresden	Dual Career Network Central Germany	Fraunhofer Cluster 3D Integration
Competence Center for Nano Evaluation nanoeva®	Energy Saxony	Fraunhofer Energy Alliance

Fraunhofer Group for Materials and Components – MATERIALS	German Engineering Association (VDMA)	NanoMat – Supraregional Network for Materials Used in Nanotechnology	Wasserwirtschaftliches Energiezentrum Dresden
Fraunhofer Group for Microelectronics	German Society for Materials Research (DGM)	Nanotechnology Center of Excellence for “Ultrathin Functional Layers”	WindEnergy Network Rostock
Fraunhofer Lightweight Design Alliance	German Society for Non-Destructive Testing (DGZfP)	ProcessNet – an Initiative of DECHEMA and VDI-GVC	
Fraunhofer Nanotechnology Alliance	German Thermoelectric Society (DTG)	Research Association for Diesel Emission Control Technologies (FAD)	
Fraunhofer Numerical Simulation of Products and Processes Alliance	Hydrogen Power Storage & Solutions East Germany	Research Association for Measurement Technology, Sensors and Medical Technology Dresden (fms)	
Fraunhofer Textile Alliance	International Energy Agency (IEA) Implementing Agreement on Advanced Fuel Cells	Research Association on Welding and Allied Processes of the German Welding Society (DVS)	
Fraunhofer Water Systems Alliance (SysWasser)	International Zeolite Association	Silicon Saxony	
German Acoustical Society (DEGA)	KMM-VIN (European Virtual Institute on Knowledge-based Multifunctional Materials AISBL)	smart ³	
German Association for Small and Medium-sized Businesses (BVMW)	Materials Research Network Dresden (MFD)	SmartTex Network	
German Biogas Association	medways	Society for Corrosion Protection (GfKORR)	
German Electroplating and Surface Treatment Association (DGO)	Meeting of Refractory Experts Freiberg (MORE)	Thüringer Erneuerbare Energien Netzwerk e. V. (ThEEN)	
German Energy Storage Association (BVES)	Micro-Nanotechnology Thuringia (MNT)		

FRAUNHOFER GROUP FOR MATERIALS AND COMPONENTS – MATERIALS

Materials research and materials technology at Fraunhofer cover the entire value chain, from the development of new and the improvement of existing materials, through manufacturing technology on a quasi-industrial scale, up to the characterization of properties and assessment of service behavior. The same research scope applies to the components made from these materials and the way they function in systems. As far as materials are concerned, the Fraunhofer MATERIALS group covers the full spectrum of metals, inorganic non-metals, polymers, and materials made from renewable resources, as well as semiconductor materials. Over the last few years, hybrid materials have gained significantly in importance. With strategic forecasts the Group supports the development of future-oriented technologies and materials. With the initiative Materials Data Space® (MDS) founded in 2015, the Group is presenting a roadmap towards Industry 4.0 enabled materials. Digitalization of materials along their entire value creation chain is viewed by the Group as a key requirement for the lasting success of Industry 4.0.

Objectives of the Group:

- Supporting accelerated innovation in the markets
- Promoting the success of Industry 4.0 through suitable material concepts (digital twins, Materials Data Space®)
- Increasing integration density and improving the usability properties of microelectronic devices and microsystems
- Improving the use of raw materials and improving the quality of the products manufactured from them, development of recycling concepts
- Enhancing safety and comfort and reducing resource consumption in the areas of transport, machine and plant construction, building & living
- Increasing the efficiency of systems in energy generation,

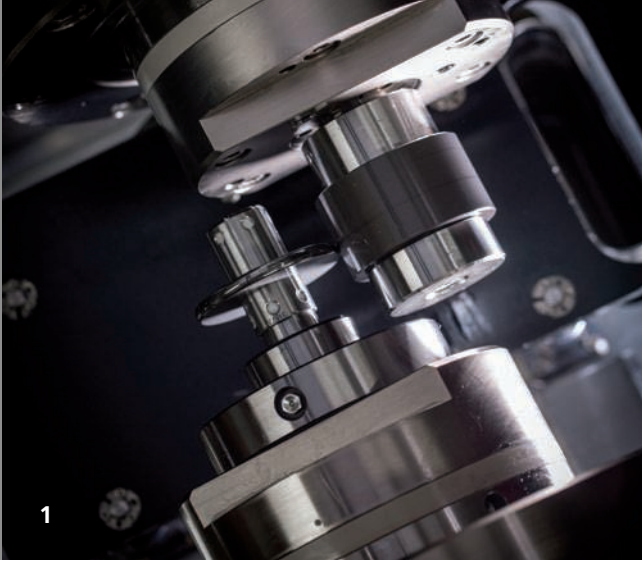
- energy conversion, energy storage and distribution
- Improving the biocompatibility and function of materials used in medical biotechnical devices, improving material systems for medical diagnosis, disease prevention and therapy
- Improving the protection of people, buildings and infrastructure through high-performance materials in tailored protection concepts

Members are the Fraunhofer Institutes for

- Applied Polymer Research IAP
- Building Physics IBP
- Structural Durability and System Reliability LBF
- Chemical Technology ICT
- Manufacturing Technology and Advanced Materials IFAM
- Wood Research, Wilhelm-Klauditz-Institut, WKI
- Ceramic Technologies and Systems IKTS
- High-Speed Dynamics, Ernst-Mach-Institut, EMI
- Microstructure of Materials and Systems IMWS
- Silicate Research ISC
- Solar Energy Systems ISE
- Systems and Innovations Research ISI
- Nondestructive Testing IZFP
- Wind Energy and Energy System Technology IWES
- Mechanics of Materials IWM
- Industrial Mathematics ITWM (assoc. institute)
- Interfacial Engineering and Biotechnology IGB (assoc. institute)
- Integrated Circuits IIS (assoc. institute)

Group chairman

Prof. Dr. Peter Elsner, Fraunhofer ICT
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FRAUNHOFER ADVANCER ALLIANCE

Systems development with high-performance ceramics

The usage of high-performance ceramics allows for new applications in energy engineering, mechanical and plant engineering, and medical technology. Well-known examples are highly efficient tools and coatings, new material and manufacturing technologies for medical-technical products as well as creative solutions for energy and resource saving industrial processes. At present, AdvanCer is working in a joint project developing systems solutions and test methods for the oil and gas industry as well as for deep sea mining. It is the objective to develop new diamond-ceramic and hard metal materials as well as the appropriate manufacturing technologies. So, components may be realized which allow for the maintenance-free operation in up to 6000 m depth in the sea.

Four Fraunhofer Institutes (IKTS, IPK, ISC/HTL and IWM) have joined together to form the Fraunhofer AdvanCer Alliance. It is the aim of AdvanCer to develop individual systems solutions with advanced ceramics for industry. The research activities of the Fraunhofer Alliance extend along the entire value-added chain from modeling and simulation through application-oriented materials development, production and machining of ceramic parts to component characterization, evaluation and non-destructive testing under application conditions. Development work is conducted and supported by modeling and simulation methods.

Furthermore, AdvanCer has established a comprehensive range of training and consultancy services to support small and medium-sized companies in solving complex tasks ranging from prototype development to technology transfer.

Fields of cooperation

- Materials development for structural and functional ceramics, fiber-reinforced ceramics, cermets and ceramic composites
- Component design and development of prototypes
- Systems integration and verification of batch-production capabilities
- Development of powder, fiber and coating technologies
- Materials, component and process simulation
- Materials and component testing
- Defect analysis, failure analysis, quality management
- Analysis of energy demand for thermal processes and to improve energy efficiency
- Increase of efficiency using ceramic components

Services offered

- Development, testing and evaluation of materials
- Prototype and small series production
- Technology development and technology transfer
- Process analysis and design
- Consulting, feasibility studies, training programs

Spokesperson of the Alliance

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1 Test stand for the tribological testing of ceramic materials and components (Source: Dirk Mahler/Fraunhofer).



GROUPS, ALLIANCES, NETWORKS

CERAMICS MEETING POINT – CERAMIC APPLICATIONS

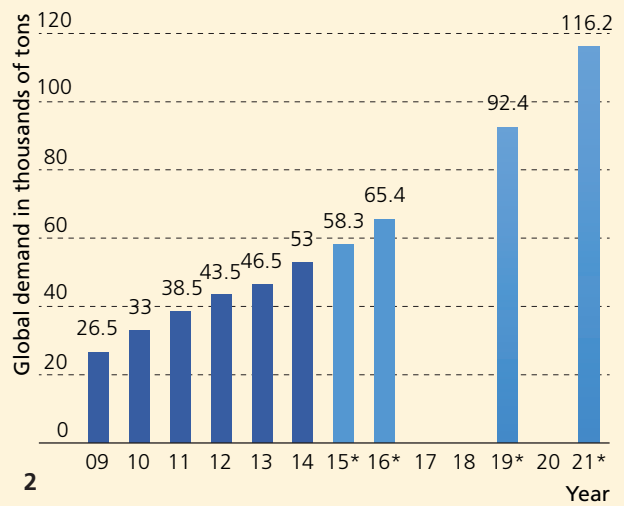
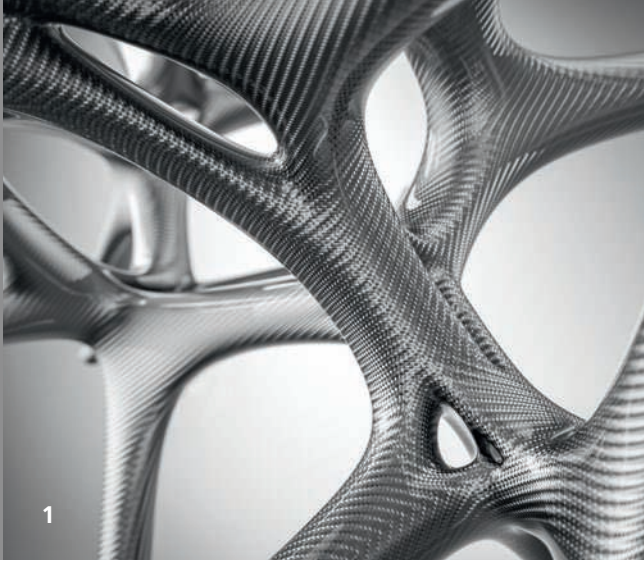
The Ceramics Meeting Point is an integral part of the public relations activities of Fraunhofer IKT. The closed production chain from powder to component is displayed, not only from a scientific point of view but also as a mirror of technologies and capacities available in the industry. The visitor gets an impression of current focal points in research and is simultaneously informed about which manufacturers offer certain products commercially. With respective touchable models, the trust in the economic feasibility of new ideas is strengthened and the initiation of new projects facilitated.

Ceramic Applications of the Goeller Verlag, which took over the TASK GmbH business in 2015, embodies the new label of the cooperation with its currently 46 partners and members. The opportunity to see the latest research topics up to systems testing in one room and to get into contact with possible suppliers will be extended. The members of the Fraunhofer AdvanCer Alliance also benefit from this infrastructure.

In the workshops and training courses of the Fraunhofer AdvanCer Alliance and the Deutsche Keramische Gesellschaft (DKG / German Ceramic Society), the Ceramics Meeting Point is used to present the state of the art in industry and to show the practical relevance desired by the participants. Thus, a project forum particularly for small and medium-sized companies has developed, facilitating contacts to project initiators and research institutes.

By visiting the Ceramics Meeting Point within the framework of numerous events, such as the ICC6, the number of visitors was again increased. More than 1800 visitors informed themselves about ceramic product innovations and manufacturers in 2016. The Ceramics Meeting Point was also an essential part of the DKG division 1 "Chemie-/Maschinen-/Anlagenbau" this year. Suggestions for various project proposal via the DKG were formed here.

¹ Hannover Messe 2016: Fraunhofer IKT at the joint booth "Ceramic Applications".



GROUPS, ALLIANCES, NETWORKS

PROGNET – TESTING OF COMPOSITE MATERIALS

Project Group Berlin, located in Adlershof, was assigned the task of forming a cooperation network within the scope of the ZIM (Central Innovation Program for SMBs) by the Federal Ministry for Economic Affairs and Energy (BMWi).

Within the network, procedures and systems as well as simulation and monitoring tools are developed for ensuring the technical safety of highly reliable components manufactured with innovative materials.

Due to their outstanding properties, composite materials can be used for the efficient design of high-strength, lightweight components. For determining the structure-property relationships in these materials, methods and instruments that enable the characterization of the designed materials structure and behavior under load are called for. Both the aerospace industry and the automotive industry have identified a high demand for evaluation and testing of pure carbon fiber-reinforced composites (CFCs) and fiber-metal laminates (FMLs).

With the international trend in use of new materials that is beginning to emerge, it is safe to say that not only in Europe and the US but also in Asia in particular, a high demand for the products of the network will arise. Figure 2 depicts the predicted global need for carbon fibers. Demand is expected to rise until 2021. Similar trends are expected for other new materials. A corresponding increase in demand for tools and platforms for developing and testing components made of these materials is hence also anticipated.

The network provides its partners with funding options for a wide range of innovative technical projects. It aims to provide a sustainable improvement in the innovative and competitive

capacity of partner companies and thus contribute to their growth as well as to the creation and preservation of jobs. The innovative capacity in the field of test technology generated through Prognet and the close relationships to standardization bodies for test regulations are sure to provide leverage to the solutions flowing into the network partners' various products.

Spokesperson of the cooperation network

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- 1 Carbon structures (© mxd - Fotolia).
- 2 Global demand for carbon fibers in thousands of metric tons for the period 2009–2021 (*estimates).





GROUPS, ALLIANCES, NETWORKS

CENTER FOR ENERGY AND ENVIRONMENTAL CHEMISTRY JENA (CEEC)

The Center for Energy and Environmental Chemistry Jena (CEEC) is an interfaculty center operated jointly by Fraunhofer IKTS and Friedrich-Schiller-Universität (FSU) Jena. The CEEC bundles the activities of the two research institutions in the fields of energy conversion, energy storage, and technical environmental chemistry. Focus is mainly on electrochemical energy storage systems and the materials, especially ceramics and polymers, used for them, energy converters, such as solar cells, and innovative water and waste water treatment methods. There are currently 12 professorships from FSU and 5 departments from IKTS represented at the CEEC. In addition to the new institute building in Jena, which has been in operation since 2015, laboratories and pilot-scale facilities for battery manufacturing and membrane technology are part of the center at Fraunhofer IKTS in Hermsdorf.

For IKTS, the CEEC represents a strategic cooperation platform with Friedrich-Schiller-Universität Jena, especially in the field of basic research. Numerous joint Master's and PhD theses are organized, joint events offered, research projects initiated, and large-scale equipment used via the center. The "Chemistry - Energy - Environment" Master's program, in which IKTS is particularly prominent with its research activities, is also supervised and overseen by the CEEC and is the only program of its kind offered in Germany.

One focus of the collaboration is the "Technical Environmental Chemistry" chair, which is held by Prof. Michael Stelter, Deputy Institute Director of Fraunhofer IKTS. The working group is dedicated to water treatment, water purification, and water analysis using novel, combined physical and electrochemical methods, such as ultrasound and hydrodynamic cavitation, electrochemistry, and ceramic membrane technology. The

group thus functions as a bridge to the extensive work being performed at Fraunhofer IKTS in Hermsdorf and Dresden.

Additional topics addressed at the CEEC and of particular relevance to IKTS include the following:

- Materials for electrochemical reactors and batteries
- Organic active materials and membranes
- Carbon nanomaterials
- Glasses and optically active materials for photovoltaics and photochemistry
- Physical characterization

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1 Center for Energy and Environmental Chemistry at the FSU Jena (Source: Anne Günther/FSU Jena).