

# COOPERATION IN GROUPS, ALLIANCES AND NETWORKS

ANNUAL REPORT 2019/20

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.

## Membership in Fraunhofer Groups, Alliances and Networks

AGENT-3D

AMA Association for Sensors and Measurement

American Ceramic Society (ACerS)

Association Competence Center for Aerospace and Space Technology Saxony/Thuringia (LRT)

Association for Manufacturing Technology and Development (GFE)

Association of Electrochemical Research Institutes (AGEF)

Association of German Engineers (VDI)

Association of Thermal Spraying (GTS)

biosaxony

BTS Rail Saxony

Carbon Composites (CCeV)

Ceramics Meeting Point Dresden

CiS Forschungsinstitut für Mikrosensorik GmbH

CO<sub>2</sub> Value Europe

Competence Center for Nano Evaluation nanoeva®

Competence Network on Optical Technologies (Optonet)

Cool Silicon

DECHEMA – Society for Chemical Engineering and Biotechnology

DeepSea Mining Alliance

Deutsche Glastechnische Gesellschaft (DGG)

Deutsche Keramische Gesellschaft (DKG/German Ceramic Society)

DIN Standards Committee Information Technology and selected IT Applications (NIA)

DKG/DGM Community Committee

DRESDEN-concept

Dresden Fraunhofer Cluster Nanoanalysis

Dresdner Gesprächskreis der Wirtschaft und der Wissenschaft

ECPE European Cluster for Power Electronics

EIT Health

Energy Saxony

e.qua impuls – Wassereconomisches Energiezentrum Dresden

European Society of Thin Films (EFDS)

European Network of Materials Research Centres (ENMAT)

European Powder Metallurgy Association (EPMA)

European Research Association for Sheet Metal Working (EFB)

Expert Group on Ceramic Injection Molding in the German Ceramic Society

Expert Group on High-Temperature Sensing Technology in the German Society for Materials Science

Fördergesellschaft Erneuerbare Energien (FEE)

Fraunhofer Adaptronics Alliance

Fraunhofer Additive Manufacturing Alliance

Fraunhofer AdvanCer Alliance

Fraunhofer Battery Alliance

Fraunhofer Big Data Alliance

Fraunhofer Energy Alliance

Fraunhofer Group for Materials and Components – MATERIALS

Fraunhofer Lightweight Design Alliance

Fraunhofer Nanotechnology Alliance

Fraunhofer Numerical Simulation of Products and Processes Alliance

Fraunhofer Water Systems Alliance (SysWasser)

## GROUPS, ALLIANCES, NETWORKS

Fraunhofer Textile Alliance	German Phosphorus-Platform DPP	Meeting of Refractory Experts Freiberg (MORE)	Society for Corrosion Protection (GfKORR)
German Association for Small and Medium-sized Businesses (BVMW)	German Physical Society	Micro-Nanotechnology Thuringia (MNT)	Trägerverein Institut für Holztechnologie Dresden e. V.
German Association of University Professors and Lecturers (DHV)	German Thermoelectric Society (DTG)	Nachhaltigkeitsabkommen Thüringen	TRIDELTA CAMPUS HERMSDORF
German Biogas Association	HYPOS Hydrogen Power Storage & Solutions East Germany	NAFEMS – International Association for the Engineering Modelling, Analysis and Simulation Community	Thüringer Erneuerbare Energien Netzwerk (TheEN)
German Chemical Society (GDCh)	InDeKo Innovationszentrum Deutschland Korea	NanoMat – Supraregional Network for Materials Used in Nanotechnology	VDMA Medical technology
German Electroplating and Surface Treatment Association (DGO)	Innovationszentrum Bahntechnik Europa e. V.	Organic Electronics Saxony	Verein für Regional- und Technikgeschichte e. V. Hermsdorf
German Energy Storage Association (BVES)	Institut für Energie- und Umwelttechnik e. V. (IUTA)	ProcessNet – an Initiative of DECHEMA and VDI-GVC	WindEnergy Network Rostock
German Engineering Association (VDMA)	International Microelectronics and Packaging Society	Research Association for Diesel Emission Control Technologies (FAD)	
German Federation of Industrial Research Associations (AiF)	International Zeolite Association	Research Association on Welding and Allied Processes of the German Welding Society (DVS)	
German Materials Society (DGM)	KMM-VIN (European Virtual Institute on Knowledge-based Multifunctional Materials AISBL)	Silicon Saxony	
German Society for Membrane Technology (DGMT)	Materials Research Network Dresden (MFD)	smart <sup>3</sup>	
German Society for Non-Destructive Testing (DGZfP)	medways	SmartTex Network	



## FRAUNHOFER GROUP FOR MATERIALS AND COMPONENTS – MATERIALS

Materials science and engineering at Fraunhofer covers the entire value chain, from developing new and improving existing materials to manufacturing technology on a quasi-industrial scale, in addition to characterizing properties and assessing service behavior. This also applies to the components and products made from these materials and their system behavior in relevant applications. Equal importance is attached to experimental studies in laboratories, technical centers and pilot plants and to methods of numerical simulation and modeling; they are used across scales, from molecule and component, to complex system and process simulation. Where 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. The Group uses strategic forecasting to support 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 Industrie 4.0-enabled materials. It considers digitization of materials along their entire value chain as a key requirement for the lasting success of Industrie 4.0. Special attention is also given to the development of customized materials for additive manufacturing, from expanding the range of materials that can be used to developing multimaterial systems. Thus the Group is making a significant contribution to maximizing and economically exploiting this promising manufacturing technology.

The importance of renewable energies is rapidly gaining momentum as the energy transition continues. A large number of materials, from copper, steel and concrete to rare earths will be used to generate, store, transport and convert energy, to a significantly greater extent compared with traditional energy

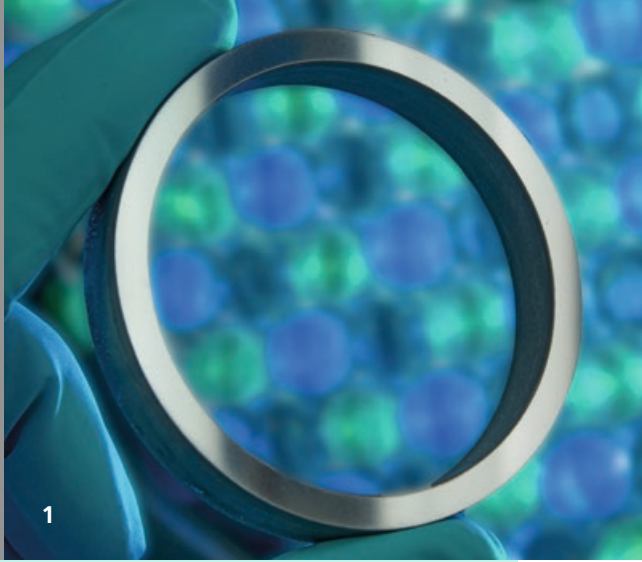
supply systems. The Group is addressing this set of questions, particularly with a view to resource availability and the creation of closed resource cycles for these systems and components.

### Objectives of the Group

- Supporting accelerated innovation in the markets
- Promoting the success of Industrie 4.0 through suitable material concepts (digital twins, Materials Data Space®)
- Increasing the success of additive manufacturing with expanded ranges of materials and technologies
- Supporting the energy transition with material efficiency and resource strategies
- Increasing integration density and improving the usability properties of microelectronic devices and microsystems
- Improving the use of raw materials and the quality of the products manufactured from them, and the 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 the generation, conversion, storage and distribution of energy
- Improving the biocompatibility and function of materials used in medical biotechnical devices, improving material systems for medical diagnosis, disease prevention and therapy
- Improved protection of people, buildings, infrastructure through high-performance materials in protection concepts

### Group chairman

Prof. Dr. Peter Gumbsch, Fraunhofer IWM  
[www.materials.fraunhofer.de](http://www.materials.fraunhofer.de)



GROUPS, ALLIANCES, NETWORKS

## FRAUNHOFER ADVANCER ALLIANCE

### Systems development with advanced ceramics

The usage of advanced 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.

One research focus of the AdvanCer Alliance is on system solutions and test methods for the oil and gas industry and deep sea mining. This includes the development of new ceramic and hardmetal materials for wear and corrosion protection, process water treatment and optical applications. This enables component properties to be achieved that enable maintenance-free operation at depths of up to 6000 m. In addition, sensors and processes are being designed that allow non-destructive defect detection, real-time monitoring and associated condition-based maintenance or plant optimization even under harsh operating conditions.

In the Fraunhofer AdvanCer Alliance, the IKTS, IPK, ISC/HTL and IWM institutes participate along the entire value chain: from application-oriented materials development, production and machining of ceramic parts to component characterization, evaluation and non-destructive testing under application conditions. The development work is also accompanied and supported by methods of modeling and simulation.

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.

### Services offered

- Development and evaluation of materials (structural and functional ceramics, fiber-reinforced ceramics, cermets, ceramic composites, hardmetals)
- Technology development and transfer
- Component design, prototype production, small series production
- Systems integration and verification of batch-production capabilities
- 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
- Consulting, feasibility studies, training programs

### Spokesperson of the Alliance

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**1** *Highly wear- and corrosion-resistant diamond ceramic seal ring for use in pumps.*



GROUPS, ALLIANCES, NETWORKS

## CERAMICS MEETING POINT – CERAMIC APPLICATIONS

The Ceramics Meeting Point is an integral part of our institute's public relations activities. Through the cooperation with the currently 51 partners and members under the label "Ceramic Applications" by the Göller-Verlag, the institute offers a unique overview of the technical ceramics market. It is possible to see the latest research topics up to systems testing in one room and at the same time to establish contact with potential suppliers. All events of the Fraunhofer IKTS thus become an ideal platform for users who are not yet familiar with the industry. Networking effects with Fraunhofer-Gesellschaft are enhanced further by including the Fraunhofer AdvanCer Alliance. This makes it possible to represent the complete service portfolio of all institutes.

The seminars organized by the Fraunhofer AdvanCer Alliance, the German Ceramic Society (DKG), and the German Materials Society (DGM) present the state-of-technology in the industry and provide participants with the desired hands-on experience. With this approach, Fraunhofer IKTS provides a project forum, in particular for small- and medium-sized companies, facilitating contacts with project sponsors and research institutions.

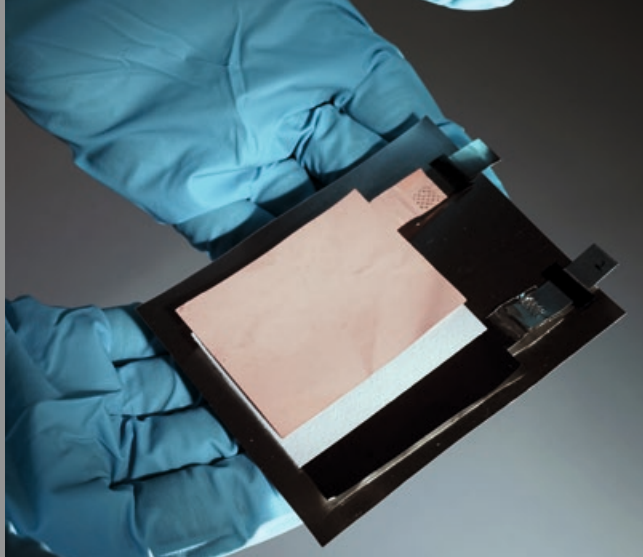
The entire production chain from powder to the component is shown. And that not only on the research side, but also as a mirror of the technologies and capacities available in the industry. Visitors gain insight into the current focal points of research while learning which manufacturer commercially supplies which product.

In 2019, the focus was on metal-ceramic joining technology and the latest additive manufacturing processes. The exhibition will remain integrated into the various events at the institute, thus ensuring that up to 2000 visitors per year will have quick access to the world of technical ceramics.

In 2019, the Ceramics Meeting Point was again an essential part of the work of the DKG's Department 1: Chemical/Mechanical and Plant Engineering. The networking of manufacturers, users and research institutes will make it easier to form the FDKG accompanying committees for projects funded by the AiF.

**1** *Ceramics Meeting Point at Fraunhofer IKTS in Dresden-Gruna.*





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 University (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 13 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 IKTS in Hermsdorf.

For IKTS, the CEEC represents a strategic cooperation platform with Friedrich Schiller University 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. The working group is dedicated to water treatment, water purification, and water analysis using novel methods, such as ultrasound and hydrodynamic cavitation, electrochemistry, and ceramic membrane technology.

In 2019, new equipment for high-performance analytics, penetrating extremely low concentration ranges and providing data on pollutant degradation processes in automated high throughput, could be procured especially in the research area of trace substances. This technology opens the path for digitalization and sensors even in water treatment.

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 *New battery electrodes from the CEEC (Source: Jan-Peter Kasper/FSU Jena).*