

PROFILE OF FRAUNHOFER IFAM

FROM MATERIAL TO EFFICIENT APPLICATION

- + METALLIC MATERIALS
- + POLYMERIC MATERIALS
- + SURFACE TECHNOLOGY
- + ADHESIVE BONDING
- + SHAPING AND FUNCTIONALIZATION
- + ELECTROMOBILITY
- + AUTOMATION AND DIGITALIZATION
- + WORKFORCE QUALIFICATION AND TECHNOLOGY TRANSFER



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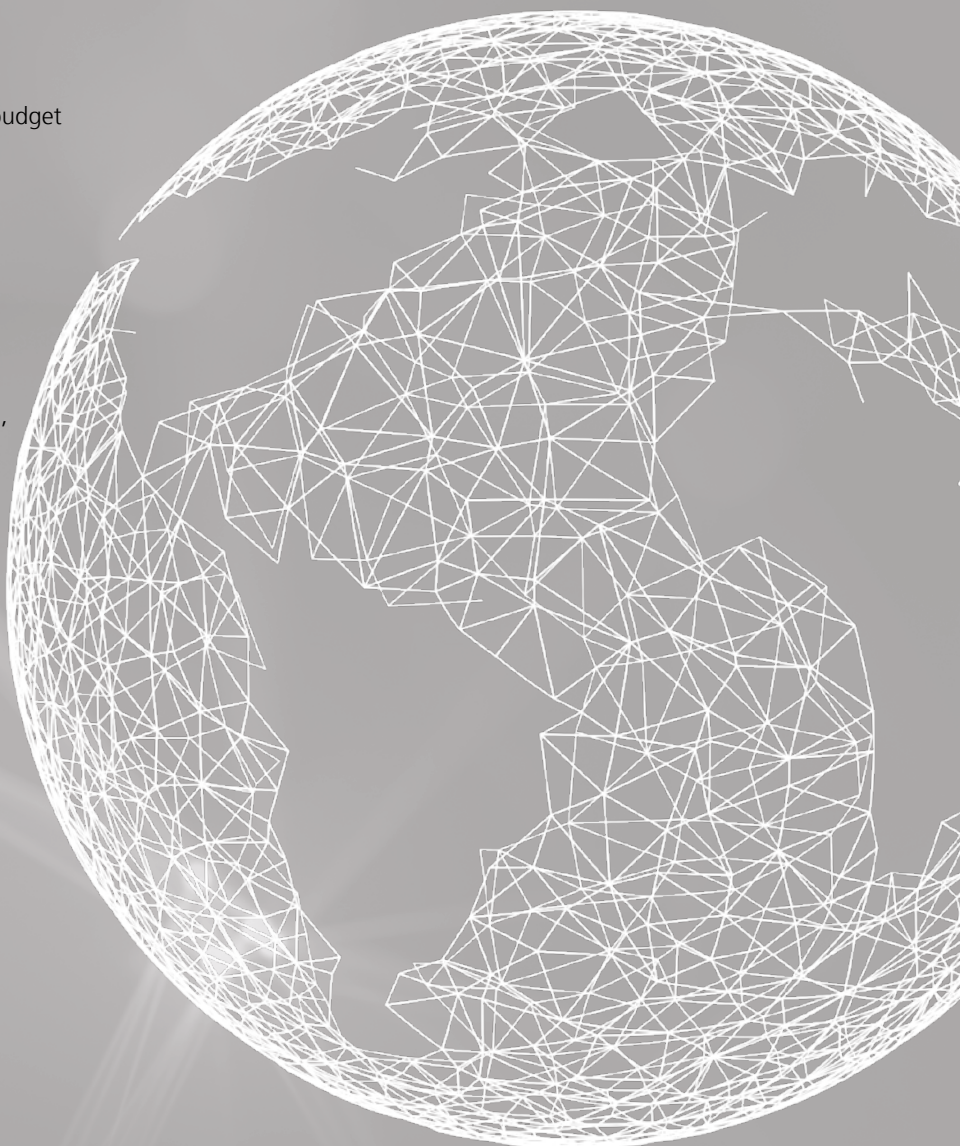
AT A GLANCE

THE FRAUNHOFER-GESELLSCHAFT

- Founded in 1949
- 72 institutes
- More than 26,600 employees
- € 2.6 billion research and development budget

FRAUNHOFER IFAM

- Founded in 1968,
part of the Fraunhofer-Gesellschaft
since 1974
- Locations in Bremen, Dresden, Oldenburg,
Stade, Wolfsburg and Braunschweig;
Test Center for Maritime Technologies
on Helgoland
- More than 680 employees
- € 52.3 million overall budget



APPLIED RESEARCH IN TRUSTFUL COOPERATION WITH INDUSTRY AND SOCIETY

THE FRAUNHOFER-GESELLSCHAFT

The Fraunhofer-Gesellschaft is the leading organization for applied research in Europe. Its research activities are conducted by 72 institutes and research units at locations throughout Germany. The Fraunhofer-Gesellschaft employs a staff of more than 26,600, who work with an annual research budget totaling 2.6 billion euros. Of this sum, almost 2.2 billion euros is generated through contract research. Around 70 percent of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects.

With its clearly defined mission of application-oriented research and its focus on key technologies of relevance to the future, the Fraunhofer-Gesellschaft plays a prominent role in the German and European innovation process. Applied research has a knock-on effect that extends beyond the direct benefits perceived by the customer: Through their research and development work, the Fraunhofer Institutes help to reinforce the competitive strength of the economy in their local region, and throughout Germany and Europe. They do so by promoting innovation, strengthening the technological base, improving the acceptance of new technologies, and helping to train the urgently needed future generation of scientists and engineers.

International collaborations with excellent research partners and innovative companies around the world ensure direct access to regions of the greatest importance to present and future scientific progress and economic development.

The Fraunhofer-Gesellschaft is a recognized non-profit organization that takes its name from Joseph von Fraunhofer (1787–1826), the illustrious Munich researcher, inventor, and entrepreneur.

FRAUNHOFER IFAM

Fraunhofer IFAM is one of the leading independent research organizations in Europe in the fields of “Adhesive Bonding Technology and Surfaces” and “Shaping and Functional Materials”. At our institute's six locations – Bremen, Dresden, Oldenburg, Stade, Wolfsburg and Braunschweig as well as at the Test Center for Maritime Technologies on Helgoland – we put our central principles into practice: scientific excellence, a focus on the application of technology, measurable utility for customers, and ensuring the highest quality.

Most of the products, processes, and technologies we develop are for sectors where sustainability is particularly important, namely for the automotive sector, energy technologies, aviation industry, maritime technologies, as well as medical technology and life sciences. The solutions developed at Fraunhofer IFAM are, however, also used in various other branches of industry including machinery and plant construction, electronics and electrical engineering, shipbuilding, rail vehicle manufacture, the packaging industry, and the construction sector.

For the realization of this task, Fraunhofer IFAM has a highly qualified workforce of more than 680 employees, organized into project teams and business segments covering specific topics. These topics include materials, shaping, joining technologies, surface functionalization, and the development of complete components and complex systems, as required in the fields of electromobility or automation and digitalization. This means that Fraunhofer IFAM covers the whole value-creation chain from the development of materials and product design up to the integration into industrial production – including pilot trials and customized workforce training in new technologies.



WORKING TOGETHER TO CREATE SOLUTIONS

The thematically different institutes of the Fraunhofer-Gesellschaft work together: They collaborate in groups and alliances and, depending on the needs of particular projects, they are also able to bundle their expertise in flexible structures. Fraunhofer IFAM is member in ten alliances, the Fraunhofer Group for Materials and Components – MATERIALS, and the Fraunhofer Academy.

CORE COMPETENCIES

Fraunhofer IFAM is a material science research institution with an emphasis on metallic and polymeric materials. We have focused our extensive scientific knowledge and technological expertise in seven core competencies. Each of these core competencies – either by itself or all together – are the cornerstones of our success in the R&D market and in the research community. They also form the basis for our future-oriented developments.

- **Metallic materials**
- **Polymeric materials**
- **Surface technology**
- **Adhesive bonding**
- **Shaping and functionalization**
- **Electromobility**
- **Automation and digitalization**

Process-oriented training as well as specific technology transfers are offered for all core competencies.

SOUND SCIENTIFIC BASIS AND ASSURED QUALITY

Our expert knowledge, in-depth expertise, and advanced equipment and facilities are the basis for a successful development of customized solutions. There is a strong emphasis on practical applications with much of the work involving collaborative projects with partners from a wide range of industries. Scientific excellence in core competencies provides the basis for this.

Close collaboration and networking with universities and technical colleges are important for the institute. Many Fraunhofer IFAM scientists are professors and lecturers in these establishments. The directors of Fraunhofer IFAM are professors in production engineering at the University of Bremen, meaning there is a close link to fundamental scientific research in this area and enabling rapid transfer of the latest knowledge to practical applications. International contacts and collaboration support this process.

Quality management at Fraunhofer IFAM guarantees the quality of our work and creates the basis for systematic and continuous improvement of processes and procedures. Selected work areas of the institute are certified in accordance with DIN EN ISO 9001 and DIN EN ISO/IEC 17024 whilst others are accredited in accordance with DIN EN ISO/IEC 17025.

Through our research we contribute to sustainable development in the sense of an ecologically intact, economically successful, and socially balanced world. We are committed to this responsibility.



WE ARE HERE FOR YOU

We understand our customers and know their future demands. Together we can develop comprehensive solutions for your long-term success.

First of all we determine your needs in detailed discussions. For each project we then define customized solutions and select a suitable project team.

Due to the synergies at Fraunhofer IFAM, we are able to develop complex solutions quickly and efficiently for specific industries and products. The full spectrum of R&D services we offer ranges from feasibility studies right through to market-ready concepts and products. On request, we can assist with technology and know-how transfer as well as relevant workforce training.

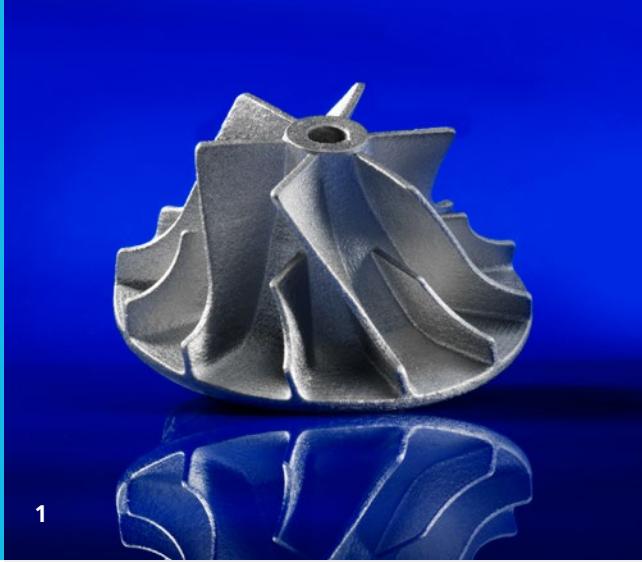
THE BEST QUALIFICATIONS FOR THE USE OF NEW TECHNOLOGIES

Fraunhofer IFAM has many years of experience in professional training. We offer industrial customers a comprehensive range of courses from the fields of adhesive bonding technology, fiber composite materials, and electromobility. The technologies developed at the institute can subsequently be used in business operations.

Our training program is particularly of interest for businesses in transportation and plant manufacture, energy technology, production of adhesives and fibre composites, and the packaging, textile and electrical industries as well as micro-systems and medical technology.

OUR RANGE OF SERVICES

- Feasibility studies | Benchmarking
- Experimental services for R&D
- Materials development and process qualification
- Technical-economic component studies for new products
- Development of new components and products with specific combinations of properties and functions
- Development and optimization of production processes
- Process simulation
- Process qualification and quality assurance
- Testing of materials and components
- Failure/damage analysis
- Materialography and analytics
- Pilot series, technology transfer, and employee training for newly developed processes
- Workforce training and quality assurance



CORE COMPETENCE

METALLIC MATERIALS

CONTACT

Prof. Dr.-Ing. Frank Petzoldt
Phone +49 421 2246-134
frank.petzoldt@ifam.fraunhofer.de

MATERIALS | TECHNOLOGIES | SERVICES

- Sinter materials
- Magnetic materials
- Composite materials
- Metal foams and cellular metals
- Composite materials and multimaterial composites
- Lightweight metals
- Materials for tribological applications
- Materials for energy conversion and storage (e.g. thermoelectrics, magnetocalorics, and latent heat storage)
- Electrode materials
- Functional coatings
- Metal hydrides for reversible hydrogen storage
- Materialography and analytics

Metallic and metal-based materials form the backbone of modern industrial production. Due to the introduction of innovative products and new production methods, the demands on the properties and behavior of materials are constantly increasing. The core competence Metallic Materials comprises a comprehensive understanding of structure-property relationships and systematic optimization with appropriate manufacturing technologies.

Powder metallurgical technologies, for example, offer unique possibilities for developing sinter and composite materials with tailored properties and property combinations. Through the mixing of powders, materials with the necessary property profiles can be produced. Thereby, properties such as hardness, toughness, elastic modulus, abrasion, and thermal expansion can be adjusted to the requirements of the customer.

In our foundry we handle the entire range of casting materials, including aluminum, magnesium, zinc, copper, and stainless steel as well as the individual special alloys of our customers. In addition, special materials such as metal-matrix composite materials are developed and optimized for casting applications.

Weight reduction for vehicle engineering technologies can e.g. be achieved by using lightweight metals and cellular materials. Further key areas include material developments for hydrogen generation and storage, heat storage, and thermoelectric generators as well as for energy technology and alternative drives. The development of materials for mechanical and corrosive loads at high temperatures completes our range of activities.

→ www.ifam.fraunhofer.de/metallic-materials

¹ Turbine wheel additive manufactured by using binder jetting.

CORE COMPETENCE

POLYMERIC

MATERIALS



The importance of polymer and polymer-modified materials has increased in the recent years due to their variable and unique properties and the potential to conserve resources. Novel polymeric materials are opening up technically interesting perspectives and represent an important key research area in the field of adhesive bonding, paint/lacquer technology, and fiber reinforced plastics at Fraunhofer IFAM. Here, the focus lies on materials that are synthetically created through fossil fuel-based or renewable materials or are transformed from natural materials.

The competence spectrum in the field of polymeric materials reaches from development to processing and formulation to material and component characterization, thus comprising the entire value-added chain from the molecule to the component. The starting points are the molecule design and the synthesis of raw materials for adhesives, coatings, and matrix resins. At the fore lie reactive systems that are processed to thermosetting, elastomer, or thermoplastic polymers, which result in, e.g., products for lightweight construction, electrical energy storage, or medical technology.

An overlapping competence component is quality assurance, which is an essential tool in the optimization of specific manufacturing processes for novel polymeric materials and the components they form. At Fraunhofer IFAM, quality assurance is supported by a certified personnel qualification program that takes place within the framework of target technology transfer.

→ www.ifam.fraunhofer.de/polymeric-materials

CONTACT

Dr. Katharina Koschek
Phone +49 421 2246-698
katharina.koschek@ifam.fraunhofer.de

MATERIALS | TECHNOLOGIES | SERVICES

Raw material development

- Adhesives
- Matrix resins
- Coatings
- Potting compounds
- Adaptable systems
- Renewable raw materials

Analytical services

- Reaction processes
- Material characterization
- Rheology
- Thermal analysis

Materials

- Additive manufacturing
- Prototype manufacturing
- Parameter identification
- Function and service life
- Processing technology
- Quality assurance

2 Lignin can be used as an alternative to fossil fuel-based raw materials in the manufacture of primers or adhesives.



CORE COMPETENCE

SURFACE TECHNOLOGY

CONTACT

Dr. Stefan Dieckhoff
Phone +49 421 2246-469
stefan.dieckhoff@ifam.fraunhofer.de

TECHNOLOGIES | SERVICES

Process and manufacturing technologies

- Plasma technology and dry chemical processes
- Wet chemical pretreatment
- Processing and application technologies for paints and coatings
- Digital and mask-based printing processes
- Plant technology and construction

Key areas of development

- Material and process development and qualification
- Functional paints/lacquers and coatings
- Corrosion protection
- Adhesion promotion
- Release layers
- Insulating coatings
- Sensor systems
- Localized heating structures

Analytical and testing services

- Surface analytics
- Applied testing methods
- Material simulations
- Accredited corrosion tests, field tests
- Damage analysis

Quality assurance

- Monitoring of surface properties
- Training in the subject of surface technology

The selection of materials and components for the respective application-related demands is often only possible with the use of tailored surface properties. Customized surfaces can improve the properties of materials and components or furnish them with additional functions.

The focus of Fraunhofer IFAM in this context lies on industrial development and manufacturing processes in the field of surface technology. The spectrum of work ranges from material and process development up to application processes, supported by the characterization, testing, and evaluation of relevant material and component properties. At the same time, the possibilities for digitalization and automation along the entire value-added manufacturing chain are tested and intelligently implemented.

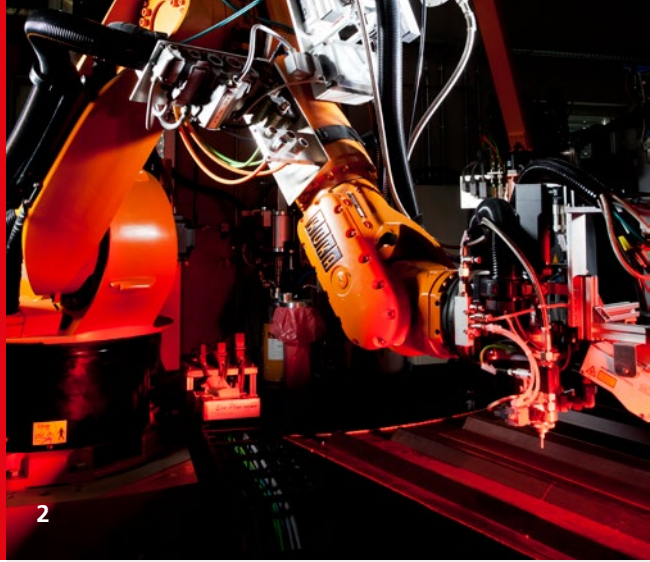
To this key work area belong the development of wet and dry chemical cleaning and surface treatment technologies, coating materials and coating processes, printing processes such as thin and thick film technologies, and quality assurance in industrial production. The characterization and evaluation of surfaces with chemical, electrochemical, and structural analyses provide valuable information about their structure and properties of surfaces and this is augmented by a variety of computer-aided simulation methods and comprehensive test facilities.

→ www.ifam.fraunhofer.de/surfaces

1 Automated wetting test for the quality control of component surfaces before further processing.

CORE COMPETENCE

ADHESIVE BONDING



Over recent decades, adhesive bonding has become ever more widely used in a host of industries. Fraunhofer IFAM is internationally recognized as the largest independent research organization working in this field. For almost 50 years, highly qualified and multidisciplinary teams of experts at Fraunhofer IFAM have been working on the advancement of this multifaceted joining technology.

The many years of experience, the highly diversified employees, and the comprehensively equipped facilities enable a fast and high-quality provision of services as well as the fulfillment of research and development contracts.

The core competence Adhesive Bonding of Fraunhofer IFAM encompasses the selection of the adhesive, the characterization of the mechanical properties, the fluid flow characteristics of adhesives, the design and validation of bonded structures, the development of processes for dosing and application, quality assurance, the detailed design of customer-specified industrial processes, and the analysis of product failures or the rectification of production faults. Challenges such as adhesion promotion, high temperature applications and aging protection belong to the portfolio as much as fast curing and hybrid joining.

A long established, comprehensive and globally offered portfolio of training in adhesive bonding technology with Europe-wide recognized certification is an essential element of the quality assurance concepts for adhesive bonding technology. This naturally includes an intensive consultation with our customers for all questions related to this technology.

→ www.ifam.fraunhofer.de/adhesivebonding

CONTACT

Dr. Holger Fricke
Phone +49 421 2246-637
holger.fricke@ifam.fraunhofer.de

TECHNOLOGIES | SERVICES

Selection of adhesive

- Requirements in the book of specifications
- Selection and characterization of adhesive and sealing materials as well as potting compounds
- Paste-like adhesives and adhesive tapes
- Flow behavior, thermomechanics, and mechanics
- Electrically/optically/thermally conductive contacting

Adhesive bonds

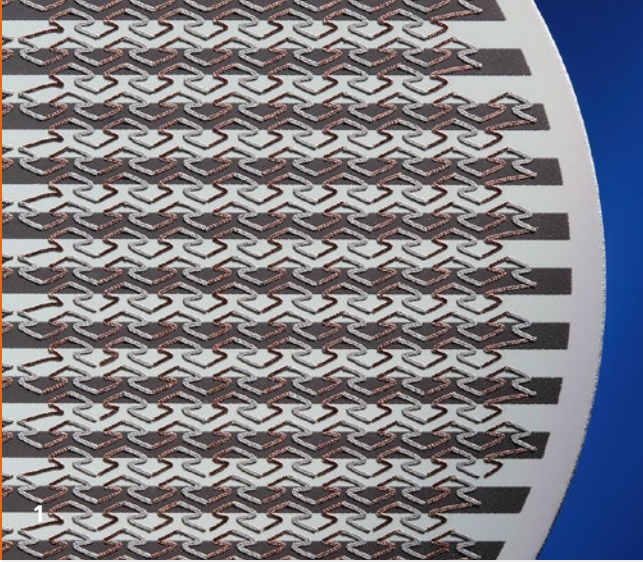
- Accredited material testing
- Design of adhesive bonds
- Qualification of bonded structures
- Numerical simulations of materials
- Crash and fatigue properties
- Long-term stability of adhesive bonds
- Hybrid bonds: Hammering, riveting, clinching, adhesive bonding
- Fiber composite components, lightweight and mixed design methods

Manufacturing processes

- Material-specific surface pretreatment
- Automated dosing, mixing, and application technology
- Production planning, process design, and automation
- Coating of flat substrates
- Manufacture of adhesively bonded prototype series

Quality assurance

- Process reviews and failure analysis
- Process audits, including company audits according to DIN 6701 and DIN 2304
- Non-destructive testing



CORE COMPETENCE

SHAPING AND FUNCTIONALIZATION

CONTACT

Dr. Volker Zöllmer
Phone +49 421 2246-114
volker.zoellmer@ifam.fraunhofer.de

TECHNOLOGIES | SERVICES

Shaping

- Powder injection molding
- Pressing and sintering
- Additive manufacturing (LBM, EBM, binder jetting)
- High-pressure die casting, low-pressure die casting, lost foam casting, investment casting and sand casting

Functionalization

- Printed electronics
- Functionalized 3D printing
- Functional composites
- Hybrid casting and fiber integration
- Complex cast components
- Cast component identification and sensor integration, e.g. the integration of RFID transponders and sensors (CAST^{TRONICS}®)
- Cast components for electrical drives

Analytical and testing services

- Numerical simulation
- Materialography and analytics
- X-ray analysis and computer tomography

Well beyond the mere mastery of the production process from material to component, the core competence Shaping and Functionalization also includes the development of innovative manufacturing processes that allow components to be furnished with extra features – without additional effort.

The most important steps in powder technological product manufacture are shaping and sintering. Unlike any other manufacturing process, the powder technological production of components allows the simultaneous adjustment of material properties and component geometry. Our offer ranges from component development to pilot series production to know-how transfer.

The use of additive manufacturing technologies, where components are created tool-free from powder materials in almost arbitrary and very complex shapes directly from CAD files, enables the production of prototypes for fast product development as well as highly individualized products for the end user.

Components can also be functionalized after production through functional printing. Various powder-based printing technologies such as paste or aerosol printing are a key part of this core competence. In a specially tailored automated production line the processes are implemented on an industrial scale.

In casting technology, the main focus is on the development of function-integrated castings. Already during production, fibers – such as carbon, ceramic, or glass fibers – are integrated directly into the cast component for the systematic tailoring of such mechanical properties as strength or rigidity. Embedded RFID transponders permit a distinct identification and tracing of castings and offer protection against plagiarism.

→ www.ifam.fraunhofer.de/shaping-functionalization

¹ Multilayer screen printing of metallic sensor structures
(in collaboration with Ecomatik).

CORE COMPETENCE

ELECTROMOBILITY



2

Fraunhofer IFAM competences in the field of electromobility are being demanded by all branches of the mobility industry. Its focus is on electric drives, energy storage, and energy systems analysis.

The safe storage of electrical energy with a high density of energy and power is a constant challenge. Aspects of materials and process technology are at the forefront of the efforts by Fraunhofer IFAM to develop solutions for future electrical, chemical, and thermal energy storage systems. The focus is increasingly moving onto lithium-ion, solid-state, and metal-air batteries. Hydrogen and fuel cell technology as well as the efficient and highly dynamic storage of thermal energy represent further research areas.

In the field of electric drives the focus is on the conception, development, prototype construction, and testing of highly efficient electric machines and their components. In addition, new approaches to their manufacturing technology as well as monitoring and control are being developed. At the forefront lies an increase in power and torque density and efficiency as well as a further development of established and novel manufacturing technologies for electric drives.

An important building block in this concept is the analysis and evaluation of energy supply systems. Decarbonization and the increasing linkage of the electricity, heat, and transport sectors are demanding new, flexible strategies. In this context, Fraunhofer IFAM is working on studies and concepts and is analyzing the economical aspects as well as regulatory frameworks of the electricity and heat markets.

→ www.ifam.fraunhofer.de/electromobility

CONTACT

Dipl.-Ing. Felix Horch
Phone +49 421 2246-171
felix.horch@ifam.fraunhofer.de

TECHNOLOGIES | SERVICES

Electric drives

- Development of electric drives
- Design and manufacture of cast coils
- Development of insulating coatings and casting compounds for electrical machines
- Control and steering units and software development
- Prototype manufacture for electric drives
- Test stand for electric drives (up to 120 kW)

Electrical, chemical, and thermal energy storage

- Battery cell chemistry
- Paste development and electrode manufacture
- Cell construction and design for lithium-ion batteries, metal-air batteries and solid-state batteries
- In-situ analytics, battery aging
- Hydrogen generation and storage
- Hydrogen fuel cell technology
- Electrochemical synthesis of e-fuels and e-chemicals
- Efficient storage of thermal energy
- Highly dynamic latent heat storage
- Test stand for traction batteries (up to 50 kWh)

Energy and heat supply

- Analyses, feasibility studies and consultation
- Energy efficient buildings and districts
 - Power-heat coupling
 - Grid-bound heat supply
 - Digital heat demand maps
 - Energy efficiency in material and processing technology
 - Housing industry and electromobility
 - System integration stationary/mobile storage



CORE COMPETENCE

AUTOMATION AND DIGITALIZATION

CONTACT

Dr. Dirk Niermann

Phone +49 4141 78707-101

dirk.niermann@ifam.fraunhofer.de

TECHNOLOGIES | SERVICES

- Collection, evaluation and visualization of data
- Development of plants and plant components
- Sensor-controlled robots with a high positioning accuracy
- Precise robots on linear axes or autonomous ground vehicles
- Large-scale assembly at a 1:1 scale
- Joining technology: Adhesive bonding, shimming, sealing
- Surface technology: Pretreatment, coating, printing
- Processing technology: Milling, drilling, water jet cutting
- Additive manufacturing and functional printing
- Quality assurance of manufacturing processes, materials, material composites and coatings

In addition to diverse materials science and process engineering research activities, research into the field of the key technologies of automation and digitalization completes the competence spectrum of Fraunhofer IFAM. The focus here lies mainly on processes that need to adapt continuously and with great precision to components with low shape accuracy or different components, changing production procedures, and human work tasks.

This core competence encompasses the key activities of Fraunhofer IFAM within the categories of adhesive application, joining, sealing, surface treatment, processing, and printing, and metal casting including the interaction with a digitalized production environment (Internet of Things, Big Data), as well as questions from customers or project partners in the context of joint projects. Here, solutions are being developed for a holistic quality assurance of production processes, materials, material composites, and coatings through the use of innovative methods to capture, evaluate, and visualize measurement data as well as through the use of intelligent materials.

The automation and digitalization solutions of Fraunhofer IFAM facilitate an increase in the effectivity and efficiency of manufacturing and repair processes, the improvement of ergonomics and work safety in the production, the optimization of the product lifecycle through quality and condition monitoring, and the improvement of product quality as well as the reduction of process costs.

A 4,000 m² research hall offers space for large-scale process and facility development, where components and structures can be larger than 20 meters in length.

→ www.ifam.fraunhofer.de/automation-digitalization

¹ Plant assembly for fuselages with flexible holding fixture for the shape and position correction of large components.

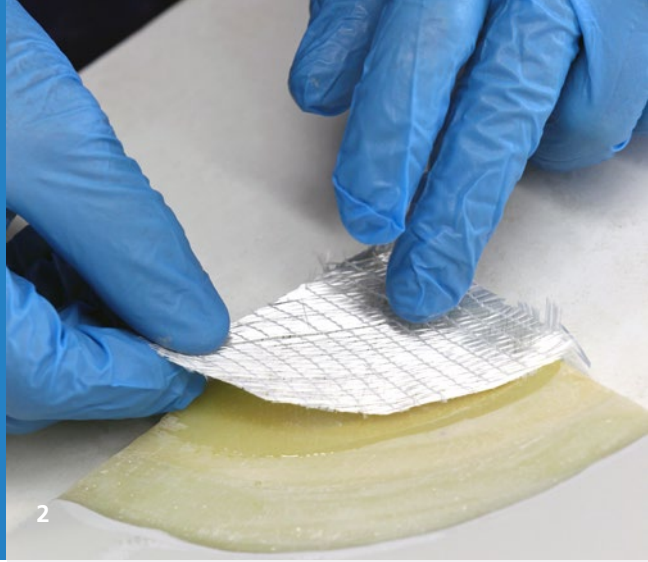
WORKFORCE QUALIFICATION AND TECHNOLOGY TRANSFER

In order for companies to effectively use new technologies and materials, it is vital that their employees have the correct technical training and qualifications. The workforce training courses we offer also allow important technology transfer to take place, whereby the latest scientific findings and methods are passed to the industry.

Fraunhofer IFAM offers a variety of opportunities for knowledge transfer. For the professional use of adhesives and fiber reinforced plastics (FRPs), employees must be effectively trained. The adhesive courses European Adhesive Bonder, European Adhesive Specialist, and European Adhesive Engineer, as well as the FRP courses Fiber Reinforced Plastic Manufacturer, Fiber Reinforced Plastic Specialist, Fiber Reinforced Plastic Remanufacturer, and Composite Engineer (in cooperation with the Fraunhofer Lightweight Design Alliance) are tailored to the needs of different target groups. Each course contains in-depth practical sessions to consolidate the theoretical knowledge.

The latest research findings are also included in the training courses at the Training Center Electromobility. The modular three-stage seminar series on electromobility offers a range of qualifications from beginner to advanced as far as specialist. The certification course as well as the Master of electromobility offer a continuing academic education in the blended learning format. The knowledge transfer occurs via direct communication between researchers and the participants. The practical qualification is complemented by laboratory exercises. In addition, training is extended in the seminar series "Functional Printing".

→ www.ifam.fraunhofer.de/qualification



CONTACT

Training Center for Adhesive Bonding Technology Training Center for Fiber Composite Technology

Prof. Dr. Andreas Groß
Phone +49 421 2246-437
andreas.gross@ifam.fraunhofer.de

- Training courses in adhesive bonding technology
- Training courses in fiber composite technology
- Quality assurance for adhesive bonding technology
- Quality assurance for fiber reinforced plastics
- Promotion of young scientists and engineers (MINT)

Technical Qualification and Consulting Training Center for Electromobility

Dr.-Ing. Gerald Rausch
Phone +49 421 2246-242
gerald.rausch@ifam.fraunhofer.de

- Seminar series on electromobility
- Certification course in electromobility
- Master of electromobility

2 Layer structure for the repair of glass fiber composite components –
part of the workforce training at Fraunhofer IFAM.

BUSINESS SEGMENTS

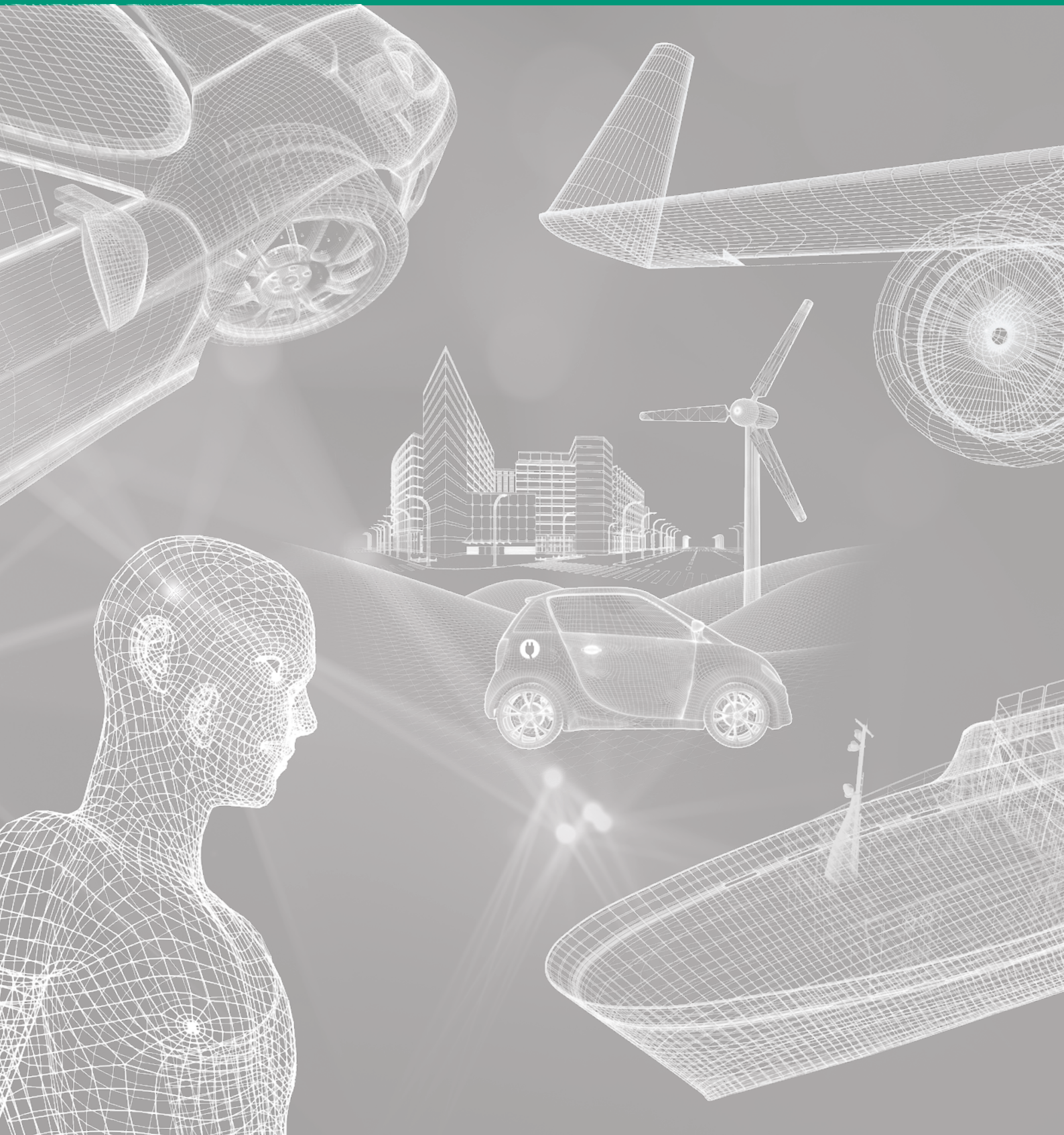
AUTOMOTIVE

ENERGY TECHNOLOGIES

AVIATION

MARITIME TECHNOLOGIES

MEDICAL TECHNOLOGY UND LIFE SCIENCES





Automotive

The automotive sector is facing time, innovation, quality, and cost pressures. Current development goals are electrification, environmental compatibility, energy efficiency, digitalization, and lightweight construction. Fraunhofer IFAM supports the automotive sector by meeting these challenges at a high technical level.

Lightweight construction solutions are particularly in demand, which often leads to a combination of various materials (material mixes) in the vehicle. This leads not only to new demands being placed on the materials but also to the need to develop suitable manufacturing technologies. Recent shaping processes such as additive manufacturing meet "traditional" processes such as casting. Due to its holistic approach, Fraunhofer IFAM is the leading development partner for the realization of modern mixed construction methods through adhesive bonding and hybrid casting. Process developments for the use of new metallic and polymeric materials as well as the functionalization of surfaces and components are further competencies.

With hybrid and electric vehicles, new solutions for electrical drives come to the fore. In all fields of use, such as in the automobile and agricultural machinery technologies, electrical drives meet challenges to increase energy efficiency, increase performance and torque, and increase reliability while reducing costs. Fraunhofer IFAM possesses an in-depth system understanding in the field of electromobility and offers technical solutions to the automotive sector for the electrification and hybridization of the drive train as well as new battery and mobility concepts. Training and quality assurance services in the fields of adhesive bonding technology, fiber composite materials, and electromobility ensure the necessary technology transfer.

¹ Development of wax models for investment casting in the injection molding process.

CONTACT

Dipl.-Ing. Franz-Josef Wöstmann MBA
Phone +49 421 2246-225
franz-josef.woestmann@ifam.fraunhofer.de

- Process and component development for casting and powder technology
- Adhesive bonding and hybrid joining
- Component identification and quality assurance
- Potting and coating processes
- Mixed construction methods and hybrid materials
- Electromobility
- Integration of functionalities
- Workforce qualification



CONTACT

Dr.-Ing. Julian Schwenzel
Phone +49 441 36116-262
julian.schwenzel@ifam.fraunhofer.de

- Recyclable materials and associated production technologies
- Integration of sensors into assemblies and components
- Electromobility in decentralized energy systems
- Materials for hydrogen generation/storage and for heat storage
- Electrical energy storage systems (batteries, capacitors)
- Functionalization of surfaces (painting, plasma, and printing technologies)
- Analysis/design of energy systems (CHP)

CONTACT

Dr.-Ing. Simon Kothe
Phone +49 421 2246-582
simon.kothe@ifam.fraunhofer.de

- Functional surfaces, sensor technology
- Paints and coatings
- Aviation-specific surface treatments, plasma and adhesive bonding technology
- Automation of production processes in manufacture and assembly
- Quality assurance
- Workforce qualification in adhesive bonding technology and fiber reinforced plastics

Energy Technologies

The Energy Technologies business segment focuses on companies involved in energy conversion (e.g. via power-heat coupling and electrolysis), energy distribution, and energy storage, thus contributing to a sustainable and reliable energy supply.

The targeted increase in efficiency when utilizing electrical and thermal energy for buildings, transport, and industrial production is a constant challenge for many industries. The expertise of Fraunhofer IFAM in materials and components for storage of hydrogen and electrical/thermal energy as well as in shaping processes and coating technology allows a wide range of solutions to be developed for companies in the energy, environment, and maritime sectors and for the construction and transport industries.

Aviation

The business segment aviation addresses aircraft and helicopter manufacture as well as the associated supply chain. The aircraft industry is facing many challenges today, including further reductions in fuel consumption, noise levels, and toxic emissions. New materials, lightweight structures, and efficient engines are some of the answers to these. Continuing cost pressures are not only forcing the manufacturers to find innovative ways of further automating and optimizing their production, but also the operators need to develop new and effective solutions for MRO.

With its core competencies, Fraunhofer IFAM is offering the aviation industry application-oriented solutions.

¹ Contaminant-free fiber composite component production using a special release film. With Fraunhofer IFAM's low pressure plasma unit, polymer films up to 2.4 m wide can be coated.



Maritime Technologies

In the maritime technologies business segment, Fraunhofer IFAM bundles its expertise in the key research areas coatings for corrosion and biofouling protection, functional surfaces, adhesive bonding technology, and lightweight structures. The development processes are accompanied by analytics and quality assurance throughout the production chain. The electrification of marine propulsion is an additional development goal. In addition to the research works in the technical center, Fraunhofer IFAM offers testing opportunities under environmental conditions. In List on the island Sylt, at the "Alte Weser" lighthouse, and on the offshore island Helgoland, hundreds of samples can be tested for corrosion and biofouling protection in the submerged zone, the tidal zone, the splash zone and on land.

Medical Technology und Life Sciences

In the field of medical technology, Fraunhofer IFAM focuses on manufacturers of implants, instruments, and medical adhesives as well as coating companies. The focus in the life sciences are functional materials and biosurface engineering.

In addition to materials and coatings, manufacturing processes are being developed so that the desired performance or rather effectiveness of the products is achieved while the high quality demands are fulfilled.

During the development of materials and surfaces, according to the purposes of the products, the normative and technical demands such as biocompatibility, degradation behavior, chemical, physical, and mechanical and morphological characterization are considered and implemented from the beginning.

2 Electrochemical analysis of battery materials.

CONTACT

Dr. Hanno Schnars
Phone +49 421 2246-7376
hanno.schnars@ifam.fraunhofer.de

- Surfaces: Pretreatment, cleaning, activation, analytics
- Functional paints and coatings
- Corrosion protection and electrochemistry
- Quality assurance

Test Centre Maritime Technologies, Helgoland

- Maritime robotics

CONTACT

Dipl.-Ing. (FH) Kai Borcharding MBA RWTH
Phone +49 421 2246-678
kai.borcharding@ifam.fraunhofer.de

- Adhesives for medical devices
- Biocompatible coatings (plasma, wet chemical)
- Powder injection molding, additive manufacturing
- Cellular materials
- Biofunctional surfaces (cell adhesion, anti-infective surfaces)
- In-vitro cell tests, biomechanics
- Degradation studies
- Surface analysis (XPS, FTIR, FIB-REM, TEM, ToF-SIMS, QCM-D)



EFFECTIVE NETWORKING OF FRAUNHOFER

GROUP

- Fraunhofer Group for Materials and Components – MATERIALS

ALLIANCES

- Additive Manufacturing
- Automobile Production
- Battery
- Cleaning Technology
- Lightweight Design
- Nanotechnology
- Numerical Simulation
- Polymer Surfaces
- Space
- Transport

FRAUNHOFER ACADEMY

- Workforce training courses

The structure of the Fraunhofer-Gesellschaft is designed for effective networking, so enabling the most demanding projects to be carried out and complex system solutions to be developed.

The Fraunhofer Group for Materials and Components – MATERIALS brings together the expertise of various Fraunhofer Institutes in the material sciences.

Fraunhofer materials research covers the entire value-creation chain from the development of new materials and improvement of existing materials to near-industrial scale production technology, the characterization of material properties, and the evaluation of material usage. The same applies for the components made from the materials and their system behavior. In all these areas equal emphasis is put on experimental studies in the laboratory/pilot plant and on numerical simulation and modeling. The Fraunhofer Group for Materials and Components – MATERIALS covers the full range of metallic, inorganic/non-metallic, and polymeric materials plus semiconductors and materials generated from renewable raw materials.

Institutes or institute departments collaborate in Fraunhofer Alliances in order to jointly focus on and exploit a business segment. For example, the Fraunhofer AutoMOBILE Production Alliance brings together the expertise of 16 institutes, so acting as an effective R&D partner for the German car industry. The complementary expertise of the different institutes allows the alliance to innovate along the entire car manufacturing process chain, namely from the planning stage to the final painted vehicles.

LOCATIONS AND DEPARTMENTS

Institute Directors

Prof. Dr.-Ing. habil. Matthias Busse

Prof. Dr. Bernd Mayer

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM

Wiener Strasse 12

28359 Bremen | Germany

Phone +49 421 2246-0

info@ifam.fraunhofer.de

www.ifam.fraunhofer.de

Lilienthalplatz 2

38108 Braunschweig | Germany

Phone +49 441 36116-262

info@ifam.fraunhofer.de

Winterbergstrasse 28

01277 Dresden | Germany

Phone +49 351 2537-300

info@ifam-dd.fraunhofer.de

Marie-Curie-Strasse 1–3

26129 Oldenburg | Germany

Phone +49 441 36116-262

info@ifam.fraunhofer.de

Ottenbecker Damm 12

21684 Stade | Germany

Phone +49 4141 78707-101

info@ifam.fraunhofer.de

Hermann-Münch-Strasse 1

38440 Wolfsburg | Germany

Phone +49 421 2246-126

info@ifam.fraunhofer.de

LOCATIONS AND DEPARTMENTS

BREMEN

- Adhesion and Interface Research
- Adhesives and Polymer Chemistry
- Adhesive Bonding Technology
- Business Development
- Casting Technology and Lightweight Construction
- Electromobility
- Paint/Lacquer Technology
- Plasma Technology and Surfaces
- Polymeric Materials and Mechanical Engineering
- Powder Technology
- Quality Assurance and Cyber-Physical Systems
- Smart Systems
- Workforce Training and Technology Transfer

BRAUNSCHWEIG

- Fraunhofer Project Center for Energy Storage and Systems

DRESDEN

- Cellular Metallic Materials
- Energy and Thermal Management
- Hydrogen Technology
- Sintered and Composite Materials

OLDENBURG

- Electrical Energy Storage Systems

STADE

- Automation and Production Technology

WOLFSBURG

- Fraunhofer Project Center for Lightweight Construction and Electromobility

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