



Dresden.
Dresden.

Smart structures

New materials in Dresden



Dresden material and development specialists

“Finding new ways to do the old. That’s innovation.”*

The competitiveness of our industry depends on innovations. Over two thirds of all new products are based on new materials, making these key drivers for a sustainable economy. Constantly addressing and examining new material developments and their economic impacts is essential to being able to hold one’s own in the global competition, and position oneself successfully for the long term.

While large companies are very flexible in responding to trends, smaller and medium-sized businesses are reliant on external skills and knowledge. For both groups, however, the demand for outstanding competence in materials and lightweight construction is growing, with increasingly shorter innovation cycles. This is where we in Dresden can provide excellent assistance.

The city and region are a perfect combination of all the factors necessary for innovative material development and practical implementation. And we figure prominently on the international stage too. Here in Dresden, we have a unique structure of material-driven research and development institutions regarded highly worldwide. Firstly, there’s the expertise of more than 2,000 material researchers, who work together as part of the DRESDEN-concept at the prestigious Dresden University of Technology and the many extramural Fraunhofer, Leibniz, Max-Planck and Helmholtz research establishments. The sheer number of these institutes, whose names attest to the quality of the research content, is unrivalled.

The industrial competence centers run by companies like Siemens, ThyssenKrupp, Rolls-Royce and Porsche at Dresden University of Technology reflect the external recognition of Dresden’s innovative strength and performance excellence.

To enable Dresden’s many different potentials to be optimally pooled and used

efficiently, all stakeholders are willing to break completely new ground – with great support from the Free State of Saxony and the City of Dresden. The DRESDEN-concept acts as an association for all institutional research establishments in Dresden, who jointly gear their activities around developing the already well-positioned city into one of the world’s leading centers of excellence, and concentrating their brightest minds here. This continuous research quest is intensely driven and utilized by industry. And Dresden itself boasts a good mix of new and established industries, with many global companies setting up bases here in recent years. Dresden’s research prestige and highly qualified experts are increasingly serving as a platform to help shape the high-tech industry of the future.

With its unique R&D landscape and international cooperations, Dresden plays a leading role when it comes to new materials and systems in modern lightweight construction in Germany. Visit Saxony’s state capital, have a look around, and contact us. I cordially invite you to become part of the Dresden success model!



Prof. Dr. rer. nat. Hubert Jäger
Institute of Lightweight Engineering and Polymer Technology (ILK)

* Joseph Alois Schumpeter,
Austrian economist and politician

The #1 address for industry

R&D stakeholders specializing in materials

- Around 20 research establishments
- Dresden University of Technology
- 7 Fraunhofer Institutes
- 2 Leibniz Institutes
- Helmholtz Center Dresden-Rossendorf (HZDR)
- 2 Max Planck Institutes
- NaMLab
- Institut für Holztechnologie gGmbH
- IMA Materialforschung GmbH
- Competence centers of reputable companies at the Dresden University of Technology

Competence all the way

Dresden is one of Europe’s most important hubs for materials research. Nowadays, technical innovations will often no longer suffice, with precision development of materials increasingly gaining importance. This expertise requires concentration and interaction. In Dresden, concentration is reflected by the fact that it is home to Germany’s densest research landscape after Berlin, while interaction occurs as part of networks, joint projects, major investments and the mission to secure the next generation of scientists and academics.

A wide range of materials

The Dresden materials scene is characterized by great diversity and interdisciplinary thinking. For example, concrete and carbon are reinforced with fibers, ceramics developed for energy systems, and metal structures designed as lightweight, airy constructions, while polymers have long been versatile, high-tech materials. Good old “manual labor techniques” are combined with the latest fiber materials and state-of-the-art processing methods to ensure they can cater to the many different requirements and application areas of 21st-century technical textiles. Ano-

ther field of specialization involves applying materials to components as super-thin coatings/coating systems with special functional properties. Many of the rapid developments achieved in micro or organic electronics in Silicon Saxony would not have been possible without Dresden materials expertise.

A Mecca for top researchers

Strategic and long-term high-end research into materials requires the latest generation of equipment. In Dresden, major investments have been, and continue to be, made in large, complex scientific devices as part of federal and state excellence initiatives. For example, the new high-performance computer at the Dresden University of Technology is being used to simulate atomic nano-structures of entire transistors before the new materials are generated in the laboratory and ultimately sent off for mass production. Meanwhile, researchers at the Helmholtz-Zentrum Dresden-Rossendorf test out materials under extreme conditions, such as very high magnetic fields or intense radiation, and scientists at the Dresden Center for Nanoanalysis use super microscopes to observe not only atoms, but also kinetic processes, which show them how materials age.

Unique systems at the HZDR help with research into new materials.



Pacesetters, not followers

Twenty20 BMBF winners consortiums

In 2014, the BMBF (German Federal Ministry of Education and Research) started providing cooperations focused on future technological issues with up to 45 million Euros each in funding – a project due to run until 2020. Three of the ten winners consortiums are being coordinated in Dresden, two of which address the topic of materials.



Attractively different – Carbon slims down building blocks.

Additive manufacturing

The basic idea is to quickly and cost-effectively manufacture individual pieces or small quantities of highly complex products with specific requirements. The challenge lies in developing suitable materials and application/hardening processes to obtain components with precisely variable properties. The aim is to achieve comparable product qualities in terms of surface condition, local conductivity or wear resistance. Twenty six research institutes and 57 companies are working to make additive manufacturing (3D printing) the key technology of Industry 4.0. The consortium is coordinated by the Fraunhofer IWS Dresden.

www.agent-3d.de

C³ – A revolution in the construction industry

Replacing the steel conventionally used in bridges, tunnels or industrial buildings with carbon reinforcements developed under the supervision of the Dresden University of Technology as part of the “C³ – Carbon Concrete Composites” consortium creates much thinner-walled, flexible options for construction. The aim is for concrete reinforced with carbon fibers to be made market-ready as a long-lasting, environmentally friendly and resource-efficient alternative to standard reinforced concrete.

The C³ consortium sees 130 partners work in an interdisciplinary manner to take the key technology of building with carbon concrete to a new level, both nationally and internationally, under the guidance of leading German providers. Coordination: Dresden University of Technology
www.bauen-neu-denken.de

FOREL

20 years of proven experience was reason enough for the German Federal Ministry of Research to authorize the ILK Institute of Lightweight Engineering and Polymer Technology at the Dresden University of Technology to coordinate an open, national platform for developing high-tech lightweight construction system solutions using multi-material designs for the electric cars of the future.

plattform-forel.de



Constructions of the future using carbon concrete.

A variety of materials



Novaled GmbH supplies worldwide display companies with OLED materials for brilliant, ultra-flat displays.



The Fraunhofer IKTS develops nanoporous membranes for energy-efficient separation of bioethanol.

A new, diverse world of ceramics

High-performance ceramics have become an essential part of environmental and energy engineering, mechanical and plant engineering, electronics and microsystem technology, and even medical technology. This broad and challenging spectrum of research is the focus of work at Dresden's Fraunhofer Institute for Ceramic Technologies and Systems (IKTS), Europe's largest ceramics research institute. As a research and technology service provider, the IKTS develops modern, high-performance ceramic materials, industry-related manufacturing processes, and prototypical components and systems in complete production lines, including on a pilot scale. In doing so, the institute acts as a competent contact and the first port of call for all ceramic-related problems.

Clean energy

Whether in electric engines or wind turbines, the demand for rare earth elements is growing. That's why the Fraunhofer Institute for Manufacturing Technology and Advanced Materials (IFAM) has developed a recycling process to recover rare materials like neodymium and samarium. Metal-hydride-based hydrogen stores constituting a clean, safe energy option for both mobile and stationary applications are also being researched here in terms of energy-effective mobility.

Polymers for high-tech applications

With 455 staff, the Leibniz Institute for Polymer Research (IPF) is one of Germany's largest polymer research establishments. Its internationally acclaimed fields of research include developing high-tech applications for displays, sensors and energy systems, or for regenerative therapies in the medical sector. Aimed at fundamental, application-oriented research, the IPF boasts top-of-the-range equipment to enable work under industrial conditions.

A world leader in functional and nano-materials

An independent international group of reviewers from the Leibniz Association's Senate has named the Leibniz Institute for Solid State and Materials Research (IFW) one of the world's leading research industries in the field of solids and materials sciences. It particularly praised the research and publication work, the intensive cooperation with the Dresden and Chemnitz Universities of Technology, and the attractive environment for young scientists. Five hundred staff from 40 countries are across this development.

Dresden setting world standards in lightweight construction



Braiding process for near-net-shape manufacturing of composite fiber structures at the Dresden University of Technology's Institute of Lightweight Engineering and Polymer Technology (ILK).



“We have been cooperating closely with the Dresden University of Technology for many years, initially informally, and since 2006 through our successful UTC model, in which we assign a small number of carefully selected university partners targeted research tasks in a clearly defined field, for specific projects. Both parties benefit from this long-term, financially secured and well-established cooperation at a technical and academic level. And the things we resolved to do at the start are already being reflected in the practical results: Our joint research into lightweight structures has enabled the construction of aircraft engines with lower fuel consumption and therefore better environmental behavior. One example of this is a vertical shaft made partly from carbon-fiber-reinforced plastic and partly from metal, and which will help future engines achieve a 5% kerosene saving. What I find particularly pleasing is the fact that aeronautical research funds can once again be used profitably here. We look forward to being involved in further, equally successful projects.”

Ulrich Wenger

Engineering & Technology Director,
Rolls-Royce Germany

Dresden's major players in lightweight construction

Research

Dresden University of Technology

- Institute of Lightweight Engineering and Polymer Technology (ILK)
- Institute of Textile Machinery and High-Performance Material Technology (ITM)
- Institute of Materials Science
- Institute of Wood and Paper Technology
- Institute of Solid Construction
- Institute of Steel and Wood Construction
- An-Institut für Holztechnologie GmbH

Fraunhofer Institute for

- Manufacturing Technology and Advanced Materials (IFAM)
- Material and Beam Technology (IWS)
- Ceramic Technologies and Systems (IKTS)
- Transportation and Infrastructure Systems (IVI)

Helmholtz Center
Dresden-Rossendorf HZDR

Industry competence centers

- FOREL
- Rolls-Royce plc “Lightweight Structures and Materials” UTC
- ThyssenKrupp Tech Center for Carbon Composites
- Competence Center for Technical Textiles
- German Center for Textile-Reinforced Concrete (DZT)

Companies

- Elbe Flugzeugwerke GmbH
- Leichtbau-Zentrum Sachsen GmbH
- EAST-4D Carbon Technology GmbH
- Korropol GmbH
- ThyssenKrupp Carbon Components GmbH
- Mitras Composites Systems GmbH
- MgF Magnesium Flachprodukte GmbH
- hollomet GmbH
- Hightex Verstärkungsstrukturen GmbH
- Qpoint Composite GmbH Dresden
- HTS Hoch Technologie Systeme GmbH
- IMA Materialforschung und Anwendungstechnik GmbH

The Dresden success model

The Dresden model of functionally integrative, systematic lightweight construction with multi-material design – a key technology used in areas such as electromobility, aircraft building and automotive engineering – has been perfected at the Dresden University of Technology's ILK for over 20 years. Out of Dresden's many stakeholders in lightweight construction, it has become Germany's leading competence center.

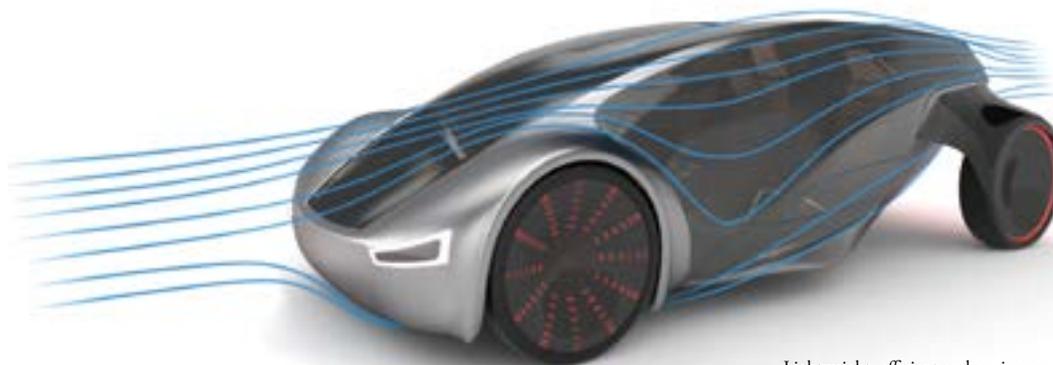
Lightweight construction has long meant more than just minimization of mass; it's also about integrating functions and components while simultaneously ensuring resource efficiency and automated production. Germany's reputable OEMs and component manufacturers are always keen to conduct research in Dresden, and often find new specialists in the process.

An afterlife for aircraft

With a workforce of 1,100 staff, Elbe Flugzeugwerke GmbH (EFW) is the Airbus group's competence center for conversion and retrofitting, and has been producing cargo aircraft out of Airbus A300 and A310 passenger aircraft here since mid-1996. In future, EFW also plans to do the same with A330 and A320/321 aircraft.

EFW develops and produces flat, fiber-reinforced sandwich panels for use in the bodywork and interior of all Airbus models. The product range covers some 50,000 different superstructures and moulds.

It has also expanded this beyond just the aviation sector by developing base plates for Bombardier Transportation's new generation of trams, as well as maritime applications.

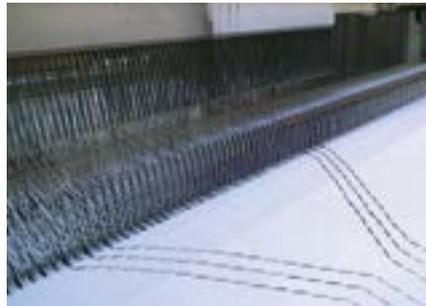


Lightweight, efficient and environmentally friendly for the transport of the future

“Handmade” high-tech

Knitting 4.0

It is impossible to imagine the growth market for technical textiles without Saxony. The Institute of Textile Machinery and High-Performance Material Technology (ITM) at the Dresden University of Technology is one of Germany's leading drivers of progress in textile technology. The spectrum of uses for the innovations is fascinating, ranging from high-tech knitting, NASA back-up parachutes, and car and aircraft components, to textile bone repair materials, and scientists are regularly awarded prizes for their developments. The success story of renewable



All manual-labor techniques are today applied to high-performance machinery with new materials.

Fast, networked production processes for the textile industry of the future.



Engine inlet cone for the Airbus A350, developed by EAST-4D Carbon Technology GmbH.



energies is heavily influenced by wind energy. Technical textile have also revolutionized wind power plant designs thanks to new chemical, thermal and, most importantly, mechanical properties, while rotor blades made from a fiber-reinforced plastic compound with integrated textile extension sensors for in-situ structural monitoring are another new ITM offering. Carbon fibers act as textile extension sensors on the rotor blade. The sensor network means extensions and therefore strains can be accurately located and measured, enabling serious structural changes/damage to be reliably identified and monitored early on in future.



The mobility industry in particular needs the creative Dresden solutions for fiber-reinforced lightweight construction products.

Lightweight construction for extreme loads

Modern-day aircraft building and automotive engineering require extremely stable, lightweight carbon structures. Dresden-based East-4D Carbon Technology GmbH is impressing customers with its “Filament Winding Forming” process, which enables series production of ultra-lightweight, robust components made from carbon-fiber-reinforced plastic with complex geometry. Sample applications include the engine inlet cone of the Airbus A350 XWB-900 or potable water and effluent tanks for various aircraft types, which need to withstand maximum loads and extreme temperatures. The company is a spin-off of the Dresden University of Technology's Institute of Lightweight Engineering and Polymer Technology (ILK). When asked about his recipe for success, CEO Raimund Grothaus replies, “We always go with

the revolutionary approach. If everyone else is saying ‘you can't do it that way’, it means we're on the right track.”

New inspiration for the automotive industry

Components made from fiber composite materials are formed and hardened in heat. Qpoint Composite skips the need for the conventionally used furnaces in this intricate production step by applying a handy trick: it heats “embroidered” carbon fibers directly. The heating structures are part of systems and tools, and harden the complex fiber composite components in a flash. The process is completely unique and patented, and is used to manufacture the roof of the Lamborghini Aventador, the bonnet of the Porsche 918, and the window frames and interior paneling of the Airbus A350.

A selection of “Made in Dresden” material start-ups

Surfaces/Coatings

- APT – Angewandte Pulstechnik GmbH
- Biconex GbR
- Dreebit GmbH
- DTF Technology GmbH
- Namos GmbH

- Evico magnetics GmbH
- SciDre Scientific Instruments Dresden GmbH
- ZetaSCIENCE GmbH
- Saxray GmbH
- Suragus GmbH

Lightweight construction/Textile-reinforced concrete

- EAST-4D Carbon Technology GmbH
- Hightex Verstärkungsstrukturen GmbH
- hollomet GmbH
- Complex Fiber Structures GmbH
- Leichtbauzentrum Sachsen GmbH
- Paulsberg OHG
- Qpoint Composites GmbH
- TUDATEX GmbH

Organic electronics/Energy

- Creaphys GmbH
- Heliatek GmbH
- Novalad GmbH
- sim4tec GmbH
- Evico GmbH

Other

- i3 Membrane GmbH – Micro-porous metal membranes
- Perfluorence GmbH – Lubricant additives

Laboratory equipment/Analytics

- BelektroniG GbR

Charisma and identity with technical design

Stakeholders

Research and training

- Dresden University of Technology
- Dresden University of Applied Sciences

Industrial designers (selection)

- Designprojekt GmbH Dresden
- neongrau design
- ESKA. Studio für Gestaltung
- Haydeyan Studio for Design and Architecture
- KUPFER.ROT GbR
- ma design GmbH & Co. KG
- Paulsberg OHG
- scoop id-Pohl & Gabschuß GbR
- WOLFRAM Design/Engineering

Network

- Wir gestalten Dresden

The Center for Industrial, Interaction and Information Design (CIID) at the Dresden University of Technology focuses on product designs for future industrial and consumer-oriented uses. Interactions involving mobile and networked controls via touch, gesture, speech and sight for man-machine interaction in Industry 4.0 provide a crucial basis for the Internet of Things.



“Cooperations with the Dresden University of Technology are a success model for Audi design, and have for years been apparent through exciting projects and new Audi design staff from the project environment. The introduction of INI.TUD – the Ingolstadt Institute at the Dresden University of Technology – sees this partnership raised to a strategic level, and the research scope significantly broadened. The long-term and now also official collaboration will involve joint research and teaching, currently in the form of an interior design project. It will help us find new creative staff, and discover innovative inspiration to help us re-think and shape the future of mobility.”

Karl-Heinz Rothfuss
Head of Audi Design Interior



Technical designers from the Dresden University of Technology and Dresden University of Applied Sciences are sought-after young professionals.

Award-winning design for the change in energy policy

Applying new technologies to the real world is what the specialists at the neongrau design agency are all about. They developed a storage system for Dresden-based company Solarwatt, denoting the next generation of local battery systems in terms of technology and design. The innovative long-fiber injection process was uniquely combined with various other deep-drawing processes to create a robust, lightweight casing, while the storage system's modular structure means it can be easily expanded up to 11 kWh. Integration into the PV system's direct-current circuit was achieved for the first time, with a round-trip effectiveness of 93%. My Reserve won the ees award at the 2015 Intersolar, and has been nominated for the 2016 German Design Award.

Knitted single-piece vehicle bodywork

The designer Haydeyan and Dresden University of Technology's Institute of Textile Machinery and High-Performance Material Technology (ITM) have jointly designed a concept car demonstrating the institute's latest research advancements in manufacturing textile-reinforced structures as integral constructions. The bodywork no longer consists of hundreds of individual parts, but is instead made from state-of-the-art textile structures in one single piece. The demo model combines various technologies like complex free-form surfaces, ramified frame designs, and shell constructions with integrated ribbing.

Bodywork design for an autonomous tractor by WOLFRAM Design/Engineering



As partners of materials research, product designers bring new materials to life. Numerous design awards reflect the high quality of the region's some 50 design agencies, and their close cooperation with the business sector. With the faculty of design at the Dresden University of Applied Sciences, and the Junior Professorship for Technical Design at the Dresden University of Technology, the city has established itself as a center of both design training and research.

Technical design for Industry 4.0

The ever changing world of production has prompted application-focused research to be conducted at the Dresden University of Technology's Junior Professorship for Technical Design.

Smaller series, more flexible (local) production using various material compositions, 3D printing, and Industry 4.0 see manufacturers and users faced with a number of new challenges.

The #1 address for material testing

Dresden is one of the top centers for material analytics and stress-based material testing, and its well-rounded competence is highly valued by global concerns like Airbus and leading automotive manufacturers.

Putting the world to the test

Whenever a new composite material is developed anywhere in the world, it will very likely undergo testing in Dresden.

IMA Materialforschung und Anwendungstechnik GmbH designs and conducts tests for materials and components, assessing the service life, function, safety and long-term behavior of aviation, automotive and railway technology. If necessary, the road is even brought into the laboratory, as was recently the case for the operating load simulation on the carbon-fiber-reinforced plastic bodywork of the BMW i8.

Combating rust with power

Corrosion is a critical factor in the planned lifetime of structures, systems, aircraft, vehicles or consumables. Drawing on its 50 years' experience, the Institut für Korrosionsschutz Dresden GmbH researches and tests the usability of coatings on various material surfaces, modern galvanizing technologies, mechanical, media-based material

IMA Dresden brings the road to the laboratory, as was the case for the operating load simulation on the carbon-fiber-reinforced-plastic bodywork of the BMW i8.

behavior at joints, and rust protection during transportation and storage. Test chambers allow even extreme conditions, such as temperatures between -70 and +200°C (-94°F and 392°F), salt spray or corrosive gas, to be simulated.

Stakeholders

Research

- Dresden University of Technology
- Fraunhofer Institute for Ceramic Technologies and Systems – Material Diagnostics (IKTS-MD)
- Fraunhofer Institute for Material and Beam Technology (IWS)
- Institut für Korrosionsschutz Dresden GmbH

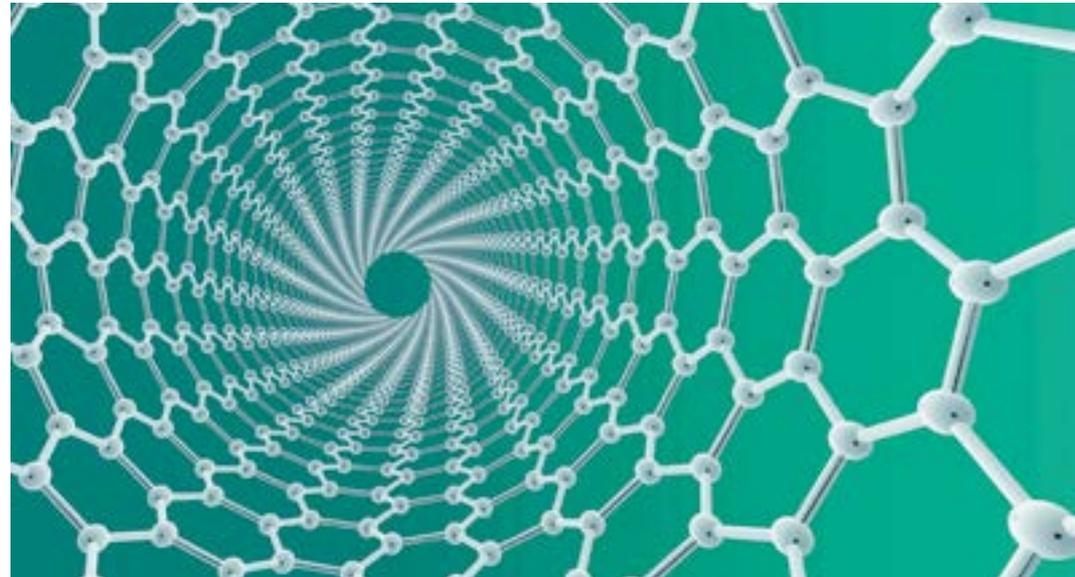
Test institutes

- IABG Dresden Luftfahrt
- IMA Materialforschung GmbH
- SGS Institut Fresenius GmbH
- Institute of Lightweight Engineering and Polymer Technology at the Dresden University of Technology (TUD ILK, DIBt)

Measuring equipment manufacturers

- SURAGUS GmbH
- ASMEC Advanced Surface Mechanics GmbH
- hiperScan GmbH

A high degree of productivity through close interactions



Networking has a long tradition in Dresden.

Carbon Composite East

The CC East regional division of the Carbon Composites association strengthens and pools the fiber-composite competencies of high-performing companies and research establishments in eastern Germany from its base at the Dresden University of Technology's lightweight engineering campus. The aim is to establish the emerging high-performance fiber-composite technology as state-of-the-art technology, and unlock a sustainable source of growth and high-tech jobs.

www.cc-ost.eu

MFD – Materialforschungsverbund Dresden

With its some twenty member institutes, the Materialforschungsverbund Dresden (Materials Research Network Dresden) represents a research spectrum covering virtually all types of materials, from metals and alloys, to polymers, to ceramics, composites, hybrids and natural materials. It particularly also includes structural and functional materials, as well as a wide range of research technology.

www.mfd-dresden.de

Saxon/Thuringian Competence Center for Aerospace

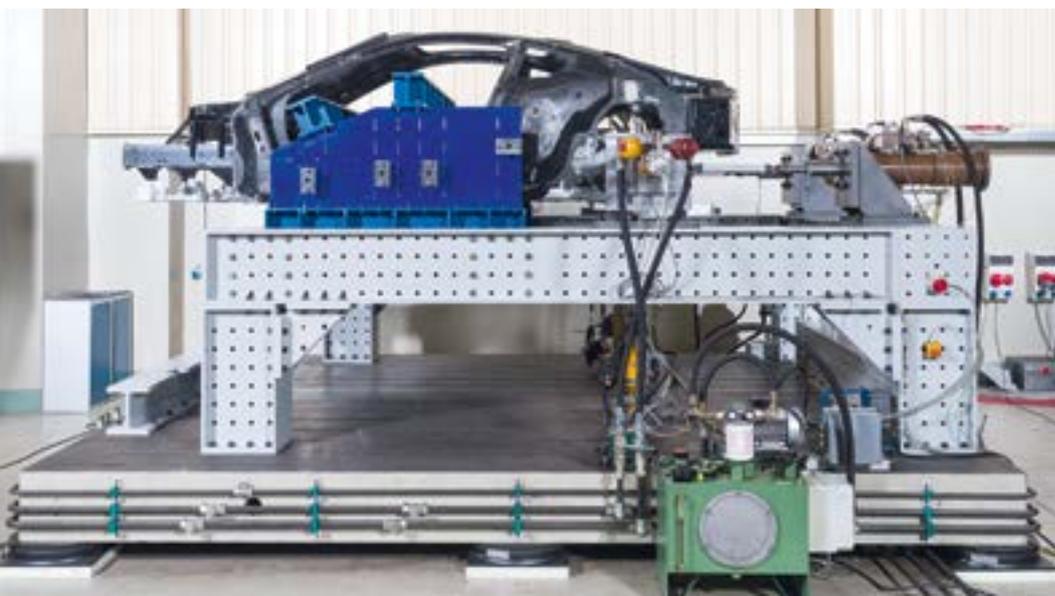
The predominantly small and medium-sized businesses in this network collaborate with a view to advancing developments in the Saxon and Thuringian aerospace industry. As reliable project partners of major aircraft manufacturers, the members are involved in large-scale international projects.

www.lrt-sachsen-thüringen.de

EFDS

The European Society of Thin Films (EFDS) pools the expertise of companies and research institutes in plasma-based coating processes and surface modification. Internationally prominent areas of specialization include resource and energy-efficient products and processes, as well as the coating of flexible substrata using the roll-to-roll method.

www.efds.org



An outstanding new generation



The diverse range of course options is exciting for young professionals.

The Dresden University of Technology among the world's top 100 universities in materials science and physics

According to the QS World University Ranking by Subject, the Dresden University of Technology is among the world's top 100 universities in the fields of materials science and physics/astronomy. It places in Germany's top 10 in eight fields of study, including 3rd in materials science and 5th in civil engineering. The evaluation process included citations, the so-called H-Index, and surveys of scientists and HR managers.

Fast-tracking to practical experience

The Dresden University of Technology has extensive experience in training materials experts and engineers, and maintains close ties with the Fraunhofer Society, due to the shared vocation of the institute managers. The industrial competence centers provide numerous points of contact for internships and dissertations.

Companies like to recruit new blood in Dresden. Indeed Dresden University of Applied Sciences ranks third among universities preferred by HR professionals.

Selected courses

Dresden University of Technology

- Materials sciences, incl. functional materials, organic materials, nanomaterials, measurement and analysis technology
- Mechanical engineering specializing in lightweight construction, process and textile machinery, aerospace engineering, automotive and rail-car engineering, general and structural mechanical engineering with extension module in technical design
- Mechatronics
- Electrical engineering
- Renewable energy systems
- Process and natural-material technology
- Physics, chemistry, biology, molecular biotechnology
- Internationally accredited Masters course in "Textile and manufacturing technology"

Dresden University of Applied Sciences

- Product design
- Mechanical engineering
- Automotive engineering
- Mechatronics systems/vehicle mechatronics
- Production technology

Dresden International University (DIU)

- Non-Destructive Testing M. Sc. (NDT)



Business development – supporting competencies and promoting ideas



As the main contact for the New Materials division, Competence Field Manager Sabine Lettau-Tischel answers subject-specific questions, and helps companies carry out their projects.

Development spaces

The strategic aim of Saxon state capital Dresden is to further develop the existing competencies of this high-tech hub.

The city supports the notion of concentrating researchers, companies, new business founders and specific service providers in terms of space and field with its technology centers, business parks, and commercial areas. The resulting synergies serve to help build and develop said competencies even faster, and ensure research results can be applied in industry sooner.

Office for Business Development

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The Office for Business Development supports and assists with the development of companies and research institutes. Its key tasks include actively overseeing the approvals process, offering advice on commercial locations for new business headquarters or expansion projects, providing information on the latest materials projects, and active networking.

Companies investing here will thus quickly and easily secure commercial space to successfully establish new bases, as well as for intended expansion or relocations, while the business service offers consulting services on the topics of funding, financing and start-ups.

The Dresden Business Development Office works with its state counterpart and industry networks to prepare for trade fair appearances, exhibitions and events, and provides information on latest projects.

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Page 6: Rolls-Royce Germany/Steffen Weigelt,
Bottom: Dresden University of Technology/ITM
Page 7: Top: Dresden University of Technology/ILK,
Bottom: Dresden University of Technology/ITM
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Realization:
www.oe-grafik.de

September 2015

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www.dresden.de/invest