HTWK Leipzig University of Applied Sciences

Insights

Research Magazine 2026

Focus:
Materials

HTWK Leipzig conducts research on printed materials, functional coatings, and packaging in the Gutenberg Building (GU), among other locations—a central teaching and laboratory building of the Faculty of Computer Science and Media. Named after Johannes Gutenberg, the inventor of traditional book printing, the building symbolizes the connection between tradition and modern media technology. Developed between 1912 and 1914 as the north wing of what was then the teachers' college, based on designs by the Saxon State Building Authority in Dresden, it has served a variety of functions ever since. Comprehensively renovated by 2013, the Gutenberg Building now serves as a venue for media-related teaching and research as well as creative media work.

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Dear readers,

Prof. Dr.-Ing. Faouzi Derbel (left) and Prof. Dr.-Ing. Jean-Alexander Müller

Materials shape the world around us. Their properties define the limits of what is possible in a whole range of fields – from media and construction to energy and manufacturing. They are at the heart of all technological advances. This issue of *Insights* is dedicated to the research and development of materials – a field deeply rooted in our university's activities.

The articles featured in this issue illustrate how researchers at HTWK Leipzig are reimagining traditional materials like paper, cardboard, timber, clay, steel and concrete to meet the demands of tomorrow. Technologies such as 3D printing are creating opportunities to use materials more precisely and combine them in ways that result in new components – and even entirely new functions. This research is paving the way for more efficient production methods, more durable products and more sustainable infrastructure.

These developments are closely linked to some of the most pressing questions facing our society and industry: How can we conserve resources? How can we promote a circular economy? And how can we strengthen our technological sovereignty? Applied research plays a crucial role by translating scientific findings into practical solutions – with tangible benefits for businesses, local communities and society as a whole.

In this issue, you will discover how new approaches to the circular economy are helping to close material loops, how additive manufacturing is making customised solutions a reality, and how innovative construction materials could shape the world of tomorrow. You will also gain insights into some of our current projects – from green roofs designed to help cities adapt to climate change to new strategies aimed at combating domestic violence. And in our interview on p. 42, you will find out why we are striving to obtain independent awarding powers for doctoral degrees.

We hope you find this issue insightful and inspiring!

Kind regards,

Prof. Dr.-Ing. Jean-Alexander Müller,
Rector of HTWK Leipzig

Prof. Dr.-Ing. Faouzi Derbel,
Vice-Rector for Research and Sustainability

Focus

Materials

On the cover photo, Luisa Sander inspects a wooden beam to see if it can be recycled. Lukas Steffen holds a curved carbon concrete component up to the camera. Both materials have the potential to make the construction industry more sustainable

Facts and figures

Photo competition

Anne Rauchbach is examining cultural transformation in rural communities

Highlights

2025

20,66
million euros

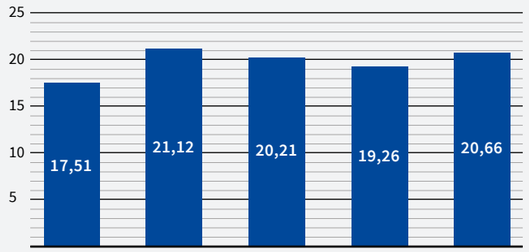
… in third-party funding was secured by HTWK Leipzig in 2025, competing with other research institutions at federal, state, industry and EU level. 4,48 million euros of this amount were allocated to the university's Research and Transfer Centre (FTZ). Deutsche Telekom donated a further 2,96 million euros to the Faculty of Digital Transformation.

414
staff members

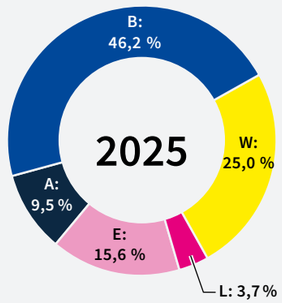
… were financed in 2025 through third-party and special funding, as well as support funds granted under the "Future Contract for Strengthening Studying and Teaching in Higher Education" initiative. They are working on numerous research and internationalisation projects, in teaching and in various areas aimed at improving study conditions. All additional positions contribute significantly to HTWK Leipzig's innovation potential and performance.

Development 2021–2025

Third-party funding in million euros

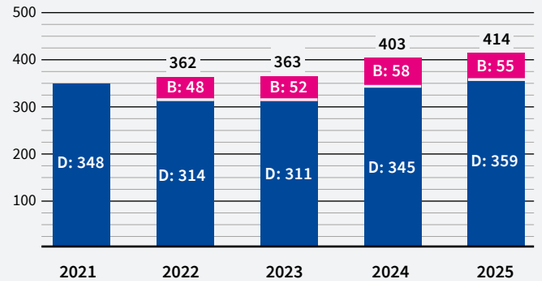


Source of third-party funding

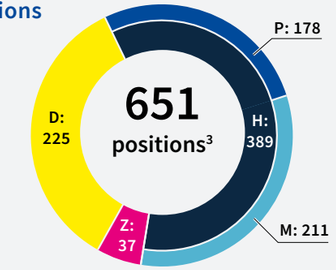


Development 2021–2025

Staff financed through third-party and special funding

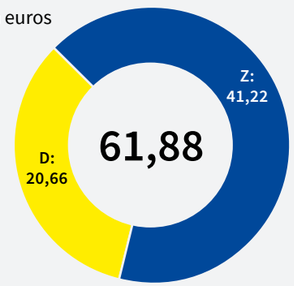


Positions



Financial volume

in million euros



6.322
Students[1]

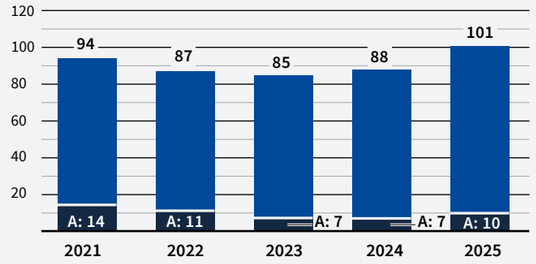
1.394
Graduates[2]

101
Doctoral candidates

… were supervised in 2025 by HTWK Leipzig professors in cooperation with partner universities.

Doctoral research projects

in cooperation with partner universities



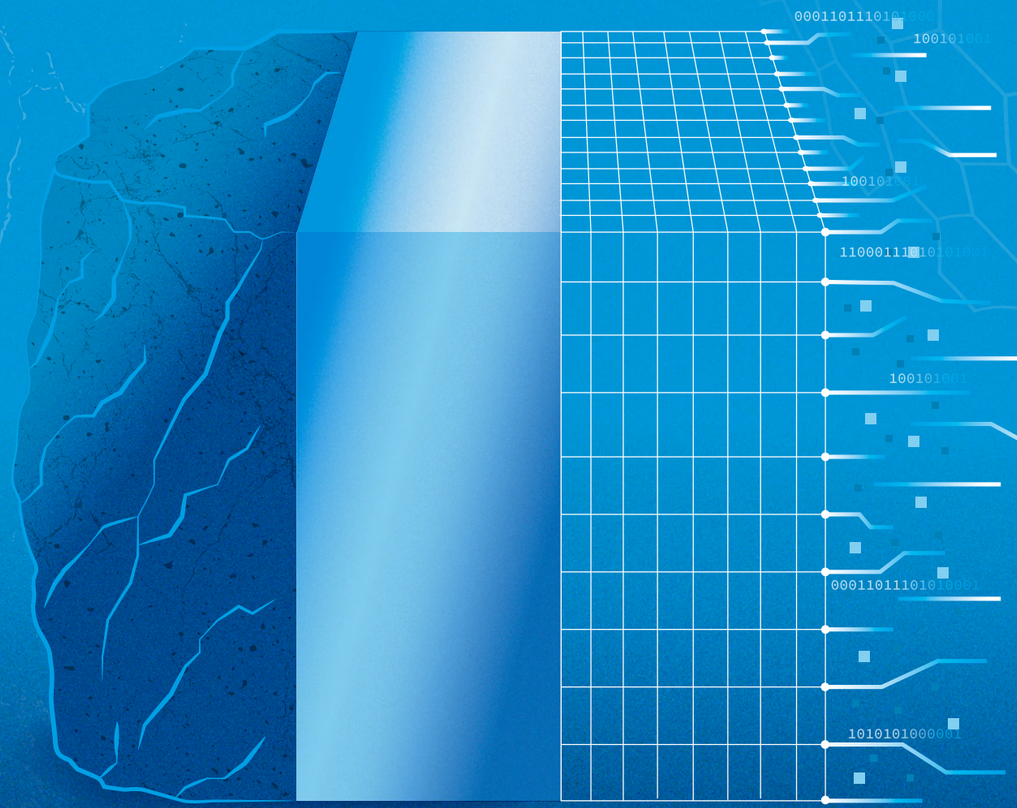
[1] as of 1 November 2025 | [2] in the 2024/25 academic year

[3] full-time equivalents | All figures valid as of 31 December 2025, unless stated otherwise

3500 BC

The ancient Egyptians developed the earliest known form of paper production using papyrus

Materials



Whether natural or man-made, our world is made up of materials that can be shaped, modified and used. The term derives from the Latin *māteriālia*, meaning “material things”. When a material is processed and formed in a certain way, it can become the starting point for all kinds of innovations. Exploring this broad field is the task of materials science and engineering, an interdisciplinary area that brings together physics, chemistry and engineering.

The use of materials is as old as humanity itself. Entire periods of history – such as the Copper, Bronze and Iron Ages – were named after the materials that defined them. Even today, materials research remains a key driver of progress. Estimates suggest that up to 70% of all new products are based on innovations in engineering materials. Advanced ceramics, composite materials and nanoparticles are creating a world of possibilities – from self-cleaning surfaces to smart materials that respond to their surroundings. Whether it’s more efficient solar cells, lighter and more powerful components in the mobility sector, flexible displays and printed electronics for communication technologies or new implants for teeth and joints – all innovation starts at the level of the material.

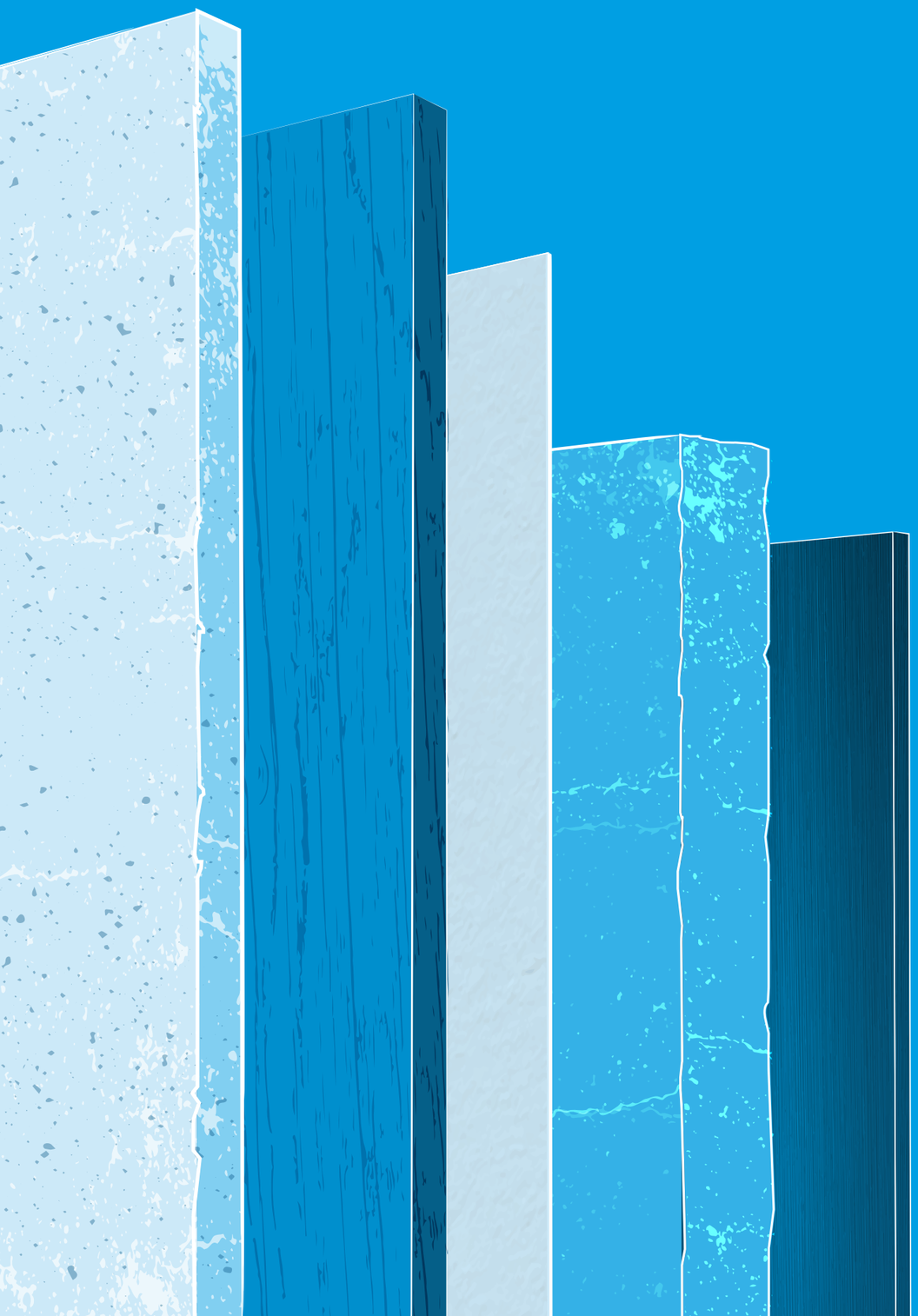
Modern analytical methods provide insights into even the smallest structures, helping researchers develop targeted material enhancements and even unlock new functionalities. This is very much evident in manufacturing technologies such as 3D printing, where new possibilities are emerging through the interaction between process and material. This form of additive manufacturing allows powders, plastics, metals and even chocolate to be built up layer by layer with remarkable precision and efficiency, marking a fundamental shift from conventional production methods. In addition to cost-effective, customised manufacturing, this approach also makes it possible to combine different materials in a single print run.

Yet as these technological possibilities expand, so too do the demands placed on materials. Today, they are expected to not only deliver high performance, but also to form a sustainable part of the circular economy. Developing such materials is one of the key challenges of our time.

At HTWK Leipzig, materials and their applications are firmly embedded across a broad range of faculties. Many of our researchers are working on solutions incorporating established materials like paper, timber, concrete and metals, as well as lightweight materials such as carbon-fibre-reinforced polymers. The articles featured in this magazine showcase the breadth of our research activities, their practical applications and the societal challenges they seek to address. — *kh*

9500 BC

The first settlements built with mud bricks emerged in areas of present-day Turkey and Jordan. Earthen construction laid the foundations for permanent settlement during the Neolithic period



Materials with a past and a future

Text: Katrin Haase

Wood, clay, paper, steel and concrete have been part of human civilisation for millennia. Today, modern research is rediscovering many of these traditional materials, enhancing their properties and finding new applications for them. Researchers at HTWK Leipzig are also working to make materials fit for the future. Here is an overview.

As a university of applied sciences, HTWK Leipzig has long focused on the application and further development of materials that are closely intertwined with human civilisation.

Timber: high-tech solutions for the world's oldest building material

Wood is one of humanity's oldest building materials. For thousands of years, it has been used to make tools, bridges, ships and houses. Yet with industrialisation and the rise of synthetic materials such as concrete and steel, timber construction gradually moved out of the spotlight. As a naturally grown material, wood was seen as difficult to process. Over the past three decades, however, timber has made a comeback – driven largely by its outstanding sustainability credentials as a renewable raw material and its ability to store carbon. At the same time, the challenges facing society have changed dramatically. Within the space of 100 years, the global population has roughly quadrupled, climate change has become measurable, and the finite nature of natural resources is no longer just a theoretical debate.

Can timber construction provide solutions to these immense challenges while remaining economically competitive and conserving resources? For the past ten years, this question has been the focus of FLEX, an interdisciplinary research group headed by Alexander Stahr, Professor of Structural Engineering at HTWK Leipzig.

In more than 20 research projects, starting with the rediscovery and further development of the material-efficient, singly curved Zollinger roof, the team has developed construction solutions, technologies and processes that combine advances in digitalisation, automation and logistics to maximise their impact.

The group's most significant achievement came in 2024, when the new Timber Construction Research Centre (HolzBauForschungsZentrum) opened its doors. This research and production facility provides 1,100 m² of space for the FLEX researchers to develop innovative timber construction concepts at full scale and test prototypes. At the heart of the facility is "FABRIX", a bridge crane system equipped with overhead-mounted industrial robots that isn't found anywhere else within the German-speaking world. This system makes it possible to process components and assemble large wall and floor elements using digitally controlled methods and with a high degree of spatial flexibility throughout the facility.

The ribbed structure of the Zollinger roof is not just pleasing on the eye – it also helps to conserve resources

"Timber construction is an important lever for a more sustainable construction industry. By systematically integrating digital planning and manufacturing methods, we'll be able to harness its considerable potential far more efficiently in the near future", says Prof. Stahr. Parametric digital models are fundamental to this approach, seamlessly linking every stage of the process – from design and planning to efficient prefabrication, logistics and on-site assembly.

But how can we address the issue of resource scarcity? Trees don't grow back as quickly as they are being harvested to meet rising demand. That's why the research group is also working on ways to reuse timber from existing buildings more effectively (↗ p. 26). For example, the team's architects and engineers are examining how previous structural loads affect the strength of construction timber, how much reclaimed timber can be recovered from existing buildings and returned to use, and how functionally enhanced cross-laminated timber can be manufactured in line with a regional economic approach. All of these projects are aligned with a common objective: making timber construction more efficient, more circular and more digital.

Prof. Alexander Stahr combines timber construction, robotics and digitalisation

Prof. Stahr explains: "Renewable building materials present a significant opportunity for transformation, allowing us to shape our infrastructure not only in material terms, but also in ways that are economically viable and sustainable. If we can become much better at combining timber – refined through millions of years of evolution – with the possibilities offered by digital technologies, both creatively and strategically, we'll turn construction into a driver of innovation within our society and open up a wide range of opportunities for industry".

Clay: local resources, new opportunities

Like timber, clay is one of the oldest building materials of all – and the two have often been used in combination. Today, more than a billion people around the world still live in buildings made from this naturally occurring material.

In Europe, however, clay gradually fell into obscurity with the industrialisation of the construction sector, as concrete and brick came to dominate. But in the face of the climate crisis, resource scarcity and fragile supply chains, attention is now returning to clay – not least because of its outstanding properties. It requires very little energy to produce, is generally available locally and in large quantities, can be completely reused and has a positive effect on the indoor climate.

Björn Höhlig, Professor of Sustainable Construction and Building Rehabilitation at HTWK Leipzig, has promoted many discussions, research projects and events focused on clay as a building material. One such initiative is a partnership with Naturbau-Campus Oschatz, a centre for education in sustainable development. He is working with this partner institution to organise the third Sustainable Building and Refurbishment Conference, which will bring together experts from industry and academia at HTWK Leipzig this autumn. Alongside building materials such as timber, straw and hemp, clay regularly takes centre stage in the technical discussions.

Prof. Höhlig is also heading *GOLEHM19-RegioLehm*, a project recently launched in collaboration with a team led by Ralf Thiele, Professor of Geotechnical Engineering. The project will investigate suitable clay and loam deposits around Leipzig with the aim of identifying previously unused resources that are available in large quantities as overburden from active open-cast mining. These resources are to be systemically documented and made available for use

2

million buildings in Germany have been constructed using clay. And the number is rising – especially in new-build projects

3,7

billion cubic metres of timber are found in Germany's forests. This is the largest timber stock in the European Union

Prof. Björn Höhlig and his team are investigating regional clay deposits

in construction products. The results will be published in an open-access database – an important step towards strengthening regional value chains in clay construction.

Paper: from knowledge medium to diagnostic lab

The invention of paper quite literally rewrote cultural history. Its origins can be traced back to ancient China. When papermaking arrived in Europe during the Middle Ages and Johannes Gutenberg subsequently developed the printing press in the 15th century, it sparked a revolution in the spread of knowledge. Information became affordable and could be distributed on a mass scale. Paper became the foundation of knowledge sharing and mass communication.

Even today, paper remains an integral part of everyday life, whether in newspapers and books, packaging materials, decorative printing or specialised technical applications such as filters. The basic principle has changed little over the centuries: Fine fibres, typically sourced from wood, are suspended in water and then bonded into a thin yet robust web before being dried.

1843

Saxon weaver Friedrich Gottlob Keller discovers the groundwood process, revolutionising paper production around the world

For more than 30 years, HTWK Leipzig has been exploring new ways of developing and using paperboard and paper in the fields of printing, media technology and packaging technology. A particular emphasis has also been placed on embossing as a method for permanently shaping these materials.

Lutz Engisch, Professor of Engineering Materials at HTWK Leipzig, is opening up an entirely new field of application for paper in the research project Paper-Based Point-of-Care Diagnostics (*Paper-ROCK*). He is working with partners from industry and research to develop sustainable paper-based testing systems for medical diagnostics. The project involves embossing microstructures into paper. These structures act as microscopic channels through which liquids like blood samples can flow automatically and react with chemical substances. This results in a miniature analytical system, known as a “lab-on-a-chip”.

Funded by the Federal Ministry of Research (BMFTR) for three years until the end of this year, the project is developing prototypes for disposable tests made from paper instead of plastic. This addresses a growing environmental concern, as medical laboratories around the world generate millions of tonnes of plastic waste every year. Paper-based tests could offer a more sustainable and affordable alternative.

“Paper is a fascinating material. By specifically altering its structure, we can give it completely new functions – even turning it into a medical diagnostic system”, says project leader Engisch. In the longer term, systems

“Paper is a fascinating material. By specifically altering its structure, we can give it completely new functions – even turning it into a medical diagnostic system”

Lutz Engisch, Professor of Engineering Materials at HTWK Leipzig

Prof. Lutz Engisch presents the paper-based prototype of a medical test strip and the two embossing tools used in its production

of this kind could make diagnostic testing possible in places that lack conventional laboratory facilities – for example in rural areas or developing countries.

Steel: a key material for today and tomorrow

Metals such as bronze and iron were so transformative that entire periods of history were named after them. Their discovery and practical use drove major advances in human civilisation. Even today, many metallic engineering materials form the backbone of modern industrial societies, supporting everything from infrastructure and mechanical engineering to energy systems. At the same time, these materials are facing growing demands. Machinery and components are expected to last longer, and we need to use resources more efficiently and increase recycling rates while reducing our reliance on critical raw materials.

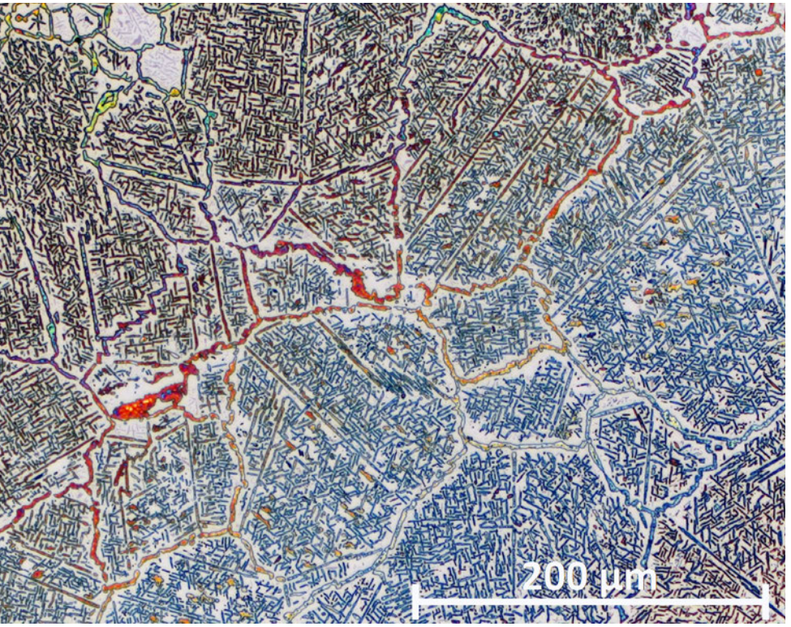
This is exactly where materials research at HTWK Leipzig comes in. One focus lies on understanding and specifically influencing the corrosion of metallic materials – one of the leading causes of material degradation and component failure. Paul Rosemann, Professor of Materials Engineering, has spent many years researching the corrosion resistance of stainless steels. These materials are particularly valuable because their exceptional corrosion resistance makes them durable, low-maintenance and almost infinitely recyclable. These properties are combined with strong mechanical performance, excellent processability, hygienic surfaces and an attractive appearance. This makes them ideal for numerous applications – from

> 90%

of metals used worldwide are ferrous materials, most of which are processed into steel

medical technology to construction. Prof. Rosemann's team is using electrochemical techniques to investigate how alloying elements, trace constituents, manufacturing processes and heat treatment affect the microstructure and properties of stainless steels. This makes it possible to optimise materials for specific applications, whether in infrastructure, energy systems, mechanical engineering, healthcare or pharmaceuticals. Ultimately, this could result in longer service life, lower maintenance costs and reduced resource consumption.

At the same time, the researchers are working on new iron-based hard-metal alloys in the *IRONHEART* project. The aim is to create alternatives to conventional hard metals that are not based on scarce and expensive raw materials. Iron-based alloys reinforced with hard phases deliver the same combination of high hardness and thermal resistance while offering clear benefits in terms of availability and affordability. These innovations are significant not only from a technological perspective, but also from a geopolitical standpoint, contributing to resource sovereignty and strengthening the resilience of industrial supply chains.



Light microscope image showing the microstructure of an experimental alloy with pronounced carbide and nitride formation resulting from thermochemical heat treatment

Concrete: from Roman building material to high-tech composite

The Romans used an early form of concrete to build impressive structures such as aqueducts, arenas and harbour facilities. Some of them still stand today – a testament to the material's exceptional durability. The development of reinforced concrete in the 19th century marked the start of the material's golden age. Combining high compressive and tensile strength, this composite material soon became the world's most widely used construction material – and remains so to this day. But its success comes at a cost: The production of concrete, particularly the manufacture of cement and steel, is responsible for around 8% of global anthropogenic carbon emissions.

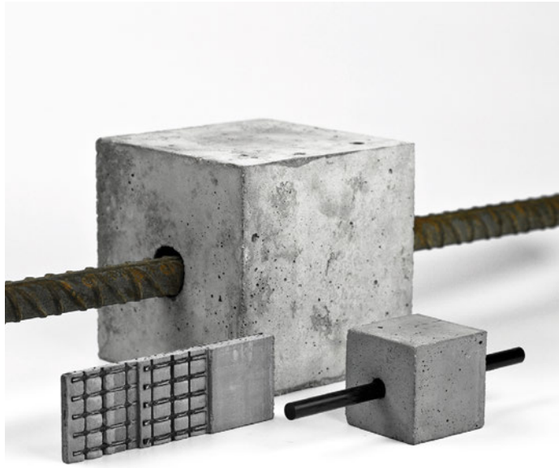
One promising alternative is carbon-reinforced concrete, a composite material in which carbon fibres replace conventional steel reinforcement. Carbon-reinforced concrete is resistant to corrosion because, unlike steel, carbon doesn't rust. This makes it possible to use thinner concrete sections, which helps to save resources while enabling more slender structural components. Since 2014, the Institute of Concrete Construction at HTWK Leipzig has been involved in researching and developing this composite material as part of a large-scale project called *Carbon Concrete Composite* (C^3). Together with Dresden and Aachen, Leipzig is one of three leading locations working to transfer this innovative material into practical use through the Carbon Concrete Technology Centre.

In the model factory, researchers led by Klaus Holschemacher, Professor of Reinforced Concrete Construction, and Tilo Heimbold, Professor of Process Control Engineering and Process Management, are exploring new production methods for carbon-reinforced concrete. An interdisciplinary team of civil and electrical engineers is developing and testing automated production processes for components that are stable, durable and sustainable. To address the challenge of resource scarcity, they are also working with industry partners to trial solutions for recycling concrete demolition waste, helping to establish a circular economy within the sector. Another focus is the combination of concrete with other materials. In the *HBVcarbon* project, for instance, the Institute of Concrete Construction is developing resource-efficient flooring systems that combine timber and carbon-reinforced concrete, combining the strengths of both materials.

At the Carbon Concrete Technology Centre, Prof. Tilo Heimbold (left) and Prof. Klaus Holschemacher are developing structural components made from carbon-reinforced concrete that can conduct electricity

Materials reimagined

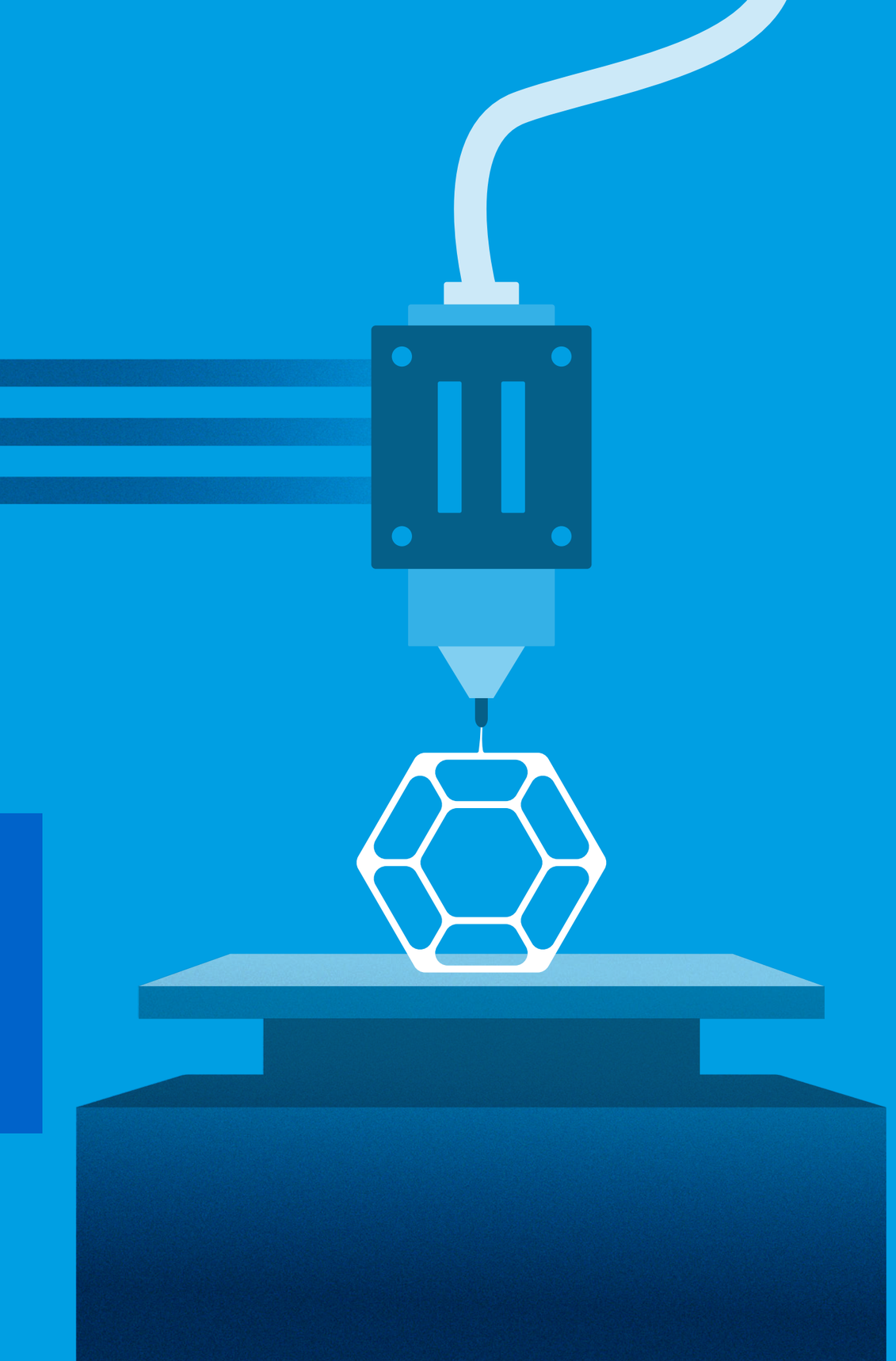
At HTWK Leipzig, traditional materials are combined with digital technologies, novel manufacturing methods and sustainable concepts. This results in a range of solutions that extend far beyond individual materials and address some of today's pressing questions: How can we build with an eye on climate change? How can we secure resources? And how can we make industrial processes fit for the future? —



Compared with reinforced concrete (large cube), carbon-reinforced concrete (small cube and slab) can reduce material consumption by up to 80% while delivering the same performance

1867

Joseph Monier files the first patent for reinforced concrete, originally developed to create more durable plant containers



Printing in the third dimension

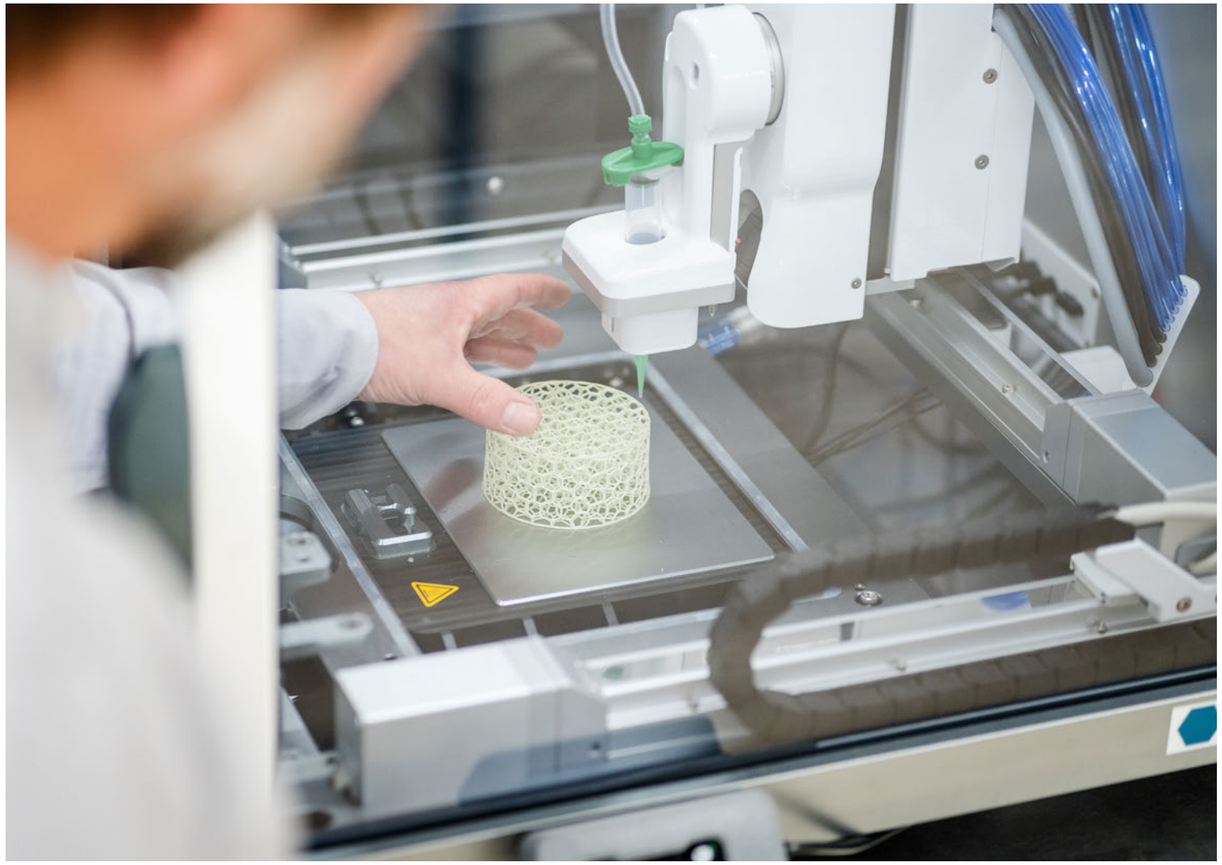
Text: Katrin Haase

Digital data is used to build real objects layer by layer – precisely, efficiently and with growing levels of sophistication. At HTWK Leipzig, the possibilities of additive manufacturing are becoming increasingly apparent.

Additive manufacturing

3D printing, also known as additive or generative manufacturing, is a production method in which components are created layer by layer. This allows materials to be deposited exactly where they are needed and can perform their intended functions. The result is greater design freedom, affordable custom-made products and more efficient use of resources. The technology is particularly promising when different materials are combined to produce functional components with built-in sensors, electrical properties or even biological functions.

Thanks to these advantages, additive manufacturing has progressed from a rapid prototyping tool in the 1980s to a key technology of modern industry. “It’s changing the way products are conceived, designed and manufactured, while opening up new dimensions for materials themselves”, says Ines Dani, describing the scale of this technological advance. Since 2025, she has been Professor of Generative Manufacturing Technology, a position created by the university in response to these developments.



3D printing is ideal for delicate, custom-made pieces

Prof. Ingo Reinhold and Prof. Ines Dani stand next to the bioprinter in the new Additive Multi-Material Manufacturing Lab

Prof. Dr. rer. nat. Ines Dani
(*1967) is Professor of Generative Manufacturing Technology at HTWK Leipzig. She is a member of the Institute of Technology and Production in Mechanical Engineering and is involved in the Additive Multi-Material Manufacturing research area. Her research focuses on multi-material 3D printing and the development of new additive manufacturing technologies. She serves as Chair of the Executive Board of the “Building 3D” association and sits on the Advisory Board of the “Smart Production and Materials” performance centre.

Prof. Dr.-Ing. Ingo Reinhold
(*1981) is Professor of Coating Processes at HTWK Leipzig. His research within the Additive Multi-Material Manufacturing research area focuses on functional coating systems and additive production methods using printing and coating technologies. He heads the DFTA Competence Centre for Digital Printing (CCD) and the Leipzig Centre for Smart Surfaces (CS^2). He is also a member of the Institute for Printing, Packaging and Processing (IP^3).

New structures for materials of the future

For many years, HTWK Leipzig has been advancing additive manufacturing through a wide range of interdisciplinary research projects. One major milestone in this effort is the Additive Multi-Material Manufacturing Lab (AM^3), a cutting-edge research environment for 3D printing. The facility is set to open in summer 2026. At its heart is a next-generation bioprinter. “This printer opens up entirely new possibilities in functional 3D printing. It can combine several materials and manufacturing processes at the same time”, explains Ingo Reinhold, Professor of Coating Processes. Thanks to a range of interchangeable print heads, different materials can be positioned precisely within a single layer, making it possible to produce intelligent, multi-functional components. As Reinhold puts it: “We’re no longer just printing shapes – we’re printing functions”.

The facility is further strengthened by additional large-scale equipment funded by the German Research Foundation (DFG), including a highly flexible powder-based High-Speed Sintering (HSS) printer that combines the properties of powder and ink into an exceptionally versatile solution. The system is ideally suited to developing new material combinations and processes. It also enables the fast and flexible production of prototypes and small-series components for research purposes. The third piece of DFG-funded equipment is a powder shear cell with an integrated climate chamber,

“This printer opens up entirely new possibilities in functional 3D printing. It can combine several materials and manufacturing processes at the same time. We’re no longer just printing shapes – we’re printing functions”

Ingo Reinhold, Professor of Coating Processes at HTWK Leipzig

1907

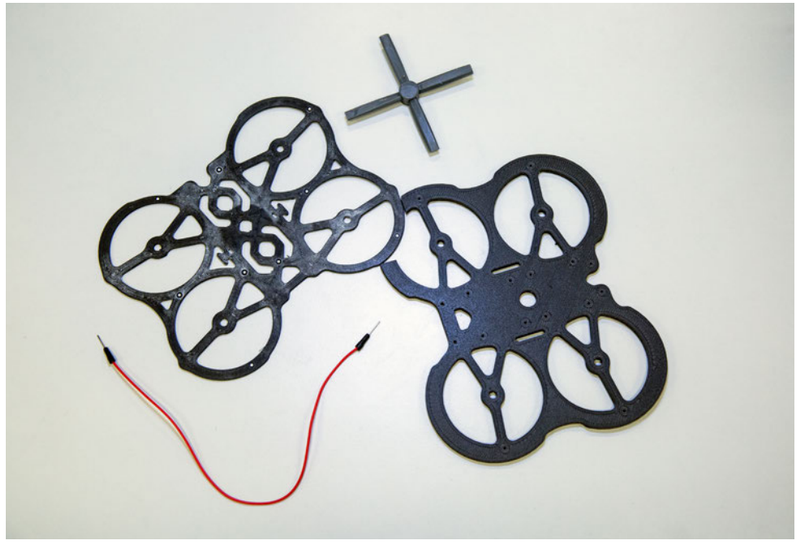
Leo Baekeland invents Bakelite, the first fully synthetic plastic to be manufactured on an industrial scale

designed for the precise analysis of powder properties. Powders play a central role in additive manufacturing. “We’re investigating processes in which powder acts as a printing material with additional functional properties. We can selectively add features like electrical conductivity using inkjet print heads. This opens up new possibilities for the production of multi-material and multi-functional components”, says Prof. Reinhold. These three large-scale instruments combine to form an end-to-end process chain – from material development to the finished component.

Researchers from different faculties are collaborating within the Additive Multi-Material Manufacturing research area to generate new ideas and promote interdisciplinary thinking. They are developing concepts for research projects, identifying opportunities for collaboration and making shared use of the available equipment for a wide range of purposes.

What is additive multi-material manufacturing?

Additive multi-material manufacturing is a form of 3D printing. Whereas traditional additive manufacturing generally relies on a single material, this approach combines different materials – such as metal alloys, polymers and ceramics – to produce components with optimised functional properties.



3D-printed drone parts combine structural support with energy storage

Batteries, concrete, steel: 3D-printed materials

The applications of additive manufacturing span a wide range of research fields – from mechanical, civil and electrical engineering to printing and packaging technology. The aim is to develop printed components that are both structurally robust and capable of performing additional functions, such as sensing and actuation. “We’re going beyond purely structural design and integrating functions directly into the material itself”, says Prof. Reinhold.

One particularly striking example is *Print-cap – Next Generation of 3D Printed Structural Supercapacitors*, a collaborative research project carried out with European partners in France and at the Dresden University of Technology. The researchers involved in the project are developing 3D-printed components that combine load-bearing capacity with energy storage. The goal is to enable electric aviation through the use of lighter components. “In an ideal world, the aircraft fuselage itself would become the battery”, explains project leader Robert Böhm, Professor of Composite Lightweight Engineering. Lighter and more efficient energy storage systems are essential for the future of electromobility – especially in aviation.

Additive manufacturing is also opening up new perspectives in the construction sector. One area of research focuses on sensor systems for 3D-printed concrete. In the *PROZEUS* project, researchers are developing a real-time monitoring system for the additive manufacturing of concrete structures. Key material properties are measured during printing and curing, helping to prevent cracks from developing or to identify potential cracking at an early stage. “We’re making the construction process more transparent and more sustainable”, says project leader Gerold Bausch, Professor of Embedded Systems and Signal Processing. The aim is to optimise the printing process so that materials can be used more efficiently for longer.

1986

Chuck Hull patents the first 3D printer. He refers to the process as “stereolithography”

1950s

The term “advanced materials” emerges in materials science to describe materials with enhanced or novel properties

The 3D-printed steel node holds the structural framework

Even steel components can now be produced in a 3D printer. In the *AGS* project, researchers are studying additively manufactured stainless steels made from steel powder. The aim is to explore new fields of application for this method of producing high-performance steels. “The wider commercial use of metal 3D printing is often held back by a general unfamiliarity with the technology, the limited range of metal powders available on the market and a lack of reliable data on material properties”, says project leader Paul Rosemann, Professor of Materials Engineering at HTWK Leipzig. To overcome these barriers, the team is systematically examining how the properties of additively manufactured steel – such as strength, formability, hardness, toughness and corrosion resistance – can be modified through subsequent heat treatments and tailored to different applications.

The Laser Institute at Mittweida University of Applied Sciences (LHM) has years of experience in laser-based additive manufacturing technologies. Alexander Stahr, Professor of Structural Engineering at HTWK Leipzig, has drawn on this expertise. Together with the LHM, he and his team have developed a method for the cost-effective production of large-format steel components. To achieve this, researchers at the Laser Institute adapted the selective laser melting (SLM) process to enable much coarser steel powders to be melted with higher laser power. Meanwhile, the Leipzig team focused on developing a pre-processing workflow tailored to the new manufacturing method. At the heart of their work was an algorithm capable of automatically generating the geometry of node elements from the geometric parameters of the attached profiles. They also created a special internal support structure based on the geometry of spatially curved continuous surfaces. The patented process is founded on the *AmiCo* principle, previously developed by Prof. Stahr and his FLEX research group. This concept combines additively manufactured, geometrically compact node elements with conventionally produced straight steel profiles to create highly flexible structural frameworks.

Soft medical robots, smart components and new musical instruments

The value of additive manufacturing is especially evident in medicine. A team of researchers led by Fritz Peter Schulze, now Professor Emeritus of

Mechanical Engineering, has spent years developing bone implants produced using 3D printing. In the *SoKoRoMed* project, additive manufacturing is being used to create heart valve models tailored to individual patients. These models allow surgeons to simulate surgical procedures under realistic conditions before operating on a patient. “We’re developing an interdisciplinary demonstrator for transcatheter aortic valve implantation”, says Stephan Schönfelder, Professor of Simulation of Energy and Technical Systems. “This is a minimally invasive procedure for replacing narrowed aortic valves with a biological prosthesis. We’re developing materials tailored to the specific requirements of 3D printing, as well as a digital twin within a fluid-dynamic simulation model, enabling us to address this complex challenge together with our project partners at ICCAS Leipzig”. The project is being carried out in collaboration with the research groups led by Jens Jäkel, Professor of Systems Theory and Mechatronics, and Robert Böhm, Professor of Composite Lightweight Engineering.

Additive manufacturing is also becoming an increasingly important technology for industry. In the *IntelliSeal* project, partners from business and research are developing seals with built-in sensors. This is relevant to many industrial sectors, as seals are critical components in pipeline systems, fluid processing machinery and countless other technical installations. If seals can use printed electronics to issue warning signals as soon as their effectiveness is waning, maintenance can be performed in advance. This helps to conserve resources by enabling repairs to be carried out before components have to be discarded, production processes are interrupted or entire machines break down. “We’re transforming passive components into intelligent systems – turning ‘dumb things’ into ‘smart things’”, says Faouzi Derbel, Professor of Smart Diagnostics and Online Monitoring, who is co-leading the project with Prof. Reinhold.

Christian Döpel examines an accordion bellows to develop alternatives with lighter components

The potential of additive manufacturing even extends to the world of musical instruments. In the *AirAkkoLight* project, researchers are using new materials and 3D printing to create significantly lighter accordions. “We wanted to add a new dimension to the accordion’s nearly 200-year history by systematically applying modern lightweight engineering principles”, explains project leader Johannes Zentner, Professor of Design Engineering. His team’s goal was to significantly reduce the instrument’s weight – without compromising its sound quality or playing feel. With the help of additively manufactured materials, they succeeded in making the instrument’s body lighter while reducing the weight of its treble and bass mechanisms. The redesigned instrument weighs around 15% less than the original model. 3D printing played a key role in this process, allowing complex structures to be produced economically and sustainably. The prototypes were built in collaboration with the Weltmeister Accordion Manufactory. Acoustic testing was conducted at the Institute for Musical Instrument Making in Klingenthal. Blind tests with professional musicians confirmed that the instrument performs well in everyday use. The HTWK team is now helping entrepreneurs who want to manufacture new accordions in Klingenthal. The lightweight accordion is at the centre of these activities.

Prof. Ingo Reinhold working on the digital model in the Voxeljet software

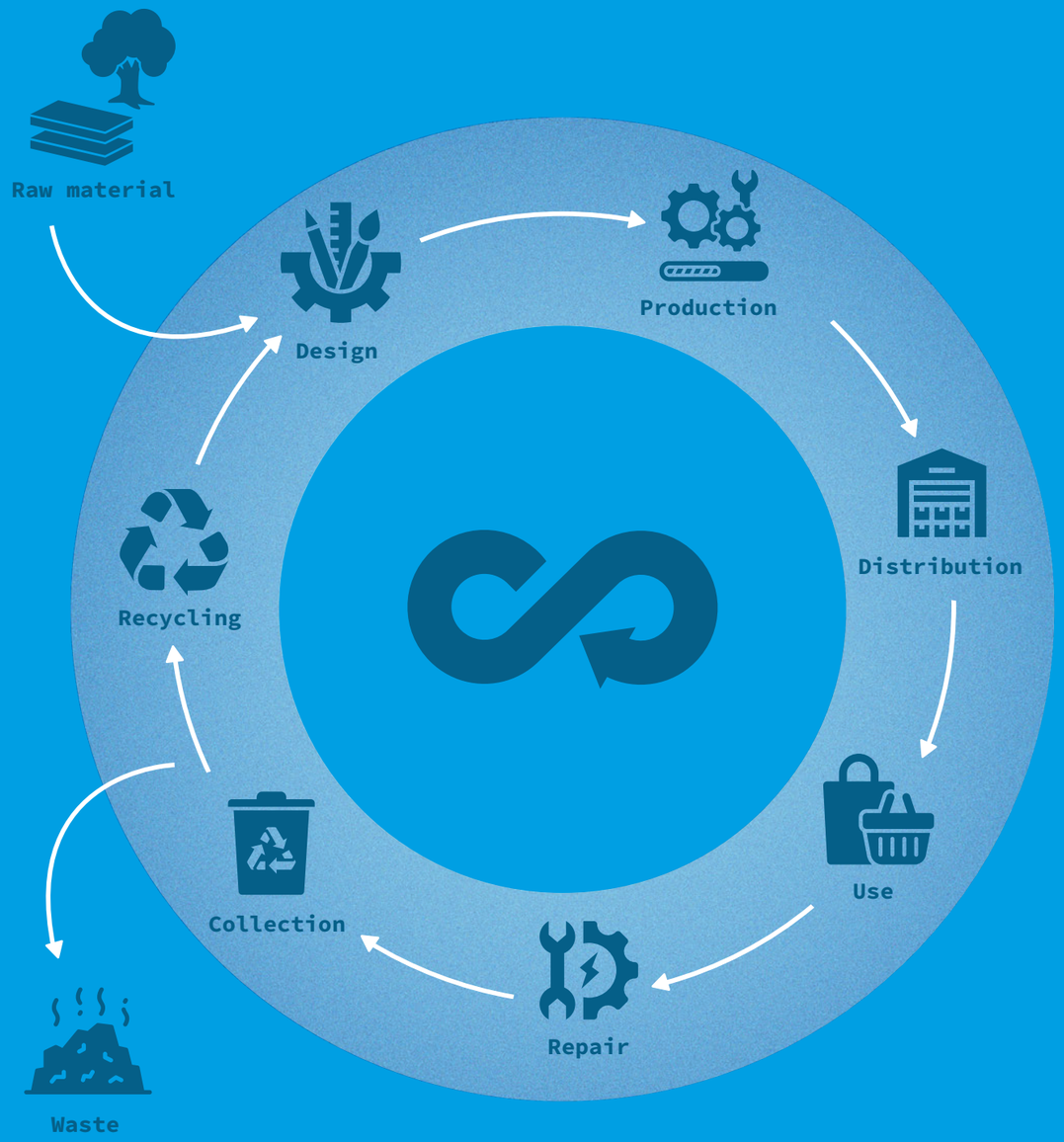
Outlook: From components to systems

These developments make one thing clear: 3D printing is far more than a new manufacturing process. It is fundamentally changing the way materials are used. In the future, components will be designed to perform multiple functions at the same time, such as carrying loads, sensing, storing energy or responding to their environment. Another major benefit is that customised components are becoming more affordable and easier to integrate into industrial value chains. HTWK Leipzig is actively pursuing this vision. The university is expanding its research infrastructure, strengthening interdisciplinary collaboration, establishing new expertise through a Professorship of Generative Manufacturing and even launching a new degree programme. From the coming semester, the first cohort of students will enrol in “3D Printing & Functional Surfaces”, providing a platform for the next generation to help shape this technological revolution. –

3D printing is far more than a new manufacturing process. It is fundamentally changing the way materials are used. In the future, components will be designed to perform multiple functions at the same time

2021

Europe’s first 3D-printed house is built in the Netherlands



Throwing away old habits – reduce, reuse and recycle

Text: Dr Franziska Böhl

As global resource consumption hits record levels, linear economic models are being pushed to their limits. To move away from a throwaway society, more sustainable approaches like the circular economy are being developed. The aim is to reuse and repurpose products and materials in order to conserve resources and reduce waste. Researchers at HTWK Leipzig are also contributing to this effort. Here is an overview of their work.

20

million tonnes of scrap metal are recycled every year by the German steel industry. That's enough metal to build around 25 million cars

Humans are extracting ever larger quantities of resources from nature to produce materials, energy and goods. The severity of this situation is illustrated by "Earth Overshoot Day", which marks the date on which humanity has effectively used up all the natural resources the Earth can regenerate within a year. In the 1970s, this point in time still fell in December; by 2026, it had already been reached on 7 May. This makes it clear that sustainable economic models are no longer optional.

One such holistic approach is the circular economy. The aim is to employ various strategies such as repair, reuse and recycling to ensure that raw materials and products can be used for as long as possible and kept in circulation even after their original use phase. For this kind of system to work, it requires not only political, economic and societal frameworks, but also practical technical solutions. Researchers at HTWK Leipzig are working on sustainable solutions.

Concrete: from downcycling to upcycling

The construction sector produces the largest amount of waste worldwide. In Germany alone, around 220 million tonnes of mineral waste are generated each year. In the past, this waste usually ended up in landfills. A first shift in thinking led to "downcycling", where a high-value product is turned into a lower-value one. Since then, crushed rubble – such as concrete and roof tiles – has mainly been reused in the lower base layers of roads. More recent, sustainable approaches aim to bring these materials back into the construction cycle. Today, construction rubble is increasingly recycled into aggregates and binders that can be used in new concrete.

While this may sound straightforward, it is a highly complex process and has taken a great deal of research and development to turn this vision into reality.

"Before old construction waste can be returned to the material cycle, we need to make sure the demolished material is good enough", says Robert Kraft, research associate at the Institute of Concrete Structures (IfB) at HTWK Leipzig. The problem is that concrete consists of water, sand or other aggregates and cement as a binding agent. When structures are demolished, cement remains stuck to the aggregate grains. If these grains were reused in new concrete, the residual cement would create a structural weak point.

That's why researchers at the IfB have been developing methods that enable concrete debris to be separated into pure material fractions, for example in reinforced concrete. This allows the rubble to be reused in recycled concrete. "Instead of downcycling, we can reuse materials properly and create as much value as possible", says institute director Klaus Holschemacher, Professor of Reinforced Concrete Construction at HTWK Leipzig.

While a shift in thinking about reinforced concrete only began in the 1990s – more than 100 years after its introduction – recycling has always been part of the conversation when it comes to carbon concrete, says Lukas Steffen, who has been involved in several projects developing this composite material. For example, the IfB team has worked on a carbon concrete variant with the same properties as conventional concrete and up to 60% crushed concrete

Reusing construction waste is already standard practice in road building – but there is still room for improvement

The ten stages of the circular economy

Smarter product use and manufacture	**R1 Refuse:**	Make product redundant by abandoning its function or by offering the same function with a different product
	R2 Rethink:	Make product use more intensive (e.g. by sharing products or putting multi-functional products on the market)
	R3 Reduce:	Increase efficiency in product manufacture or use by consuming fewer natural resources and materials
Extended lifespan of products and parts	**R4 Reuse:**	Have another consumer reuse a discarded product that still performs its original function
	R5 Repair:	Repair and maintain a defective product to restore its original function
	R6 Refurbish:	Restore an old product and bring it up to date
	R7 Remanufacture:	Use a discarded product or its parts in a new product with the same function
	R8 Repurpose:	Use a discarded product or its parts in a new product with a different function
Useful application of materials	**R9 Recycle:**	Process materials to obtain the same or lower quality
	R10 Recover:	Incinerate materials to recover energy

Promoting the circular economy

The circular economy ranked from the best-case scenario (prevention) to the worst-case scenario (incineration), based on the classification proposed by José Potting et al.

The "10 Rs" of the circular economy

The circular economy aims to keep products and materials in use for as long as possible while maintaining high quality. This helps to conserve resources and allows natural systems to regenerate instead of being depleted. The guiding principles of the circular economy include different approaches and levels. While some models describe "6 Rs", others refer to "10 Rs". These approaches include designing for circularity, extending product lifespans, and separating biological and technical cycles.

3

trillion trees are on Earth. That's about 422 trees for every person. The number of trees has roughly halved since the start of deforestation

Luisa Sander and Henri von Mulert collect wood samples from a roof rafter for subsequent contaminant analysis

aggregate – a particularly high proportion of processed recycled concrete. "Carbon concrete is synonymous with resource efficiency and climate action in the construction sector. It allows us to produce significantly more durable and slender components with the same performance. At the same time, textile reinforcement enables the use of binders that produce significantly lower emissions during their production", says Steffen.

Very low reuse rate for reclaimed timber

Timber faces similar challenges. Around eight million tonnes of waste wood are generated in Germany every year. Most of it is currently burned to produce energy, while only around 20% is reused as a material, much of it in the particleboard industry. Given the growing interest in circular construction methods and the expansion of timber construction, the question arises as to how used timber components can be returned to the construction cycle in a more valuable way. "At the moment, using fresh timber is cheaper than processing reclaimed wood because contaminants such as wood preservatives and unwanted materials like nails and screws first have to be removed. There's no financial incentive to recycle more", explains Luisa Sander, a research associate in the FLEX research group at HTWK Leipzig. "But we could save costs if recycling logistics were considered from the very beginning. Processes should be interlinked and automated on site or close to construction sites", Sander adds.

2022

The world's first carbon concrete building, "The Cube", is constructed in Dresden

Jesse Ewers (left) and Henri von Mulert measure wooden beams in a roof structure

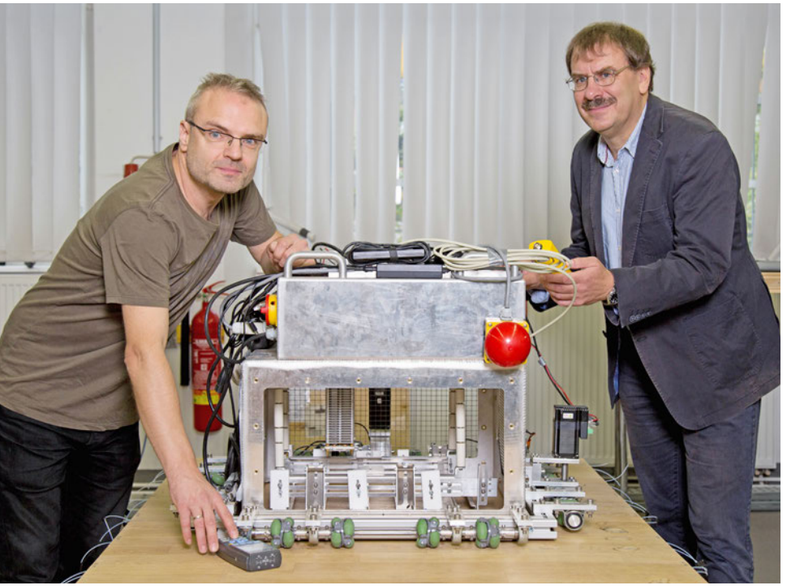
That's exactly why the FLEX team is collaborating with the Technical University of Braunschweig on a joint research project. Together, they are developing digital models to record the quantities of reusable timber recovered from building demolitions, particularly from roof structures and timber beam floors. The researchers are focusing on methods for documenting dimensions, damage characteristics and the potential for high-quality reuse of structural elements. Based on these findings, they are developing logistics concepts for material procurement, sorting and transport. The aim is to create qualitative and quantitative decision-making tools that will support the safe extension of timber material cycles.

Contaminants are one of the biggest challenges when it comes to recycling materials. In the past, roof beams, wooden furniture and cultural artefacts made of wood were often treated with various preservatives to protect them from pests such as insects and fungi or to make them more resistant to weather and fire. What was once regarded as technological progress has since become a problematic legacy; materials containing hazardous substances cannot be recycled and instead have to be discarded or destroyed as costly hazardous waste. Researchers at HTWK Leipzig and the Helmholtz Centre for Environmental Research (UFZ) are working on a more sustainable alternative. To remove environmentally harmful chemicals from wood, they have developed a gentle treatment method based on radio-wave heating. "We're using high-frequency electromagnetic waves as a direct heat source. Unlike methods involving microwaves, this allows slow, controlled and uniform heating, so it isn't just suitable for wood, but for a range of other materials as well", explains Dr Ulf Roland, research associate at HTWK Leipzig and UFZ Leipzig. The heating process allows contaminants to be removed in a controlled way, collected and then rendered harmless, for example through a novel chemical treatment.

The researchers have also developed a piece of technology that uses 3D scanning to digitally estimate how much usable timber is available

This method comes into its own when existing structures are to be preserved. Its greatest potential therefore lies in the refurbishment of buildings and the conservation of art and cultural heritage. The research team is currently developing a process to remove contaminants directly from structures on site.

Textiles are another major source of waste. In Europe, each person generates around 15 kg of textile waste every year. Recycling these materials is highly challenging, particularly because of quality requirements, but above all because it is difficult to separate fibres in blended fabrics. But our researchers are on the case. For example, FiberFlow, a spin-off from HTWK Leipzig, has developed an innovative process for high-quality textile recycling (↗ p. 57).



Radio-wave technology can help to remove contaminants from wood and other materials. Dr Frank Holzer (left) und Dr Ulf Roland demonstrate the process using a prototype in the radio-wave laboratory

Recycling composite materials

Researchers in fields such as lightweight engineering face similar challenges when it comes to recycling. "Separating composite materials is a complex process that requires specialised equipment. And the quality of the separation ultimately determines how well the materials can be reused", explains Robert Böhm, Professor of Composite Lightweight Engineering at HTWK Leipzig. His research group at the Composite Circularity Lab (CCL) is working with fibre-reinforced polymer composites taken from old wind turbine blades. These are made from a combination of different materials that offer specific properties but are difficult to separate once their service life has ended.

By shredding and sorting them, however, the materials can be recycled, reused and repurposed. "Wind turbine blades contain a wide range of high-tech materials. It would be a shame to limit their potential to downcycling, so we're exploring alternative approaches within a circular economy", says Prof. Böhm.

The team is particularly focused on the concepts of reuse and repurpose. "We've collected old wind turbine blades, cut them into suitable segments and used them to build new demonstrators such as floating platforms", explains research group leader Philipp Johst. The researchers are currently assessing whether these concepts could be commercially viable. To do so, they have developed a large-scale demonstrator for floating solar installations, known as floating PV systems, whose floating structures are made from segments of retired wind turbine blades. They are now testing the system under real-world conditions and conducting a market study.

The research group is also working with industry partners to develop a mobile scanning and processing unit. The system is designed to record the condition of wind turbine blades directly on site, check them for damage and cut the material into suitable sections, creating standardised components for new products. Much like with reclaimed timber, however, logistics pose a challenge here as well, as transporting blades from wind farms to processing facilities is highly expensive.

1990

The "Green Dot" is first used on packaging in Germany. The symbol is hardly used anymore

Dimitrij Seibert (left) and Jan Bürgener test a floating photovoltaic system on a lake in Leipzig, mounted on old wind turbine blades

Next goal: series production

"If we want the circular economy to succeed in the long run, we need viable options for series production", adds Prof. Böhm. The validation project involving the floating PV demonstrators is intended to create exactly that foundation. It could pave the way for a start-up specialising in the manufacture and distribution of products made from materials recovered from wind turbine blades.

These research projects support resource conservation through a variety of approaches aligned with the circular economy. If vast quantities of waste and recovered raw materials can be reused and repurposed through effective quality assurance measures, Earth Overshoot Day may gradually shift back towards the end of the year – the benchmark for genuine sustainability. —

"Wind turbine blades contain a wide range of high-tech materials. It would be a shame to limit their potential to downcycling, so we're exploring alternative approaches within a circular economy"

Robert Böhm, Professor of Composite Lightweight Engineering at HTWK Leipzig

Prevention as a means of conservation

In a circular economy, materials and products should be used for as long as possible. In the resource-intensive construction sector, measures such as corrosion protection and monitoring can help to extend the service life of buildings. These topics have also been addressed by research projects at HTWK Leipzig.

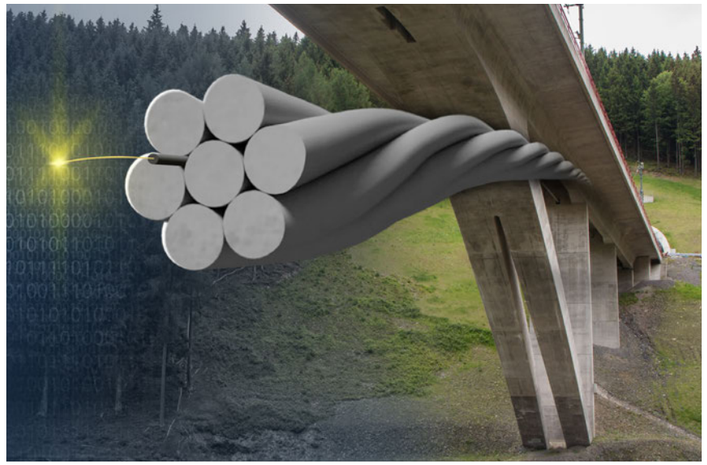
Structures such as bridges are usually built to last around 80 to 100 years. Regular visual inspections can help to identify and repair any obvious defects. More extensive maintenance work is required at longer intervals, for example when road surfaces need to be renewed. However, a structure's service life can also be extended by using high-quality materials from the outset, ensuring that loads match the intended use, and improving maintenance practices.

Corrosion protection

Cracks can significantly shorten the lifespan of buildings. They allow water and pollutants to penetrate the structure, which can lead to corrosion of the steel reinforcement inside. Repairs are complex and expensive. This is a particularly critical situation for concrete floor slabs that lie directly on the ground. As concrete cures and cools, it shrinks. And because this deformation is restrained by friction with the subsoil, internal stresses build up and often lead to cracks. In practice, concrete manufacturers tend to use more reinforcement steel than structurally necessary in order to absorb these stresses. As part of the *SlideTex* project, funded by the Federal Ministry for Economic Affairs and Energy (BMWE), researchers at HTWK Leipzig are working with partners on a textile-based sliding layer to address this issue. The layer is placed between the subsoil and the concrete slab and significantly reduces friction. This allows the slab to deform more freely, reduces internal stresses and helps to prevent crack formation. Another benefit is that lower stress levels allow for a reduction in the amount of reinforcement steel needed. This helps to save resources, lower costs and reduce greenhouse gas emissions. The researchers will continue testing the system on large floor slabs under real-world conditions until summer 2026. "We want to study its behaviour in authentic construction environments", says Florian Junker from the Institute of Concrete Structures (IfB) at HTWK Leipzig. If the tests are successful, the system would move one step closer to widespread use. However, further research is still required, particularly regarding the long-term stability and recyclability of the textile materials.

Continuous monitoring

Targeted monitoring enables damaged structural components to be detected at an early stage and repairs to be carried out in good time. In line with this principle, IfB researchers are currently involved in the *pHalcon* project with the aim of developing a minimally invasive measurement system to assess the extent to which concrete reinforcement is susceptible to corrosion. The system measures pH value, chloride content, temperature and humidity. "Using this corrosion indicator, we can estimate whether the non-visible internal reinforcement is corroding and whether any maintenance is needed to keep the structures in use for as long as possible", explains Dr Martin Weisbrich. He heads the Sensor Technology and Monitoring research group, which develops integrated solutions designed to monitor the condition of structures, components and building materials – with a particular focus on measurement challenges in cement-based materials. This monitoring enables even the smallest defects to be detected at an early stage and maintenance to be carried out based on actual needs rather than fixed schedules.



Integrating sensors into prestressing tendons can help to monitor prestressed concrete bridges

This form of early and needs-based maintenance is also being investigated by Volker Slowik, Professor of Structural Mechanics at HTWK Leipzig. As part of the *smart_tendon* project, funded by the Federal Ministry of Transport (BMV), he and his team studied prestressed concrete bridges, with a particular emphasis on how to extend their service life. In prestressed concrete bridges, concrete is compressed using tensioned steel tendons, which helps to reduce cracking. To ensure the safety of prestressed concrete structures, they are monitored through regular visual inspections and measurement technology. If spatially distributed strain sensors were installed on the tendons, as explored in the project, data on the condition of prestressed concrete bridges could be collected over their entire lifespan. "This would allow us to detect potential damage at an early stage and plan maintenance measures more efficiently, keeping bridges in use for longer", says Prof. Slowik.

Extending the lifespan of complex structures

At the same time, researchers at the Institute for Structural Analysis, Structural Dynamics, System Identification and Simulation (I4S) are drawing on concepts of structural health monitoring to extend the lifespan of complex structural systems under the guidance of Armin Lenzen, Professor of Structural Mechanics at HTWK Leipzig. As part of the DFG-funded Priority Programme *Hundert Plus*, which is now in its second phase after launching in 2017, he and his team have developed a method for automatically detecting structural changes and identifying early signs of damage in buildings and infrastructure. The system automatically generates digital models based on measured data. When combined with sensors installed on structures, it allows local, global and continuous monitoring of buildings and bridges. If measurements reach critical levels, targeted on-site inspections can verify whether components are actually damaged and what measures are needed. The method has been successfully tested on two large-scale structures, one of which was a 400-metre-long bridge in operation. The researchers were able to clearly localise structural changes. These findings could help to better analyse the condition of bridges and predict their service life, while also helping to plan maintenance and repair measures with greater efficiency in line with actual needs. — *frb*

↗ doi:10.1016/j.engstruct.2025.121626

Research Perspectives

The “Research Perspectives” photo competition provides a platform for scientists at HTWK Leipzig to share an inside look into their research activities. Here are the award-winning entries from 2025.

First place in 2025 went to the photograph “Straw Test Specimens”. It shows Robin Berg, a research associate at HTWK Leipzig’s Research and Transfer Centre (FTZ), filling straw into a mould. He then compresses the material and heats it together with the mould. Once removed from the mould, the result is a dimensionally stable straw prism. This work is part of the *RadioWaveSaxony* research project, which is exploring new ways of producing construction panels from compressed straw – without binders – using radio-wave technology. The ultimate goal is to save energy and resources. The picture was taken by Alexander Oschim from the Faculty of Civil Engineering, who is also involved in the project. The research team is aiming to optimise the production of plant-based building panels, such as those made from straw, for use in interior construction. They are also investigating the further potential of panels that are held together solely by their natural lignin content.

↓ Straw Test Specimens – Robin Berg and Alexander Oschim

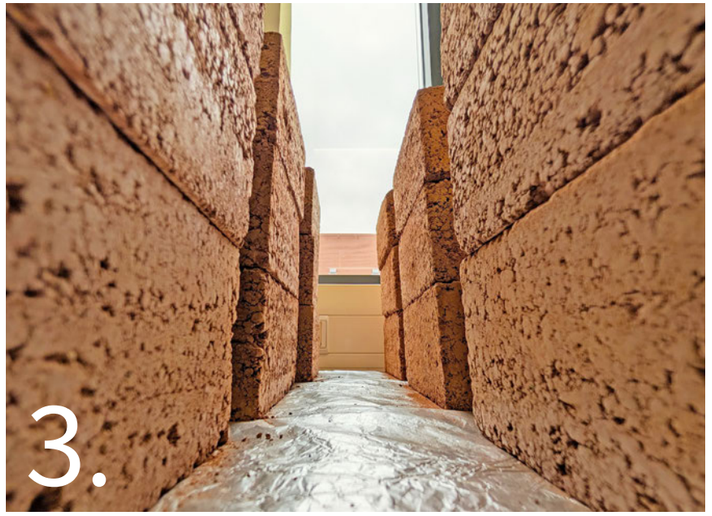
Among Everyday People: Cultural Research in Höxter – Anne Rauchbach

This is the moment where research and its subject became one. As a research associate in the *KulTRes* project, Anne Rauchbach is studying the impact of art and culture as a factor of transformation and resilience in rural areas such as the district of Höxter in North Rhine-Westphalia. The open-air exhibition “Everyday People” on the banks of the Weser presents life-sized sculptures of ordinary people in contemplative poses. She is using participant observation – even hiding among the sculpted figures – to explore the unique characteristics of cultural initiatives in rural communities. “The visual dialogue that emerges from sitting among the sculptures reflects the idea that research is not only about observing from a distance, but also about immersion and interaction. The combination of historic urban space, natural landscape and contemporary art creates a unique dynamic that mirrors our interest in processes of cultural identity formation in rural areas”, says Rauchbach. Bathed in the golden evening light, overlooking the Weser Bridge, the interplay of art, nature and research becomes particularly apparent.

Research Perspectives

Since 2015, all researchers at HTWK Leipzig have been invited to submit an outstanding photograph from their daily work to the “Research Perspectives” photo competition. This year’s jury consisted of HTWK communications specialists Katrin Haase, Dr Franziska Böhl and Franka Platz, as well as HTWK photographer Saskia Pramor and external photographer Swen Reichhold. There were four winning images in 2025. Each submission is judged on a range of factors such as photographic quality, creativity, uniqueness and composition. This time around, two images tied for third place.

This photograph shows a stack of adobe bricks that serve as test specimens for detecting salts and moisture using impulse radar measurements. As a member of the *GreenInnoSax* junior research group, Alexander Oschim is involved in the non-destructive testing of existing buildings using impulse radar technology, also known as ground-penetrating radar (GPR). He is investigating how harmful salt contamination in mineral building elements can be detected without damaging the structure. As part of this research, he produced various test specimens, including these adobe bricks, which are contaminated with different types and concentrations of salts that are harmful to buildings. The aim is to develop a fast and non-destructive method for identifying areas affected by salts and moisture in masonry, earthen structures and reinforced concrete. This could provide an alternative to more destructive and time-consuming methods that require material samples to be removed and analysed in the laboratory. It could also enable more comprehensive and large-scale assessments – especially in the renovation of existing buildings. At present, only selected samples are taken for laboratory testing.



Adobe Bricks as Test Specimens – Alexander Oschim

Research at a Greened Bus Shelter: Small Box, Big Impact – Ludwig Ostertag and Stefanie Penzel

In the *FaGULab* project, schoolchildren and researchers are investigating the impact of green bus shelters on the local microclimate and biodiversity in Leipzig. The photograph shows a self-developed sensor box capable of measuring temperature, humidity, air quality and solar radiation. The compact device, featuring a 3D-printed housing, was specifically designed for use in school projects at bus shelters. It actively encourages young people to get involved in environmental research. The image shows research associate Stefanie Penzel and student assistant Philipp Lorenz at the "HTWK Leipzig" bus stop.

Learn more:
↗ **htwk-leipzig.de/researchperspectives**

SieWo supports women affected by violence in finding a new home. The project is supported by research activities at HTWK Leipzig, including qualitative interviews prepared by Dr Friederike Frieler (left) and Selma Matzberger

Escaping violence

Around one in three women in Europe will experience domestic violence at least once in her lifetime. Many seek refuge in women's shelters, but places are limited and intended only as temporary accommodation. To help women – and often their children – to start a safe new chapter in their own homes after leaving a shelter, researchers at HTWK Leipzig have teamed up with practitioners to launch a model project called She Lives Free from Violence (*SieWo*). Since January 2025, the initiative has been funded by the Saxon Ministry of Social Affairs and the European Social Fund.

Together with the Leipzig-based association Zusammen and its housing support office (Kontaktstelle Wohnen), a team of researchers at HTWK Leipzig led by Rüdiger Wink, Professor of Economics, have set up a housing placement service to connect affected women with landlords and help them find suitable apartments.

The demand is high. Many women affected by domestic violence struggle to find affordable accommodation, which means places in women's shelters remain occupied for extensive periods. To combat this shortage, *SieWo* actively acquires housing from private and commercial landlords, supports landlords with organisational matters and helps women transition into stable tenancy arrangements. The project recently celebrated a significant milestone by signing a cooperation agreement with Leipziger Wohnungs- und Baugesellschaft (LWB), the city's largest municipal housing provider, which has since made selected apartments available to the initiative.

And the approach is working. More than 60 women have registered with the project so far, and several families have successfully moved into new homes. Additional encouragement came in November, when the project received the "SINN Innovation Prize", recognising innovative projects with a strong social impact. This has strengthened efforts to continue the initiative beyond its current funding period, which runs until mid-2026.

"Every form of support is important because having a safe home of your own is essential for building an independent life", says Dr Friederike Frieler, research associate at HTWK Leipzig. "That's why we want to secure follow-up funding and, above all, additional housing. Every single apartment helps to ease the pressure on Leipzig's support system and creates space for a new life free from violence". — *frb*

Doctoral Thesis Award 2025

Which heating system is the best fit?

Dr Tom Radisch, winner of the Doctoral Thesis Award 2025, has applied the method of multi-criteria decision analysis to the comparison of different types of heating systems

Just over twenty years ago, selecting a heating system for a building was usually straightforward: oil or gas. Today, planners can select from a much broader range of options – many of them based on renewable energy – including heat pumps, pellet heating systems, solar thermal systems and district heating. Since a heating system is a long-term investment that often remains in place for decades, the decision needs to be made early in the planning process. Subsequent changes are generally complex and costly. But how can planners determine which system is the best fit for a particular building?

Dr Tom Radisch answered this question in his doctoral thesis, where he conducted a comparative evaluation of heating system options during early planning phases. He completed his thesis at HTWK Leipzig in cooperation with the Technical University of Dresden, earning the distinction summa cum laude. In recognition of his work, the HTWK Foundation presented him with the Doctoral Thesis Award 2025. His supervisors were Ulrich Möller, now emeritus Professor of Building Physics and Building Construction at HTWK Leipzig, and John Grunewald, Professor of Building Physics at TU Dresden.

“When selecting a heating system, clients are increasingly splitting their focus between costs and factors such as supply reliability, sustainability and user comfort, all of which need to be balanced”, explains Dr Radisch. That’s exactly what his multi-criteria decision-making tool seeks to address. The approach breaks down the complexity of different options and influencing factors, providing a reliable basis for informed decisions.

Heating systems should ideally be selected as early as possible to reduce planning effort and costs. In a case study, Dr Radisch compared six possible heating systems for an apartment building and demonstrated how building and system simulations could be used to identify the most suitable option at an early stage.

Since completing his doctorate, he has been applying his research findings in his work at an engineering office. He remains connected to HTWK Leipzig as a research associate at the Chair of Building Energy Technology, headed by Gero Guzek, where he continues to investigate how buildings can be equipped with the most suitable heating technologies. — *frb*

Doctoral Thesis Award 2026

Strengthening organisational resilience

Dr Ann-Kathrin Dieterle won the Doctoral Thesis Award 2026 for her work exploring how partnerships can make companies more resilient in times of crisis

In today’s world, businesses face major challenges from a range of spheres, including global conflicts, pandemics, rapid technological advances and other significant events. To deal with such unexpected developments, organisations must be able to adapt as quickly as possible to new circumstances. This ability is known as organisational resilience. In her doctoral thesis, Dr Ann-Kathrin Dieterle showed that cooperation across organisational boundaries can help to strengthen this resilience. In recognition of her outstanding research, the HTWK Foundation presented her with the Doctoral Thesis Award 2026.

Dr Dieterle completed her thesis at the Brandenburg University of Technology Cottbus-Senftenberg in cooperation with HTWK Leipzig under the supervision of Rüdiger Wink, Professor of Economics at HTWK Leipzig. She earned the distinction summa cum laude. Her groundbreaking work brought together insights from organisational studies, supply chain research and regional economics. She also examined how companies cooperate in response to both short-term and long-term crises and conducted case studies in established firms.

Cooperation between companies, start-ups and research institutions is already common practice for developing innovations and exchanging knowledge. But can these partnerships also make organisations more resilient and, if so, how should they be structured? “My analysis shows that short-term, flexible collaborations can help organisations respond to acute crises, while long-term cooperations provide the foundation for sustainable adaptation”, says Dr Dieterle. Organisations that combine a range of innovation strategies and make use of both internal initiatives and external partnerships are particularly well prepared for future challenges. And the relationship quality makes all the difference – trust, mutual respect and a willingness to learn from one another are key sources for success.

“I would advise companies to actively build partnerships, share resources and expertise, and jointly shape innovation processes”, says Dr Dieterle. One practical approach would be to use innovation scouts to identify suitable external partners. Her findings are especially relevant for industries currently undergoing major transformation, including the energy sector, automotive industry, healthcare and construction. — *frb*

“The right to award doctorates is a logical step”

While almost all German federal states already grant universities of applied sciences the right to independently award doctoral degrees – or are in the process of amending their higher education laws to enable this – Saxony remains an exception. As a result, it risks falling behind in the nationwide competition for innovation, research funding and skilled professionals. We sat down with Karim Khakzar, President of Fulda University of Applied Sciences, and Faouzi Derbel, Vice-Rector for Research and Academic Director of the Graduate Centre at HTWK Leipzig, to talk about current opportunities, shortcomings and the need for political action.

Prof. Dr.-Ing. Faouzi Derbel
(*1970) has been Vice-Rector for Research and Sustainability at HTWK Leipzig since 2023. He also serves as Academic Director of the Graduate Centre. He was appointed Professor of Smart Diagnostics and Online Monitoring at HTWK Leipzig in 2013. Before that, he spent many years as Vice Dean for Research within his faculty and previously worked in industry, including as Head of Development and Head of Product Innovation at Siemens Building Technologies.

Prof. Dr.-Ing. Karim Khakzar
(*1960) has been President of Fulda University of Applied Sciences since 2008. After earning his doctorate and gaining industry experience at Alcatel, he was appointed Professor of Applied Computer Science in Fulda in 1996. He later held positions as Dean and Vice President. Khakzar has been actively involved in higher education policy, serving for many years as Vice President of the German Rectors’ Conference. There, he represented universities of applied sciences and advised several federal states on matters relating to doctoral awarding powers. In 2018, he was named “Higher Education Manager of the Year”.

Doctoral awarding powers
They give a higher education institution the authority to confer doctoral degrees. This was a right traditionally reserved for traditional universities. Today, universities of applied sciences in almost all federal states also have the right to award doctorates independently. The different models established for this purpose are enshrined in the higher education laws of the respective states.

What are universities of applied sciences, and what role do they play in today’s research, development and transfer landscape?

Faouzi Derbel: Universities of applied sciences were founded in West Germany in the late 1960s – with a clear focus on teaching and study programmes. This focus has gradually shifted over time, with greater emphasis now placed on research and the training of junior researchers, much like the established practices of traditional universities. This development is also reflected in the naming of such institutions; the term “polytechnic” has been replaced by “university of applied sciences”. Today, most universities of applied sciences are heavily involved in research and development. For this reason, the right to award doctorates independently is a logical step and by no means an unreasonable demand.

Karim Khakzar: Research and knowledge transfer now stand alongside teaching as core responsibilities of universities of applied sciences, as enshrined in the higher education laws of all 16 federal states. Thanks to their practical orientation and strong regional networks, they play an important role – particularly in cooperation with small and medium-sized enterprises. Newly appointed professors are usually required to demonstrate experience in research, teaching and practice. This makes them particularly well suited for applied research and knowledge transfer.

Prof. Khakzar, it was under your leadership in October 2016 that Fulda University of Applied Sciences became the first institution of its kind in Germany to obtain independent awarding powers for doctoral degrees in selected research-intensive fields. How did this come about?

Khakzar: During the 2013 state elections in Hesse, we managed to convince policymakers that supporting the further academic development of our research staff – and providing the legal framework to do so – was essential for successful research at universities of applied sciences. The opportunity to pursue a doctorate is a key motivation for many of our researchers. At the time, doctoral projects carried out in cooperation with traditional universities often faced recurring problems that couldn’t be resolved. The Hessian state government – a coalition of the CDU and Alliance 90/The Greens – agreed to launch a temporary pilot scheme and subsequently amended the Hessian Higher Education Act at the end of 2015. This allowed universities of applied sciences in Hesse to apply for independent awarding powers for doctoral degrees in fields with proven research strength. From the very beginning, maintaining the highest quality standards for doctoral education was a priority. We based our procedures on national and European quality assurance frameworks. Five years later, an evaluation conducted by a distinguished panel of experts found that universities of applied sciences in Hesse were running doctoral programmes at a very high level. Following this positive assessment, the ministry made the temporary awarding powers permanent.

What has changed for your university as a result? What measurable effects have you observed?

Khakzar: Research has become much more important and visible at our university. We now have around 200 doctoral candidates each year working on specific research questions. This has also increased our chances of securing third-party research funding, which has more than tripled in recent years. The change has also made our professorships more attractive. The right to award doctorates has come up in almost every faculty recruitment interview. However, we will gradually lose this clear competitive advantage over other federal states, as almost all of them – except Saxony – have either already adopted the Hessian model or are in the process of doing so.

As a member of several expert commissions, Prof. Karim Khakzar has advised a number of federal states on doctoral awarding powers

That being said, there are still reservations about granting independent awarding powers to universities of applied sciences…

Derbel: There was a time when traditional universities only awarded doctoral degrees in medicine, law, theology and philosophy. When Germany's newly established technical universities gained the right to confer doctorates more than 120 years ago, it followed a difficult social and cultural struggle for recognition. It's interesting to note that the reservations expressed by traditional universities back then closely resemble those voiced today with respect to universities of applied sciences. Just as the debate over the Dr.-Ing. degree has long since been settled, a similar development has taken place regarding doctoral awarding powers for universities of applied sciences. The fact that 15 of the 16 federal states have introduced – or are about to introduce – independent doctoral awarding powers shows that this development can no longer be reversed. History is repeating itself.

Khakzar: At the time, there was fierce resistance from traditional universities in Hesse because they feared losing one of their last remaining privileges over universities of applied sciences. However, the arguments put forward were not particularly convincing. Today, independent doctoral awarding powers for universities of applied sciences are no longer questioned within the higher education community. It has become an established part of the system, and there are even calls for traditional universities to adopt comparable standards and quality assurance mechanisms.

Traditional universities often argue that granting independent awarding powers to universities of applied sciences could devalue the doctoral degree. How is quality ensured?

Derbel: A doctorate must meet the same quality standards regardless of where it is completed. The high standard of doctoral projects supervised at our institution is reflected by a number of things, such as the fact that the overwhelming majority of our doctoral candidates graduate with the highest possible honours. And it should be noted that these distinctions are actually awarded by traditional universities as part of cooperative doctoral programmes.

Khakzar: The federal states have adopted different models, but all of them include binding quality standards. In Hesse, doctoral awarding powers are exercised through doctoral centres dedicated to specific disciplines. These centres consist of at least twelve professors with a strong research profile who must demonstrate their qualifications through criteria such as publications and third-party funding. Different people are responsible for supervision and evaluation, as is standard international practice. In many respects, this quality assurance system is more rigorous than those found at many traditional universities.

What is the situation at HTWK Leipzig? How are doctoral studies organised there?

Derbel: HTWK Leipzig supervises 90 to 100 doctoral projects each year. These programmes are conducted in cooperation with traditional universities throughout Germany. To pursue a doctorate, candidates must first be accepted by a traditional university. There are no uniform rules for this process; each university faculty sets its own requirements in its doctoral regulations. Although some progress has been made in recent years, unexpected hurdles still arise. Even the co-optation model recently discussed in Saxony doesn't really solve these issues. For cooperative doctorates to run smoothly, we still rely heavily on personal networks and on traditional universities being willing to cooperate. Doctoral candidates are supported by our Graduate Centre (GradZ), which offers advice, networking opportunities and professional development programmes. When GradZ was founded at HTWK Leipzig ten years ago, we were already leading the way among universities of applied sciences in providing structured support for doctoral candidates. Our CompeTE+ qualification programme has even been around for longer – it was set up fifteen years ago – and has become a key pillar of interdisciplinary doctoral training. We wanted to show that we were ready for independent doctoral awarding powers by putting appropriate structures in place. That remains true today. We have the structures, the quality standards and, of course, researchers working on ambitious and diverse topics. What is still missing, however, is the political framework.

Prof. Faouzi Derbel advocates for independent doctoral awarding powers for universities of applied sciences in Saxony

What impact does the lack of doctoral awarding powers in Saxony have?

Derbel: The effects are wide-ranging. One major issue is faculty recruitment. Many professors want the opportunity to supervise doctoral projects independently – especially now that this has become standard practice in almost all federal states. This places us at a significant competitive disadvantage. The same applies to prospective doctoral candidates. As they can only pursue a doctorate in cooperation with a traditional university, they are often forced to travel longer distances and face additional hurdles in terms of administration, financing and scheduling. It is also worth noting that some university doctoral regulations still do not fully recognise degrees from universities of applied sciences as being formally equivalent to those awarded by traditional universities – even if they are completed at the same academic level. We also face disadvantages when competing for research funding. This is particularly true for prestigious programmes such as DFG Research Training Groups – we can't apply for them without independent doctoral awarding powers. This means that we

are missing out on important development opportunities and substantial research funding. Overall, the absence of doctoral awarding powers reduces Saxony's appeal as a research and innovation location. In the medium to long term, we risk losing ground in the nationwide competition for talented researchers and external funding. And once that gap has opened, it can be very difficult to close.

Khakzar: After working in the German Rectors' Conference for a number of years, I can say that universities of applied sciences play a crucial role in strengthening regional economies through their practical orientation and close ties to small and medium-sized enterprises. Innovation needs to reach businesses throughout the country, and universities of applied sciences are essential in making that happen. If you weaken universities of applied sciences, you ultimately also weaken the backbone of the local economy. And that simply cannot be the goal of political decision-makers.

What specific changes would you like to see in Saxony?

Derbel: If Saxony wants high-performing universities of applied sciences with strong research profiles, it needs to provide them with opportunities for development. And the fact that we don't have independent doctoral awarding powers sends the wrong message. While all other federal states are actively modernising their higher education systems and making them more competitive, Saxony is holding on to a structure that no longer reflects today's reality. I would therefore like to see the next amendment to the Higher Education Act allow doctoral awarding powers to be granted to doctoral centres or faculties with proven research strength. The Hessian model, which has now been in place for ten years, could serve as a blueprint.

What are the current developments in the German higher education system, and what would you like to see happen next? What is the future model for universities of applied science?

Khakzar: We urgently need the federal and state governments to provide much more research funding for universities of applied sciences. While traditional universities receive roughly four billion euros in annual funding through the DFG alone, the funding programmes available to universities of applied sciences are severely underfunded. In fact, only about 1% of DFG funding goes to universities of applied sciences. This in no way reflects their true potential. For years, universities of applied sciences have been calling for dedicated funding programmes for applied research and knowledge transfer. We hope to see the establishment of a German Applied Research Foundation (DAFG), as well as so-called "transfer boosters". Both initiatives are intended primarily to benefit universities of applied sciences.

Derbel: I fully agree. Over the past 20 years, universities of applied sciences have evolved into a real success story and are now an integral part of Germany's higher education system. But I would still like to see much stronger political recognition and support – at federal and state level – for our achievements in the fields of applied research and knowledge transfer.

Thank you for talking to us.
Interview conducted by Katrin Haase.

GradZ

Since 2016, the Graduate Centre (GradZ) at HTWK Leipzig has served as the university's central support and coordination hub for junior researchers. It was one of the first graduate centres of its kind to be founded at a university of applied sciences. GradZ provides comprehensive support for doctoral candidates – from advice and funding opportunities to interdisciplinary training and networking. In doing so, it enhances the quality of cooperative doctoral programmes while supporting career paths in academia, government and busines.

↗gradz.htwk-leipzig.de

Knowledge without barriers

Handbook for designing workflow models and toolkit for modelling communication and data flows

Knowledge is the only asset that multiplies when it is shared. This quote is often attributed to Marie von Ebner-Eschenbach – and it remains just as relevant today. In an interconnected world, it seems only natural that people everywhere can access knowledge and reap its benefits. This principle was formally defined in the Budapest Open Access Initiative. As a result, university presses and libraries are increasingly providing services for open-access publishing.

To optimise the complex workflows involved – from manuscript submission to the final digital or printed publication – and to analyse the necessary infrastructures, HTWK Leipzig collaborated with Potsdam University Press on the project *Workflow Management Systems for Open Access University Presses*. The joint initiative received two years of funding from the Federal Ministry of Research, Technology and Space (BMFTR), ending last year.

The project explored how universities and libraries can produce open-access publications more efficiently. "We want to make research literature freely accessible and streamline the process of turning scholarly manuscripts into multi-channel publications", explains project leader Michael Reiche, Professor of Media Prepress Process Engineering at HTWK Leipzig.

Research into open access at HTWK Leipzig began around eight years ago. Earlier projects resulted in a handbook for designing workflow models and a toolkit for modelling communication and data flows. These resources are freely available to all institutions. Most recently, the research team analysed the current requirements for software solutions used by university presses and libraries. Their key finding was that connecting existing partial tools through solutions like middleware is more effective than developing entirely new monolithic systems. As part of the project, a middleware prototype was developed that could serve as a blueprint for future implementation.

↗**doi.org/10.25932/publishup-69356**

Open access at HTWK Leipzig

The university library offers a wide range of services to support open-access publishing and provides personal advice to members of HTWK Leipzig. In addition, students enrolled in "Book and Media Production" run an open access publishing project in which outstanding dissertations and theses are published as printed books and freely accessible digital editions.

Career paths

There are many reasons why people pursue a doctorate at HTWK Leipzig – and just as many career opportunities afterwards. Four doctoral graduates share their stories.

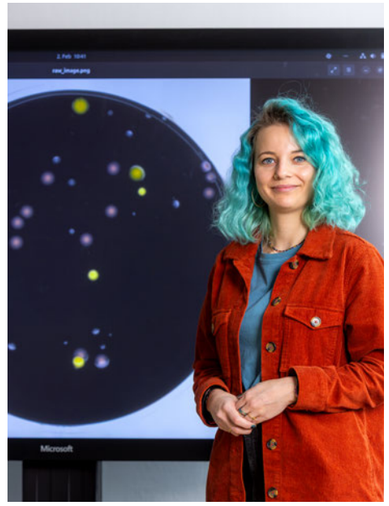
Dr André Valdestilhas

Connecting data, structuring knowledge and broadening horizons – that's what drives Dr André Valdestilhas. Raised in Santo André, Brazil, he developed an early interest in technology. After obtaining a bachelor's degree in computer science from the University of São Paulo, he spent ten years working as a software engineer before curiosity drew him back to academia. After completing his master's degree and publishing his first academic papers, he came to Leipzig University on a doctoral scholarship. When his supervisor passed away unexpectedly, Prof. Thomas Riechert from HTWK Leipzig stepped in. "It was a perfect match, both academically and personally", Dr Valdestilhas recalls. For his doctoral research, he connected all openly available linked datasets on the internet, laying an important foundation for the Semantic Web. After successfully defending his dissertation in 2021, he moved to Berlin to join the Federal Institute for Materials Research and Testing, where he helped to standardise numerical data from concrete testing. He also launched an international conference that brought together researchers from materials science and the Semantic Web community. Most recently, the 46-year-old held a post-doctoral position at the Vrije Universiteit Amsterdam. Looking ahead, he hopes to obtain a professorship and set up a new Semantic Web conference dedicated to the social sciences and humanities. — *kh*

Dr Ulrike Leistner

For Dr Ulrike Leistner, health is more than just a private matter. It is also a key responsibility of local governments. The 43-year-old works at the coordination office for municipal health within the Leipzig Public Health Department, where she connects municipal offices, health insurance providers and local stakeholders to promote healthy living conditions in the city's districts. The coordination office – founded in 2015 as the first of its kind in Germany – stems from her research at HTWK Leipzig, where she helped to develop the concept as a research associate in the Social Affairs and Health group. Her path into social work began with a vocational qualification in social studies, followed by a degree programme at HTWK Leipzig. She completed her doctorate in 2017 after five years of research conducted in cooperation with the Technical University of Dresden – all while raising her first child as a single mother. Her research into the comprehensibility of Jobcenter correspondence showed that even professionals often struggle to understand official notices. Bureaucratic language, poor accessibility and weakened trust all contribute to misunderstandings. Today, Leistner streamlines administrative processes for the City of Leipzig and advises districts on public health projects. "Sometimes I miss teaching", she says. "I wouldn't rule out returning to the university in the future". — *kh*

Dr Bianca Reichard



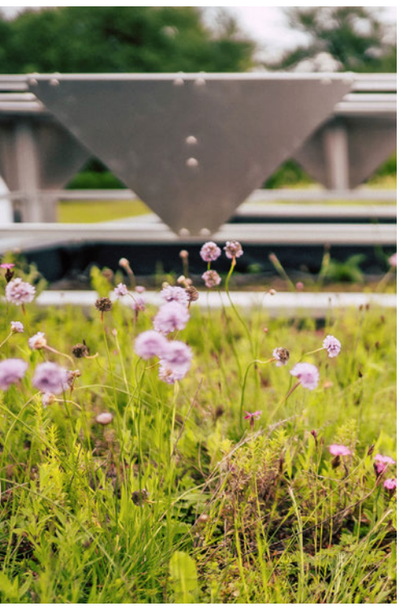
Holding firm in male-dominated fields has been a constant theme throughout Dr Bianca Reichard's career. Born in Eichstätt in Upper Bavaria, the daughter of an electronics technician came into contact with cables and soldering irons at an early age. After secondary school, she trained as a mechatronics technician at Audi, where she later assembled centre consoles on the production line. A trainer once told her she belonged "in the kitchen". Instead, she decided to complete her university entrance qualification and look for suitable study programmes. "As a Goethe fan, I chose Leipzig, even though I'd never been there before", she recalls. At HTWK Leipzig, she studied Electrical Engineering and once again faced prejudice. "Despite good grades, I often felt underestimated or not taken seriously", says the now 35-year-old. During an internship at the Laboratory for Biosignal Processing at HTWK Leipzig, she developed a strong interest in image processing and found a mentor in Prof. Matthias Sturm, who recognised her talent. Together with Prof. Gerold Bausch and her medical supervisor Dr Kerstin Bode at the Leipzig Heart Centre, she began her doctoral research in 2019, focusing on pain recognition. A camera records patients' facial expressions, while algorithms detect patterns indicating pain. "This is especially helpful for people who cannot express themselves, such as newborns or patients with dementia", she explains. She completed her doctorate in 2024, earning the distinction magna cum laude. She now works as a research associate at the Institute for Applied Informatics associated to Leipzig University, where she develops image-based algorithms to detect Legionella bacteria in drinking water samples. — *kh*

Dr Markus Gentzsch

Born in Zeitz, Dr Markus Gentzsch graduated at the top of his secondary school class, opening up a wide range of career opportunities. He initially chose to study Business Mathematics at Leipzig University but soon switched to Law. "Law offers a platform to continuously renegotiate societal conflicts", he says. After completing his legal traineeship and second state examination, he began a doctoral project in 2017 as part of a cooperation between Leipzig University and HTWK Leipzig. At HTWK Leipzig, he worked as a research associate on Legal Issues Concerning the Legitimation of Central Banks, a project led by Prof. Cornelia Manger-Nestler. He defended his thesis on supervisory decisions of the European Central Bank in 2023, earning the distinction summa cum laude, and was honoured with the Doctoral Thesis Award from the Faculty of Law at Leipzig University. Since 2021, the 35-year-old has been working for the Federal Ministry of Finance in Berlin. At his own request, he is currently seconded to the Federal Constitutional Court in Karlsruhe. There, he supports one of the judges by preparing legal recommendations and assessments. His demanding schedule leaves little time for former hobbies such as writing short crime stories. He lives in Karlsruhe during the week but returns to Berlin at the weekend to spend time with his wife and two children. — *kh*

Green roofs above the city

Researchers at HTWK Leipzig are involved in a number of projects intended to investigate, monitor and communicate how green roofs can make cities more resilient to heat, heavy rainfall and biodiversity loss. Here is an overview of their work.



This specially designed irrigation system supplied measured amounts of water to ten flat roofs over the course of a year

A hot summer's day in Leipzig. The air shimmers above the streets. Asphalt and concrete trap the heat. A few hours later, the weather turns… A violent thunderstorm rolls in. Heavy rain pounds the rooftops, roads and public squares. Within minutes, drains and sewers are pushed to their limits. Situations like these are becoming more frequent and presenting cities with growing challenges. One solution lies in a place that often goes unnoticed: on rooftops.

Which roofs make the biggest difference?

Green roofs can store rainwater and improve the urban climate. But not all green roofs perform in the same way. Their effectiveness varies greatly, from lightweight extensive roofs planted with succulents to intensive roof gardens featuring perennials. To better understand these differences, a test facility was built on the outskirts of Leipzig in 2024. It includes two conventional flat roofs and eight experimental green roofs. The facility is part of a major research project funded by the German Federal Environmental Foundation, known as *MaNu-Grün*. HTWK Leipzig is working with the Educational and Demonstration Centre for Decentralised Infrastructure, the Helmholtz Centre for Environmental Research (UFZ), Leipzig's waterworks and Dresden's wastewater management service to investigate how different roof systems cope with heavy rainfall.

Over the course of a year, the roofs were exposed to both natural weather conditions and artificial rainfall simulations. These tests reproduced rainfall amounts equivalent to extreme events expected statistically once every one, five, or one hundred years. Sensors measured how much water was retained by the roof substrate and how much ran off. The researchers then calculated how much water would reach the sewer system and how long the process would take. "The aim of water-sensitive urban development is to create a balance between evaporation, runoff and groundwater recharge that resembles natural conditions. Rainwater should be retained, evaporated or infiltrated. Green roofs are an effective means of achieving this", explains Hubertus Milke, Professor at HTWK Leipzig and Head of the Institute of Hydraulic Engineering and Urban Water Management. His research associate Friederike Wensch adds: "The project aims to provide a robust foundation and simulation parameters that will help water utilities to incorporate green roofs more realistically into their planning".

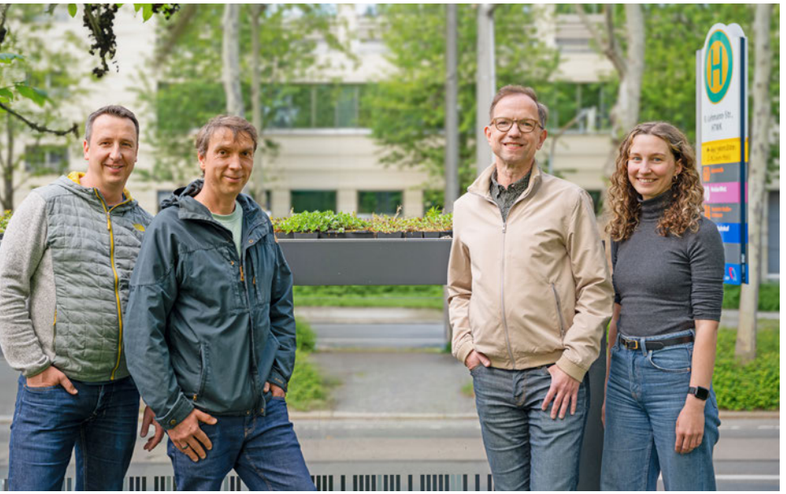
Which green roof retains the most rainfall and produces the lowest peak runoff into the sewer system?

When the project came to an end in March 2026, the results showed that an intensive green roof with flow control – also known as a retention green roof – stored the largest amount of water and delayed runoff into the sewer system for the longest period. Special retention devices installed at roof drains temporarily held back water, reducing peak runoff and easing pressure on urban drainage systems during heavy rainfall. However, the project partners emphasise that there is no universal solution. The most suitable type of green roof depends on local requirements and conditions. In any case, the project's findings now provide municipalities, housing companies and policymakers with a sound basis for deciding where green roofs can have the greatest impact.

High-tech for healthy urban greenery

Research is also being conducted in the heart of Leipzig – on the roof of the Gewandhaus. What was once a gravel-covered surface is now green and thriving. Invisible to visitors attending concerts below, fibre-optic sensors installed in and on the roof substrate continuously record temperatures and

Researchers install fibre-optic cables in and on the substrate of the new Gewandhaus green roof. The cables monitor temperature and moisture, providing early warning signs of drought stress



From left to right: Sebastian Hänsel (City of Leipzig), Rolf Engelmann (Leipzig University), Prof. Mathias Rudolph and Stefanie Penzel (both HTWK Leipzig) are working with schools to collect environmental data on the green roofs of public transport shelters

provide valuable information about plant drought stress. “This allows us to precisely identify when and where a green roof is becoming too dry”, says Martin Weisbrich, head of the Sensors and Monitoring research group within the Institute of Concrete Construction (IfB) at HTWK Leipzig. “As a result, irrigation can be targeted exactly where it is needed instead of watering the entire roof indiscriminately”.

By installing the green roof, the Gewandhaus also made itself available to leading regional research institutions as a living lab in 2025. In the *ValiGrün* research project, researchers from the UFZ have joined forces with HTWK Leipzig, the Technical University of Dresden and the Leibniz Institute for Tropospheric Research (TROPOS) to develop recommendations and optimisation strategies for municipalities and private stakeholders. Earlier studies occasionally found that expected benefits such as cooling, increased biodiversity and rainwater retention did not always achieve the anticipated results. The new measurements are intended to provide reliable evidence of the actual performance of green roofs. Supported by funding from the Free State of Saxony and the European Union, the project aims to help public and private developers design and plan green roofs more effectively, ultimately enhancing their contribution to a healthier urban climate.

Learning from green bus shelters

In Leipzig, researchers are not the only ones measuring the effects of green roofs on climate and biodiversity. As part of the *FaGULab* educational project, school classes are studying the green roofs of public transport shelters under supervision. Using modern sensor technology, they are measuring environmental parameters, observing plants and insects, and jointly analysing the resulting data. “*FaGULab* encourages young people to take action. They collect real data, develop their own ideas and are actively involved in the process”, says Mathias Rudolph, Professor of Industrial Metrology at HTWK Leipzig, who is leading the project with funding from the German Federal Environmental Foundation. The project combines education, research and urban development, demonstrating how citizen participation can work in practice. In addition to the school-based measurement campaign, the project aims to establish a living lab. Partners from science, government, business and civil society are collaborating on practical greening strategies. The aim is to translate the findings into concrete recommendations for urban development that supports biodiversity.

More than just greenery

Whether on experimental roof systems, concert halls or bus shelters, the projects in Leipzig show that green roofs play an important role in helping modern cities adapt to climate change. They store rainwater, cool buildings and support biodiversity – provided they are properly designed and maintained. In any case, the research now provides reliable data for politics and industry. — *kh*

Tips for maintaining green roofs can be found in this free brochure (in German)
↗ **htwk-leipzig.de/Broschur_Gruendaecher.pdf**

This figure of Jesus is still nailed to the cross – but it can already move its head and, once taken down, also lower its arms

How does the crucified figure move?

This is the unusual question that drives Arianna Favaretto Cortese, a visiting researcher at HTWK Leipzig. She is studying medieval crucifixes from the former Republic of Venice, whose figures of Christ feature movable joints – in the arms, legs, tongue or even throughout the entire body. From the 14th to the 16th century, these sculptures were mainly used during Holy Week in Passion plays, processions and reenactments of the death of Christ. While conventional crucifixes are typically static depictions of suffering, these movable figures once brought biblical stories to life for contemporary audiences.

Favaretto Cortese came to HTWK Leipzig to work alongside her supervisor, Johannes Tripps, Professor of Art History of Material Culture. “He’s one of the leading experts on the origins of movable crucifixes, and his expertise is extremely valuable to me”, says the Italian art historian.

Favaretto Cortese first encountered movable crucifixes while researching the iconography of the Crucified Christ in Venice during her master’s studies. After graduating, she set out on a pilgrimage along the Camino de Santiago. At the end of her journey, she came across another movable crucifix, reigniting her interest in the subject. “What fascinates me is how these sculptures of Christ literally came to life, giving believers a tangible encounter with the divine”, she explains.

Now a doctoral candidate at the University of Verona, Favaretto Cortese is cataloguing surviving crucifixes and documenting how they were used. Figures with movable limbs could be nailed to the cross, taken down again, placed in Mary’s lap and finally laid in the tomb with their arms resting alongside the body. “Her work combines art history, theatre history and the study of technology”, says Tripps. “She analyses how the mechanisms work, which workshops produced them and how they relate to the development of automata. She’s making a valuable contribution to the study of material culture”. The 28-year-old researcher looks back on her time at HTWK Leipzig as a great opportunity to gain practical experience and further develop her work within an international context. — *st*

“Our goal is to make digital spaces safer”

Chatting, streaming, learning… The internet is part of everyday life for young people. But it also exposes them to cyberbullying, extremist content and other risks. How can we keep young people safe in the digital world? Marc Liesching, Professor of Media Law at HTWK Leipzig, is part of an expert commission that advises the German government on ways to safeguard young people online. In this interview, he explains why action is needed and how protection can be achieved.

Prof. Marc Liesching specialises in media law. He conducts research and provides advice on youth protection law

You advise the German government on digital youth safety. What risks do young people face online?

Prof. Marc Liesching: Children and adolescents are moving in increasingly complex and fast-paced digital circles. Various risks arise from manipulative platform designs, addictive mechanisms and algorithmic amplification logics, as well as harmful content, hate speech and sexualised violence. New risks are also emerging through AI-generated deepfakes or chatbots that simulate intimate relationships. Young people are particularly susceptible to these dangers throughout their development.

What safeguards are already in place?

There are various laws and regulations, such as the *Digital Services Act* and the *German Act for the Protection of Minors* (JuSchG), as well as voluntary measures implemented by platforms. Tools such as age verification, safe default settings and risk assessments can help, but they are applied very inconsistently. Prevention efforts are also supported by initiatives such as *klicksafe*, *Gutes Aufwachsen mit Medien* and *BIK+*. Additional support is available through counselling services, hotlines and complaint channels.

Australia introduced a social media ban for under-16s in 2025. Would it be legally possible for Germany to follow suit?

That would be difficult, as many social media platforms are headquartered in Ireland. This means that German regulations only apply to a limited extent – and it creates certain legal complications. Some countries, most recently France, have tried to introduce national age limits and place greater responsibility on platform providers. However, many regulatory areas have been harmonised across Europe through the Digital Services Act. As a result, national measures quickly reach their legal limits. This was confirmed by a German administrative court when it issued a ruling on platform regulation in early 2026. Joint European solutions would therefore be a more realistic option.

How important is education and media literacy?

Media literacy is one of the commission’s main priorities and a key factor in ensuring the sustainable protection of minors. Young people need to learn how to identify risks, critically evaluate information and reflect on their own media use. At the same time, parents and educators also need support in navigating the often overwhelming challenges.

What does the expert commission hope to achieve?

We are working on a joint strategy to provide greater protection in the digital lives of children and adolescents. Our goal is to make digital spaces safer for minors – with an unwavering focus on their well-being, as required by the United Nations Convention on the Rights of the Child. My research into platform regulation, youth protection law and the risks of AI helps us assess what legal options are available to offer greater protection.

We are still at a very early stage. We are currently analysing existing regulations and measures, identifying gaps and examining where stronger safeguards may be needed. Based on these findings, we will then develop specific recommendations for the German government. The commission is initially slated to work for about a year. It’s a tight schedule, because we have a lot to do.

Thank you for talking to us.
Interview conducted by Sophia Trupp.

Prof. Dr. Marc Liesching
has been Professor of Media Law and Media Theory at HTWK Leipzig since 2013. After completing his doctorate at Ludwig Maximilian University of Munich, he worked as an attorney and founded a law firm specialising in media law. In 2025, the German government appointed him to the interdisciplinary expert commission on digital youth safety. There, he contributes expertise gained through his research on regulation and the country-of-origin principle.

Learn more about the expert commission here (in German):
↗ **https://t1p.de/f21yj**

Rethinking electrical planning

In modern buildings, electrical systems do much more than power lights and sockets. Energy supply, data networks and security systems all need to be carefully planned and coordinated to ensure reliable operation.

The Leipzig-based company *AdaptING* specialises in electrical planning. Since 2021, its team has been designing a range of complete electrical systems for buildings – from power distribution and lighting to data networks and safety-related installations. Their goal is to create energy-efficient solutions that are economically viable and fit for the future.

Founder Florian Baron, who studied electrical engineering at HTWK Leipzig, identified shortcomings in traditional planning processes. Electrical planning was often carried out late in the construction process, in two-dimensional formats and with insufficient coordination between different trades. This frequently led to planning errors, on-site clashes, unclear cost structures and extensive coordination efforts during construction. To address these issues, *AdaptING* relies on digital planning based on building information modelling (BIM). Early coordination, transparent cost planning and close collaboration among all project partners helps to identify problems sooner and streamline construction processes.

The company now employs twelve people and has already completed several demanding projects. One example is electrical planning work around the Monument to the Battle of the Nations in Leipzig, where work on existing structures requires exceptional care and precision. More recently, *AdaptING* was awarded a contract by Deutsche Bahn to plan a section of the Upper Rhine Railway, a major infrastructure project with stringent requirements.

HTWK Leipzig presented its inaugural Start-Up Award to Florian Baron of *AdaptING* for successfully founding a company and continuing to mentor aspiring entrepreneurs

Baron was guided through the pre-founding phase with a range of workshops and coaching sessions held by Startbahn 13, HTWK Leipzig's very own start-up initiative. The engineering firm has since become one of the university's most successful spin-offs. Baron now mentors other entrepreneurial teams and was honoured with the inaugural Start-up Award during the advisory service's fifth anniversary celebrations last year. — *fo*

FiberFlow: Lena Strobl and Ludwig Morgenstern

Textiles in a circular economy

The textile industry is one of the world's most resource-intensive sectors. On average, every person in the European Union consumes 12,000 litres of water per year – equivalent to 80 filled bathtubs – and 523 kilograms of raw materials to meet their clothing consumption. Instead of conserving resources, the textile market continues to grow, driven largely by "fast fashion" trends, where low-quality clothing is bought at a fraction of the price. At the same time, only around 1% of used clothing is recycled into new textiles.

FiberFlow wants to make a change. HTWK alumni Lena Strobl and Ludwig Morgenstern are developing a new method for textile recycling aimed at producing clean, single-type fibres suitable for high-quality reuse. One key challenge is the composition of modern textiles. "Natural and synthetic fibres are often blended to improve comfort and functionality. These mixtures are difficult to separate using conventional methods – and the process tends to be uneconomical", explains environmental engineer Strobl. That's why *FiberFlow* uses a multi-stage mechanical separation process inspired by wastewater treatment plant workflows.

"We first shred textiles down to fibre level and then separate them step by step. In the end, we obtain pure fibres that can be recycled", says energy engineer Morgenstern. They also use infrared spectroscopy software to automatically identify different materials.

The company is based at the Eilenburger Straße research campus, where it is supported by the university's dedicated start-up service, Startbahn 13. It was thanks to this support that the team secured an EXIST start-up grant to advance their technology. The founders have since established a limited company and are now aiming to build a demonstrator. — *fo*

Interdisciplinary research for green solutions

A sustainable future depends on clean materials, long-lasting buildings and technological solutions for the energy transition. For the past three years, young researchers at HTWK Leipzig have been developing a range of applied solutions in the *GreenInnoSax* junior research group.

Sustainability has many dimensions. Its diversity is reflected in the work of *GreenInnoSax*, a junior research group funded by the European Social Fund and the Free State of Saxony. Since 2023, researchers from the fields of civil engineering, environmental technology and materials science have been developing solutions to remove pollutants, promote the use of natural building materials and support the use of hydrogen in the energy transition. The group is led by Björn Höhlig, Professor of Sustainable Construction and Building Rehabilitation at HTWK Leipzig. Höhlig reflects on the project: "*GreenInnoSax* has demonstrated the great potential of interdisciplinary collaboration. The researchers brought together expertise from several faculties, worked closely with the Helmholtz Centre for Environmental Research (UFZ) and were actively involved in regional and national networks". The individual research topics are outlined below.

The members of the *GreenInnoSax* junior research group: Alexander Oschim, Elena Lorenz, Oliver Bartzok, Viktoriia Karabtsova, Alexander Kühne, Robin Berg and Dr Maria Balda (from left to right)

Targeted degradation of pollutans

Old wooden floors, historic works of art and plastered façades often contain hidden pollutants. Chlorinated organic pesticides, once commonly used in wood preservatives, can continue to pose risks to people, the environment and building materials decades later. That's why one area of research focused on the targeted degradation of these substances without damaging the materials themselves. The researchers developed a two-stage process for removing toxic pesticides from wooden objects and artworks. First, the pollutants are carefully extracted from the material. Then they are chemically converted using hydrogen, which greatly reduces their toxicity. Environmental chemist Viktoriia Karabtsova achieved degradation rates of over 90%, demonstrating how cultural heritage objects can be restored safely and preserved for the future.

The researchers used a mobile X-ray fluorescence device to analyse a sample treated with wood preservatives

This rainfall simulator recreates rainwater running down a façade. Robin Berg collects a water sample to analyse which biocides are leaching from the material

From rainfall to rivers and lakes

Pollutants rarely stay where they first appear. What starts on a building façade often continues through the water cycle. Rain washes biocides out of paints and renders, carrying them into soils and waterways. Dr Maria Balda and Robin Berg studied these pathways and made them visible. The researchers improved a rainfall simulation system that reproduces real weather conditions and generates detailed data on leaching processes. They also tested filter materials made from activated carbon and biochar, developed jointly by HTWK Leipzig and the UFZ. These materials were able to bind biocides and prevent them from spreading through the environment. This also created the basis for their further breakdown. "This is an important step towards future filtration systems and more sustainable water management", says Dr Ulf Roland, the project group's scientific supervisor.

Testing building materials for climate action

Moisture and salt contamination can seriously damage buildings and shorten their lifespan. To pinpoint these areas in mineral building materials, Alexander Oschim developed a ground-penetrating radar technique that visualises affected zones without damaging the structure. Early studies showed that salt-contaminated areas can be detected reliably. Elena Lorenz expanded the research using X-ray fluorescence analysis. With just a few reference measurements, chloride concentrations in existing buildings can be determined directly on site, allowing structures to be assessed quickly and accurately.

Harnessing the potential of renewable materials

Timon Macht investigated the load-bearing capacity of large timber-straw elements. He found that straw can withstand far greater loads than

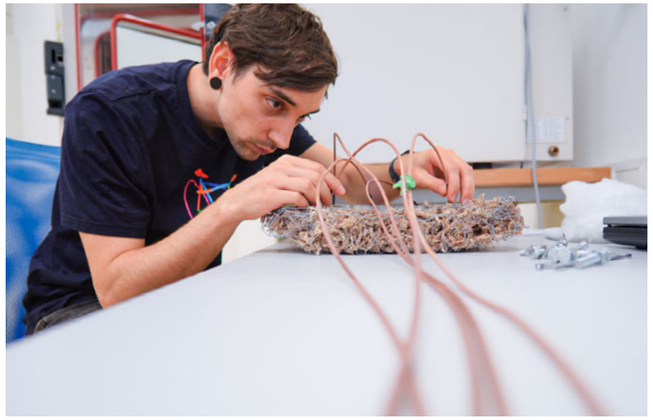
many would expect. His tests confirmed the material's high stability, generated valuable data for future structural design and demonstrated how renewable materials can help to conserve resources in the construction sector. Jan Bertram developed a façade element that doesn't just drain water away; it passively collects moisture from the air, turning the building envelope itself into a resource. Concepts like this could allow future buildings to play an active role in water supply systems while integrating blue-green infrastructure directly into their architecture.

Hydrogen for the energy transition

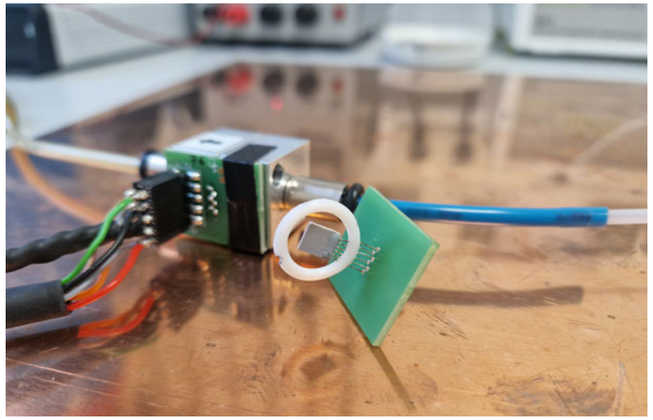
Hydrogen is widely regarded as one of the key energy carriers of the future. It can replace fossil fuels and store renewable electricity. For hydrogen to be used safely in natural gas networks, precise and affordable sensors are needed to monitor hydrogen levels in oxygen-free environments. Alexander Kühne and Oliver Bartzok developed a semiconductor sensor that can reliably measure hydrogen concentrations of up to around 20%. The sensor is particularly effective at detecting low concentrations, making it highly relevant for many real-world applications. Andreas Blum created an additional explosion-proof electronics platform that allows the sensor to be deployed cost-effectively in industrial environments. — *st*

↗ greeninnosax.htwk-leipzig.de

Timber and straw can be used to create load-bearing walls



Jan Bertram sets up the sensors used to measure moisture levels



The semiconductor sensor developed in the project monitors hydrogen levels in the natural gas network

This is how an AI image generator imagines researchers collaborating with intelligent computers. Our author has written an essay that should be taken with a pinch of salt

The ultimate research report

Research without artificial intelligence (AI)? Unthinkable! We can't even look for funding programmes without it. A search AI picks out options for us. A generative language AI then goes through the calls for proposals. Saves time, saves effort. "Perfect fit!" says the AI – and who are we to argue? Next step: the proposal. Back in the day, that took ages! Now we just let research platforms do the heavy lifting.

The AI reads the call, understands it better than we do and writes a flawless proposal – project plan included – neatly aligned with the funding line and somehow also with our project. It even writes the budget. A presentation AI then makes everything look convincing with charts, graphics and general visual optimism. You want everything in English? No problem!

Luckily, the funding body also uses AI to sort applications for logic, consistency and "fit". Ours passes with flying colours. We get the grant! What kind of obligations has the AI kindly included in our proposal? Regular meetings, reports, transfer work and publications? Thankfully, we can just focus on our research – meetings are AI-assisted too. This makes them more efficient – and kind of fun. We usually just let our avatar attend and report back to us.

Then it's time for the final conference – online of course – with international speakers sending video talks and avatars answering questions. Everything gets recorded, transcribed and turned into a proceedings volume. At some point, you wonder: What was this project about again? Doesn't matter – the final report will fit anyway. — *Prof. Gabriele Hooffacker (satire)*

Prof. Dr. Gabriele Hooffacker
(*1959) is a journalist and author who served as Professor of Media-Compatible Content Creation at HTWK Leipzig from 2013 to 2025. She is the editor of the textbook series *Journalistische Praxis* and *Leipziger Beiträge zur Computerspielekultur*. She also co-edits the open-access journal *Journalistik*.

Column

A night that brought knowledge to life

The freely programmable robot dog was a hit with visitors young and old

The Long Night of Sciences, held every two years in Leipzig, invites visitors to explore research topics in an interactive and engaging way. HTWK Leipzig was in attendance once again last summer, providing a wide range of hands-on activities, insights into 30 areas of research, teaching and study, and guided tours of laboratories that are normally closed to the public.

What happens to old wind turbine blades or aircraft parts? Can water be "harvested" from the air? How are spare parts made when they are no longer available on the market? And how exactly does the lid end up on a yoghurt cup? At the Long Night of Sciences on 25 June 2025, researchers and staff at HTWK Leipzig once again had the answers.

Every two years, the City of Leipzig and its research institutions open their laboratories, lecture halls, collections and archives to curious minds on a Friday evening. This year, a record-breaking 55 research institutions got involved – with nearly 700 individual events. Throughout the city, visitors explored topics ranging from artificial intelligence and climate change to the energy transition, medicine, society and culture, discovering science through a range of playful and interactive formats.

Timber, carbon concrete and sand

The evening began with the presentation of the Leipzig Science Award. For the first time, one of the recipients was a researcher from HTWK Leipzig: Alexander Stahr was recognised for his commitment and innovative approach to advancing structural engineering, digital manufacturing and resource-efficient timber construction. From 6 pm onwards, he and his team showcased their research to visitors. Augmented reality headsets showed how carpenters might one day have all the information they need projected straight into their field of vision – and how robots can manufacture customised building components with remarkable precision in automated production processes.

Sustainable construction was also highlighted at neighbouring exhibits featuring glowing carbon-concrete components and materials made from recycled wind turbine blades. Visitors could also explore the principles of soil compaction by jumping on an interactive geotechnical testing platform.

Robots, ice cream and lightning

Many of the evening's activities were both entertaining and informative. Visitors could try out the *Humen Dynamics* system, which uses contactless technology to show how different lifting and bending movements affect the body. Others took on a speedy SCARA robot in a game of tic-tac-toe or programmed stage lighting systems in the hardware lab. Lots of people were also drawn in by the latest generation of robot football. Another crowd favourite was our four-legged robot. After a presentation on bionics, it took a stroll around campus and even shook paws with visitors.

Our laboratory tours were a constant source of amazement. For example, the scanning electron microscope lab revealed that surfaces appearing smooth to the naked eye are surprisingly rugged when magnified 1,000 times. In the hydraulic engineering lab, visitors explored two models showing the risks posed by flash floods and heavy rainfall. The digital reconstruction lab even welcomed visitors with their own "patients", including

A bench that used to be a wind turbine blade? Researchers in materials science explained the transformation in the foyer of the Nieper Building

40

interactive stations and exhibits were presented by HTWK Leipzig during the Long Night of Sciences – not to mention a wide range of guided tours

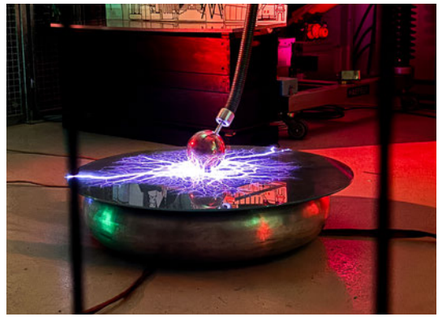
Primary school children became “chemistry detectives” and experimented to find out why the fish in the aquarium were unwell

In the 3D printing lab, visitors learned about the possibilities, benefits and challenges of additive manufacturing

part of an old teapot. Researchers showed how replacement parts for damaged household objects can be recreated with 3D printers, highlighting the enormous potential of additive manufacturing. Meanwhile, researchers in the Media Centre and Gutenberg Building revealed the secrets behind printing and packaging technologies. At the Faculty of Electrical and Information Engineering near Leipzig city centre, sparks literally flew in the high-voltage laboratory, where visitors witnessed the fascinating effects of electricity.

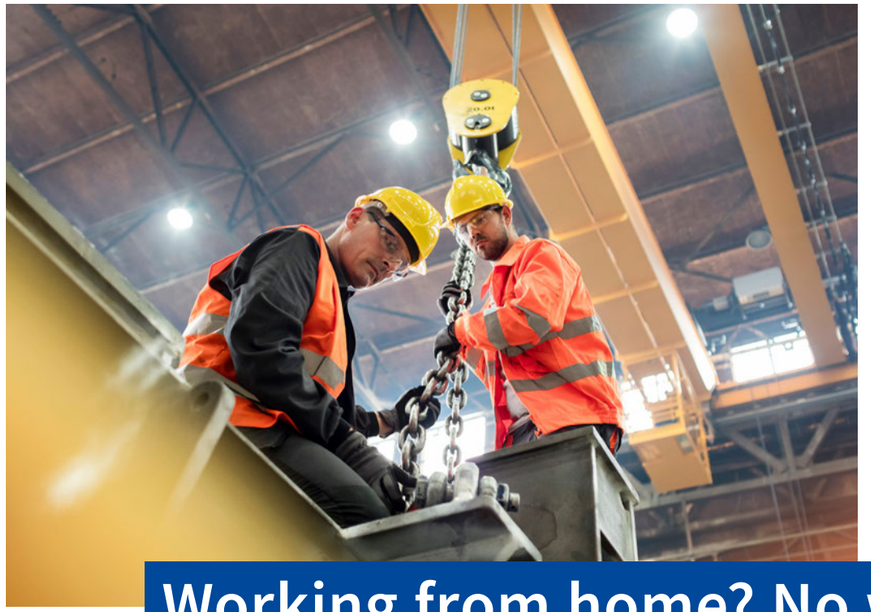
To cool down afterwards, the Makers Lab served up delicious ice cream shaped like electrical components from its workshop-and-ice-cream cart. They also demonstrated the whole ice cream-making process – from initial idea to finished product.

Other popular attractions included the university library’s new escape game, a range of chemistry-themed puzzles for primary school children organised by the Chemistry Group at the Mathematical and Natural Sciences Centre, and the alumni gathering for graduates of computer science, mathematics and natural sciences, where the Smart Driving Team presented its latest developments in autonomous driving. — *frb*



High-voltage phenomena on display: Experimental demonstrations showcased the fascinating effects of electricity

Save the date!
The next Long Night of Sciences will be held in Leipzig on **25 June 2027**.



Unappealing jobs? Working conditions can also be improved for deskless workers

Working from home? No way!

Various forms of remote work are now standard in many jobs – at least for those who work at a desk. But what about employees without a desk? About 80% of people around the world are tied to their workplace – whether in waste management, healthcare or nursing. These so-called “deskless”, frontline or blue-collar workers have long been overlooked in research on the world of work – and are rarely included in discussions about improving working conditions.

Peter M. Wald, Professor of Business Administration and Human Resources, wants to change exactly that. In his new book *Deskless Work und Personalmanagement* (2025, Springer), he outlines ways to make work more flexible and supports his findings with practical experience.

“In the past, it wasn’t difficult to fill deskless positions. But the landscape is changing. These jobs are gradually losing their appeal, which makes recruitment more challenging”, says Prof. Wald.

At the same time, companies can better address deskless workers’ needs – for example through shift planning or more flexible working time models. Other approaches include improved communication and non-financial benefits – so-called “perks”. Professional development opportunities are becoming increasingly important. All of these factors help to build trust and make deskless jobs more appealing.

Engineers trained at HTWK Leipzig should also develop a critical awareness of this topic during their studies and gain first-hand insight into deskless work. By gaining in-depth understanding of the relevant issues, they can help shape the employee experience – through the design of machines and systems or later in their role as managers. — *frb*

Giving a voice to children affected by violence

Adults aren't the only ones affected by domestic violence. When children live in the same household, they are always drawn into the conflict – often unseen and unheard. Prof. Anja Pannewitz and illustrator Aike Arndt have brought them into focus in a non-fiction comic. *Von Kindern, Eltern und Gewalt* combines academic insights with powerful visual narratives.

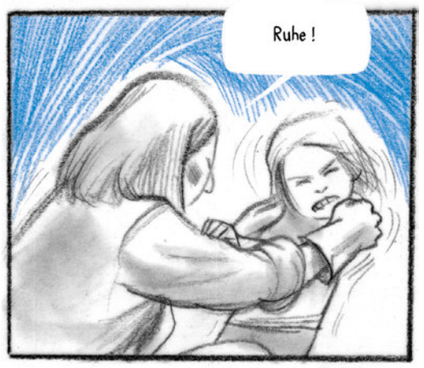
Von Kindern, Eltern und Gewalt. Ein Sach-Comic für Erwachsene was published by Unrast Verlag in 2025 (in German)
↗ https://unrast-verlag.de/produkt/von-kindern-eltern-und-gewalt-2

When domestic violence is discussed in politics and the media, the focus is usually on adults. But children hear, see and experience everything that happens behind closed doors, says Anja Pannewitz, Professor of Social Work at HTWK Leipzig. In the research project *Biographical and Spatial Experiences of Domestic Violence,* she and her team collected numerous accounts from victims of domestic violence who had themselves been children at the time. This led to the idea for the book. "While reading the accounts, images began forming in my mind", recalls Prof. Pannewitz. "These stories and perspectives are often neglected in public discourse. I wanted to change that".

Visualising research

Together with Berlin-based illustrator Aike Arndt, Prof. Pannewitz developed a format suited to her approach to science communication: a non-fiction comic. Unlike many other graphic novels, it is explicitly aimed at adults and enriched with extensive explanatory texts and scientific references.

Illustrator Aike Arndt portrays scenes of domestic violence with sensitivity and clarity



Children's perspectives are missing from public discourse

The book opens with an introduction to domestic violence based on the 2011 Istanbul Convention. It defines domestic violence as any form of physical, sexual, psychological or economic violence within a family or household – regardless of legal or biological relationships. This is followed by an overview of the current discourse in politics and media, as well as the latest research findings. For instance, we learn that approximately half of all children and adolescents around the world have experienced physical, sexual or emotional violence at home, and six in ten have been subjected to corporal punishment. One in four children aged 0 to 5 have witnessed their mother in an abusive relationship. Due to methodological limitations, the number of unreported cases is likely to be even higher.

This level of detail may be unusual for a graphic novel, but for Prof. Pannewitz it reflects sound scientific practice, especially in times of increasing scepticism towards research. Based on this foundation, the book presents 14 illustrated short stories, which are repeatedly contextualised by explanatory texts.

At the centre are three fictional child characters: Bianca, Laura and Henrik. Their experiences and perspectives run throughout the book. The depicted scenes are largely based on biographical interviews with adults who experienced violence as children. While names have been changed and narratives merged, the accounts closely reflect how participants described their experiences in the interviews.

More than an individual problem

The stories in the book portray violence in many different forms: psychological and physical violence, violence within intimate relationships and violence between parents and their children. One of the book's key observations is that parental violence against children is often underestimated or overlooked. And it is not merely a psychological issue attributable to individual perpetrators; it is shaped by broader social and political factors, including gender relations and authoritarian or totalitarian ideas about parenting and society.

Research also shows that so-called "milder" forms of violence, such as hitting, pushing or kicking, are the most common within families. Despite growing awareness of the issue, these behaviours remain widespread in many Western industrialised countries and are often still socially accepted. More severe forms of violence tend to be more strongly condemned – provided they are recognised in the first place.

Prof. Anja Pannewitz

Prof. Dr. phil. Anja Pannewitz
(*1977) has been Professor of Social Work at HTWK Leipzig since 2016. Her research focuses on domestic violence, the sociology of space and gender studies. Before completing her doctorate at Friedrich Schiller University Jena, she had worked as a consultant, coach, trainer and process facilitator, with a particular focus on social skills, diversity, civic courage and democracy.

Three fictional characters – Bianca, Laura and Henrik – guide readers through the book by sharing their perspectives on their experiences

Standing up for children

Von Kindern, Eltern und Gewalt is written for a broad audience, including parents and adults affected by domestic violence. It also offers valuable insights for professionals in early childhood education, social work, family courts, healthcare, nursing and schools. Most importantly, however, the book seeks to stand up for children and give them a voice. After all, their perspectives are rarely heard in public discourse. Through its combination of information and visual storytelling, the non-fiction comic aims to change that. It invites readers to confront these stories, even if they are difficult to bear. The book also highlights the fact that domestic violence is a societal challenge that concerns politics, business and civil society alike. The message is clear: pay attention, understand and take action. — *kh*

Dr Dmytro Rassokhin mixes nanoparticles into a polymer compound in a glovebox

A second skin for turbines and pumps

Russia's war of aggression against Ukraine has left many power plants heavily damaged. Almost every major hydropower plant has been targeted. Beyond the immediate impact on the local population, this also puts significant stress on the infrastructure itself. If the plants cannot be repaired, corrosion and other forms of wear will continue to damage metal components, pump elements and concrete structures. As extensive repairs are currently unfeasible, there is a need for cost-effective and practical solutions. This is where the *ProHydroComp* research project at HTWK Leipzig comes in. Since January 2025, a German-Ukrainian research team has been developing novel protective coatings for heavily stressed metal components in hydropower facilities. The aim is to stabilise existing damage and reduce future wear.

At the heart of the project is Dr Dmytro Rassokhin, a Ukrainian mechanical engineer specialising in metal coatings. While working at the Pryazovskyi State Technical University, he had already researched materials capable of restoring damaged metal surfaces through the application of polymer coatings. Following the destruction of Mariupol, he is continuing this work at HTWK Leipzig in cooperation with his home university, supported by funding from Germany's Federal Ministry of Education and Research (BMFTR).

The technology is based on polymer-based composite materials enhanced with nanoparticles. These coating systems can be applied cost-effectively across large surfaces. Their purpose is to extend the service life of heavily stressed components and protect them against wear caused by cavitation and corrosion. The project deliberately uses polymer materials available in Ukraine to ensure that the repair solution remains affordable and practical for local use.

"I'm glad that I've been able to continue my previous research at HTWK Leipzig and support Ukraine from here", says Dr Rassokhin. He fled the war with his wife, daughter and parents in 2022 after his family home was destroyed in a bombing raid. In Leipzig, he looked for a university with a suitable research profile and found support in Robert Böhm, Professor of Composite Lightweight Engineering at HTWK Leipzig. A one-year scholarship for displaced researchers initially enabled him to continue his work until the joint project was granted funding. Since then, he has been refining existing coating systems, optimising them and testing them under real operating conditions. — *kh*

Award-winning research in timber construction

For Alexander Stahr, Professor of Structural Engineering at HTWK Leipzig, the future of sustainable construction lies in digital planning and automated prefabrication. His goal is to conserve resources while bringing timber – one of humanity's oldest building materials – into the modern age. With a constant focus on practical relevance and real-world needs, Prof. Stahr connects regional partners from business, government and society.

In the summer of 2025, Prof. Stahr won the Leipzig Science Award for his applied research in timber construction. He shared the honour with Antje Körner, paediatrician and Professor of Metabolism Research at Leipzig University. Awarded by the City of Leipzig, Leipzig University and the Saxon Academy of Sciences and Humanities since 2001, the €10,000 prize recognises individuals whose work strengthens Leipzig's reputation as a science and research hub. The jury was particularly impressed by Prof. Stahr's practical solutions for modern and sustainable construction. His research combines architectural design, engineering planning and computer-assisted manufacturing. The result is construction systems that use less material, last longer and can be integrated into the circular economy. For Prof. Stahr, this is about more than technology: "For me, environmentally friendly construction is also a reflection of my social responsibility as a researcher".

At the heart of his work is FLEX, a group he founded in 2014 with a focus on research, teaching and experimentation. Together with his interdisciplinary team, he has successfully completed more than 20 research projects. His efforts ultimately led to the group's most recent milestone in 2024, when the new Timber Construction Research Centre (HolzBauForschungsZentrum) opened its doors. The facility allows digital timber construction technologies to be tested at full scale. The team is currently building a specially designed manufacturing system for customised timber building elements – one of a kind in Europe in terms of its concept and scale. The facility will use industrial robots capable of accessing every point of each individual component, enabling highly customised production. With pioneers like Prof. Stahr, a team like FLEX and Europe's largest timber model factory, Leipzig is setting new standards in timber construction research. — *kh*

For the first time, the Leipzig Science Award has been presented to a researcher from HTWK Leipzig: Prof. Alexander Stahr

The *HTWK Robots* made it onto the podium several times last year – with new models from Booster Robotics

World champions in robot football

The small humanoid NAO robots from HTWK Leipzig might look a bit clumsy on the ball, but they have long been the hot favourites in international robot football competitions. The *HTWK Robots* started in 2009 as a small student experiment. Today, they are multiple-time world champions and a shining example of how far applied artificial intelligence has come. Armed with a new generation of robots, the Boosted HTWK Robots team won the Humanoid League world title at last year's RoboCup in Brazil, defeating a Chinese team 11–0 in the final. The new Booster upgrades have little in common with their predecessors. They are larger and more agile than the original NAO models – and bring robot football closer to human-level dynamics.

This success is founded on 17 years of continuous teamwork between students and alumni of HTWK Leipzig, who have developed and refined algorithms enabling humanoid robots to walk, stand up and score goals. "Every tournament presents new scientific challenges, as the rules evolve each year", says Jens Wagner, Professor of Mobile Robotics and one of the team's supervisors at HTWK Leipzig. The group's findings feed into theses, conferences and workshops, making the RoboCup a global testbed for robotics and AI research.

The 2025 world title in Brazil and a runner-up finish at the first humanoid robot world championship in China attracted international attention, with widespread media coverage and talk show appearances. This put HTWK Leipzig on the world map as a robotics hotspot. In 2026, the team plans to compete in the World Championship in South Korea with its Booster robots, which use AI to perform faster, more precisely and more intelligently. The long-term ambition is that by 2050, the robots will autonomously compete against – and beat – the human world champions. — *st*

What is robot football?

Robot football is a field of research in which autonomous robots compete in organised football tournaments. Equipped with cameras and sensors, they detect the field, calculate positions and control their movements independently. The work draws on methods from computer science, robotics and artificial intelligence. Findings from this field also help to advance humanoid robots for everyday use.

C as in carbon concrete

Over the next four years, Leipzig will become home to the *C-Factory*, the world's first manufacturing plant for carbon concrete. The new facility will produce CO_2-storing structural elements made of carbon concrete in a fully automated process. The carbon concrete construction method has been extensively researched over the past two decades, and HTWK Leipzig has been actively involved in the process. At the university's Carbon Concrete Technology Centre, automated production processes for these new components have been developed and tested since 2022. The *C-Factory* now marks the decisive step in transferring scientific findings into market-ready applications, enabling scalable and competitive production. The project has received around €14 million in funding from the Federal Ministry for Economic Affairs and Energy (BMWE).

From left to right: Dr Alexander Kahnt, Minister of State Dirk Panter and Dr Matthias Tietze press the ceremonial start button for the *C-Factory*

One key innovation lies in the material combination, which could make it possible to store carbon in building components. As Saxony's Minister for Economic Affairs, Dirk Panter, said at the launch event on 30 March 2026, "The idea that buildings could become CO_2 sinks is revolutionary for industrial transformation and climate action".

The project is being implemented largely by Kahnt & Tietze GmbH, a spin-off from HTWK Leipzig. Together with partners from science and industry, including the university's Research and Transfer Centre (FTZ), managing directors Dr Alexander Kahnt and Dr Matthias Tietze are overseeing the development of the factory. The pilot plant is expected to go into operation by 2029 and will serve as a model for future carbon concrete factories. — *frb*

High-frequency measurement technology using drones

HTWK Leipzig has launched a new laboratory for high-frequency measurement technology. At the start of the year, the Munich-based engineering consultancy *AeroXess* transferred its infrastructure to the Faculty of Digital Transformation. The new laboratory is headed by Robert Geise, Professor of Electrical Engineering at HTWK Leipzig. *AeroXess* specialises in the use of drones to measure high-frequency signals, particularly those emitted by large antenna systems. The company has worked with HTWK Leipzig on numerous research projects over the years, including the VDEA project run by the European Space Agency (ESA), where they developed a deployable ultra-wideband antenna that will be integrated into future Earth observation radar systems designed to study the planet's subsurface from space. The new drone laboratory opens up a wide range of opportunities for researchers at HTWK Leipzig. For example, they will be able to measure very large antenna structures – especially in the low-frequency range – and analyse complex antenna systems directly at operational sites such as airports. Additional drone-assisted applications are already under development, including the measurement of mobile phone base stations. — *kh*

Ten years ago, Simon Lober appeared on the cover of *Insights* in front of the same inkjet printer now shown with his successor, Katharina Roeber (left)

Printed Packaging

The 2016 issue of *Insights* featured Simon Lober on the front cover, studying a machine that was opening up new possibilities for digital printing research. The young packaging engineering graduate was standing in front of the Pixdro LP30 inkjet proofing press, equipped with camera systems, software controls and an interchangeable printhead. Unlike analogue printing methods, inkjet technology places tiny droplets of ink directly onto the substrate without the need for a fixed printing plate. The machine allows researchers to investigate how ink properties, printhead design and control signals affect the printing process and image quality. Ten years later, it is still in operation. But what has changed since then?

At the time, the Competence Centre for Digital Printing (CCD) was still being established in Leipzig as an independent institution run jointly by the DFTA and HTWK Leipzig. "Digital printing for packaging was still in its infancy back then. The technology was new, and many machines were essentially black boxes. Our goal was to open these black boxes for industry practitioners, explain digital printing on a sound scientific basis and transfer that knowledge into industry", explains printing and packaging engineer Katharina Roeber, who took over from Simon Lober as the centre's coordinator in 2019.

Today, the CCD has established itself with a clear focus on digital packaging printing, a field that is becoming increasingly important. Digital printing makes it economically viable to produce small print runs. "The growing demand for lower print volumes in packaging is driving wider adoption. At the same time, we need reliable printing processes that reproduce brand colours accurately and can print on a wide variety of materials", says Roeber. The CCD supports companies by connecting industry and research and by assisting development projects in digital printing. Using advanced measurement and testing equipment, the centre analyses printing defects and process phenomena, helping users to understand and successfully implement the technology.

Students also gain valuable experience. They work on real-world challenges and gain direct insights into applied research. The findings are incorporated into the university's teaching, including a new degree programme in "3D Printing and Functional Surfaces", paving the way for the next generation of printing technologies. — *st*

A look back

This cool gadget …

… is a Laser Doppler Vibrometer (LDV) manufactures by Optomet.

… can measure surface vibrations without contact and with high precision – even over long distances.

… is used in mechanical engineering to monitor the condition of machine tools and motors, and in civil engineering for structural monitoring and load measurements.

… belongs to the Laser Laboratory headed by Prof. Christian Weickhardt at the Centre of Mathematics and Natural Sciences of HTWK Leipzig.

… cost €48,000 and was funded by the European Regional Development Fund (ERDF) and the Free State of Saxony.

Project partners and funding

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