Bundesanstalt für Materialforschung und -prüfung

Knowledge builds trust

BAM Report 2025/26

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2025/26

Editorial

Dear readers,

the world around us is changing at a breathtaking pace: We are witnessing political disruption and technological advancement while the global economic framework is transforming faster than we are able to adapt to from within our established routines. More than others, such times make clear the significance of knowledge: It is the foundation for progress and innovation, it creates new economic opportunities – and builds trust.

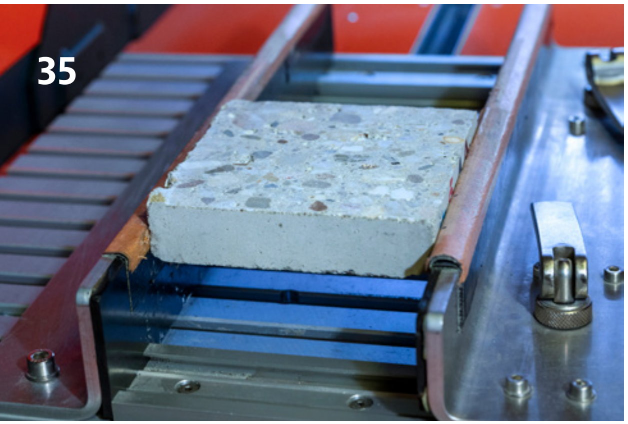
In 2025, BAM once again impressively demonstrated that knowledge is the strongest catalyst for impact. Our scientific output across our five focus areas – Energy, Infrastructure, Environment, Materials, as well as Chemistry and Process Engineering –, our ongoing commitment to our mission as a senior federal research institute, and our efforts to share our knowledge with the economy, politics, and society underline our role in strengthening Germany's safety, sustainability, and technological sovereignty.

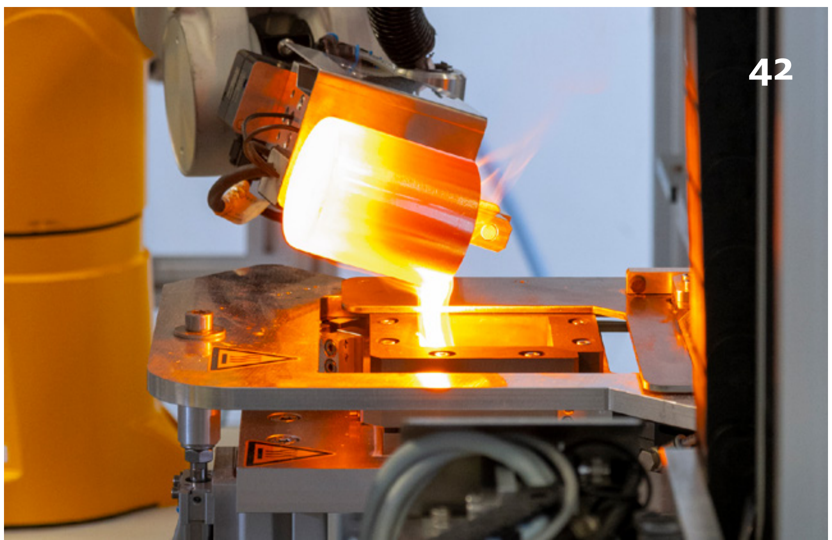
In all this, the crucial factor is the economic, technological, and societal benefit that we are able to leverage. Applications range from more robust wind turbines and safe bridges to new high-performance materials to unbureaucratic but dependable regulations governing the transport of hazardous goods and substances.

Digital transformation marks a particular focus of our work. Our overarching "data first" approach is enabling us to intelligently integrate data-driven research methods into our modern research infrastructure and take that process further continuously. For us at BAM, going digital is not an end in itself – it accelerates and boosts our research. And it makes our services an even better fit for our partners in science, politics, and the industries.

All this is built on a culture of collaboration, interdisciplinarity, and curiosity. One of BAM's unique strengths is the exchange that we foster across our five focus areas and their respective fields of activity: This approach affords us cross-departmental insights that make us resilient against oversimplifications, and it enables us to contribute to solving the challenges of our age. And it is the very starting point for knowledge that builds trust. Not only, but especially in turbulent times.

Sincerely,
Prof. Dr. Ulrich Panne, President Bundesanstalt
für Materialforschung und -prüfung (BAM)





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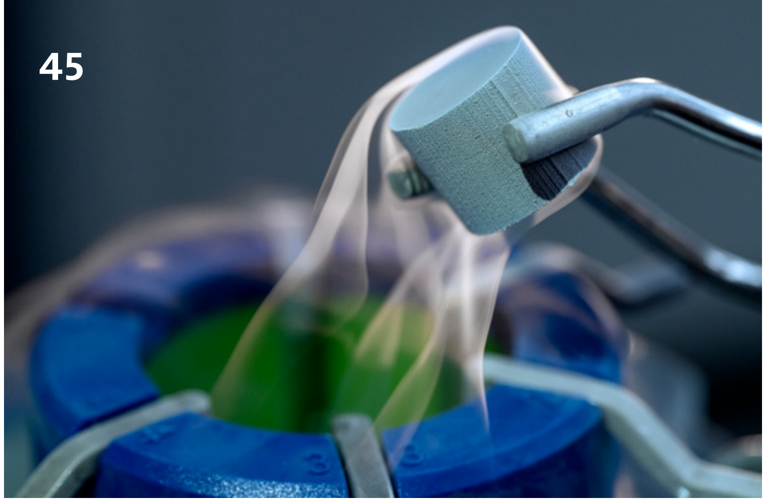
Chemistry and Process Engineering



“New analytics are driving battery development, deciphering failure mechanisms and aging processes.”

Beatrice Battistella,
Division Inorganic Reference Materials and Gas Analysis

“Automation and AI take NDT to a new level in the monitoring of critical infrastructure.”

Friedrich Bake,
Head of Department Non-destructive Testing

Knowledge builds trust

In times of profound change, knowledge unleashes a special power: it provides orientation and reliability, opens up new perspectives, and strengthens trust – in innovation, progress, and growth. This has been BAM’s mission for over 150 years. Our employees translate research into practical solutions that make technology and chemistry safer, day after day. Here, some of them reveal why current developments in their fields of expertise give cause for optimism.

“Autonomous laboratories are the future of materials science, enabling new discoveries.“

Mohammad Zaki,
Division Material Synthesis and Design

“High-performance glasses demonstrate how scientific ideas lead to real breakthroughs.”

Andrea Stucchi de Camargo,
Head of Division Glasses

"A fair digital quality infrastructure makes the circular economy more socially just."

Mariam Rasheed,
Digitalization of Quality Infrastructure

"New discoveries in laser beam welding enable industry to manufacture more efficiently."

Pablo Pusbatzkies,
Division Welding Technology

"Successful spin-offs show that the results of our research are finding their way into applications."

Teresa Kollakowski,
Research Coordination and Transfer

"Digital acoustic twins improve the monitoring of structural changes in concrete bridges significantly."

Gulshat Zaripova,
Division Building Materials

"Hydrogen storage tanks can now be designed in an even safer, more durable, and more economical manner."

Bartosz Popiela,
Division Safety of Gas Storage Systems and Tanks for Dangerous Goods

"Clearer classifications in dangerous goods legislation reduce bureaucracy and create greater safety."

Viktoria Niemietz,
Division Classification of Hazardous Substances and Dangerous Goods


BUNDESANSTALT FÜR MATERIALFORSCHUNG UND-PRÜFUNG (BAM)
Wissenschaft mit Wirkung
Science with Impact
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BAM and its five focus areas

The Bundesanstalt für Materialforschung und -prüfung (BAM) integrates research, assessment and consultation in technology and chemistry under one umbrella. Within the context of our legal and socio-political responsibilities, we identify needs that will shape safety requirements in technology and chemistry in the future. Our work is focused on five focus areas: Energy, Infrastructure, Environment, Materials, and Chemistry and Process Engineering.

Energy | Infrastructure | Environment | Materials | Chemistry and Process Engineering

Energy

The path to cheaper green hydrogen

A pipe made of a fiber-reinforced composite is filled with a mixture of glycol and water to prepare it for a burst test.

Up to 50 percent of the cost of an electrolyzer used to produce green hydrogen is attributable to the complex steel piping system. Plastic pipes could bring significant cost savings here.

Germany wants to increase its green hydrogen production capacity to ten gigawatts by 2030 – a hundred times its current capacity. Electrolyzers, which use electricity to break water down into its components hydrogen and oxygen, play a central role in this. Compact systems cost up to one million euros, while large devices with a capacity of 100 megawatts cost around 100 million euros.

Plastic as a cost-effective alternative

Up to 50 percent of these costs are attributable to a complex steel pipe system, that is required for the various process steps involved in electrolysis. These pipes must meet high safety requirements to prevent flammable hydrogen from leaking and endangering people.

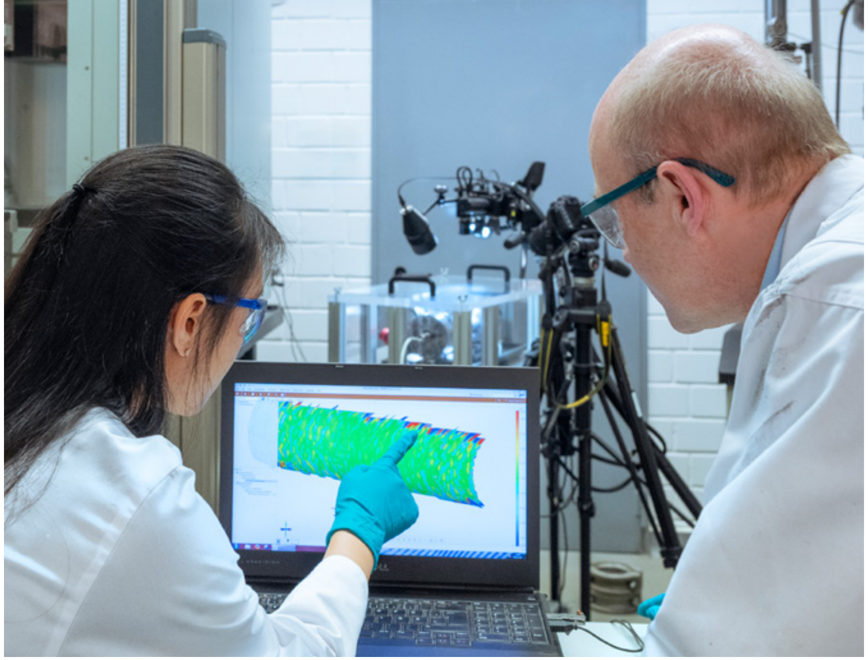
“A significantly more cost-effective alternative to expensive steel would be plastic pipes, such as those already used in the natural gas network today,” explains Volker Trappe, a member of the BAM Hydrogen Competence Center. “There, they have to withstand an operating pressure of 15 bar. In electrolyzers, however, operating pressures of up to 50 bar are generated, depending on the process step.”

In the “PolyH2Pipe” project, which is part of the “Industrial Collaborative Research” program and is funded by the Federal Ministry for Economic Affairs and Energy, he and his colleague Ngoc Tam Thi Nguyen are working closely with researchers and industry to optimize commercially available plastic pipes to make them suitable for use in electrolyzers. “We want to make it easier for small and medium-sized enterprises (SME) that can manufacture such pipes but do not have the necessary testing infrastructure to test them to get started with hydrogen technology and, at the same time, promote the expansion of the hydrogen economy in Germany,” says Ngoc Tam Thi Nguyen.

The focus is on selecting the right materials and optimizing the production process. To achieve the required tensile and compressive strength, glass fiber-reinforced tape is wrapped around the plastic pipes under heat. Among other things, the width of the tape, the number of layers, and the angle at which it is wrapped are important factors.

In the “PolyH2Pipe” project, the Institute for Plastics Processing at RWTH Aachen University is initially advising SMEs on the selection of the right materials and winding technology. The

Deformations in the pipe are measured optically using high-resolution cameras.



The internal pressure is increased in a controlled manner until the pipe bursts.

Before the experiment, the measuring instruments are calibrated to obtain the most reliable data possible.

Welding and Joining Institute, also at RWTH Aachen University, is supporting them in optimizing the joining of the pipe segments.

Plastic pipes suitable for mass production

The BAM team finally tests the burst strength of the resulting pipe samples. Volker Trappe and Ngoc Tam Thi Nguyen have developed a special testing device for this purpose: the plastic pipes are filled with a mixture of glycol and water, which can be compressed via a cylinder so that the internal pressure increases continuously. The results are promising: “While the unreinforced pipes initially withstood a pressure of 30 to 40 bar, after several optimizations of the winding process they now burst at 230 bar,” explains Volker Trappe. To be on the safe side, they should be able to withstand five or six times the operating pressure of 50 bar inside an electrolyzer – and remain resistant to hydrogen, oxygen, and the coolant in the pipes for many years.

In the next step, the team will test the most promising plastic pipes under real conditions and fill them with hydrogen. “Our long-term goal is to bring to market plastic pipes for electrolyzers that are suitable for large-scale production as soon as possible,” says Ngoc Tam Thi Nguyen.

Energy

More wind energy, less steel

A monopile in the plant after fabrication: As turbine performance increases, so do the dimensions of these foundations.

Offshore wind farms require large amounts of steel due to their enormous foundations. Optimized designs and manufacturing processes can save valuable resources and make wind power expansion significantly more economical.

To ensure that offshore wind turbines remain stable in the sea, they need foundations that can withstand waves, storms, and extreme mechanical forces. This is usually a so-called monopile: a huge steel pipe, sometimes over 100 meters long and up to twelve meters in diameter, which is driven into the seabed. The production of a single monopile consumes over 2000 tons of steel. However, corrosion and constant mechanical stress limit its service life to only about 30 years.

Welded steel specimens are subjected to up to five million load cycles to analyze their fatigue behavior.

OptiMP project: Identifying potential savings

The high consumption of resources poses a challenge to the German government's ambitious expansion targets in the offshore wind sector, as it ties up capacity in production and logistics and has a negative impact on the economic efficiency of wind farms.

This is where the BAM-coordinated OptiMP project comes in. By looking at the entire process chain – from the design of a monopile to its manufacture, transport at sea, installation on the seabed, and ongoing operation – the aim is to identify potential savings in resources and at the same time extend the service life of monopiles. "Through targeted improvements in all areas, we expect savings of up to ten percent in steel and an extension of the service life of monopiles by up to 30 percent," explains Marc Thiele from BAM's Wind Competence Center, who is heading the joint project.

One focus is on optimizing the design and manufacturing of critical areas. For example, the weld seams, which are intended to hold the pipe segments together for decades, are particularly important for service life. Is it possible to design or treat them in such a way that they are more fatigue-resistant than before and, as a result, have thinner and more material-efficient steel plates?

"The correct dimensioning of monopiles involves many variables, for some of which there is little robust empirical data, even though offshore wind farms have been connected to the grid in Germany since 2010," explains Marc Thiele. "They are subject to standards that originate from general steel construction, i.e., standards that were developed for bridges and buildings, but which still have potential for optimization specifically for wind turbines. For safety reasons, many turbines are therefore possibly too conservative and the steel plates too thick."

The project aims to provide more clarity here through laboratory tests and realistic load scenarios. For example, it will investigate the extent to which installation at sea damages the welds of a monopile. The steel pipe is driven into the seabed with thousands of blows from a hydraulic hammer. However, the blows may reduce the fatigue strength of the welds less than previously thought, meaning that they could be designed to use less material.

Transfer into practice

In close cooperation with partners from industry and certification, the project results are to be transferred into standardization in order to adapt them for monopiles and accelerate their transfer into industrial practice. The following organizations are participating in the joint project: Fraunhofer Institute for Large Structures in Production Engineering (IGP), Leibniz University Hannover (Institute of Materials Science), JBO Engineering Group GmbH, Grillo Zinc Metals GmbH, and Vattenfall Europe Windkraft GmbH. Associated and project-accompanying partners are EEW Special Pipe Constructions GmbH, Siemens Gamesa Renewable Energy, EnBW AG, Jungheinrich Norderstedt AG & Co KG, ZEISS/GOM Industrial Quality Solutions, Skyborn Renewables GmbH, and DNV Renewables Certification GmbH.

The project is funded by the German Federal Ministry for Economic Affairs and Energy through Project Management Jülich as part of the 8th Energy Research Program. –

> **"We expect savings of up to ten percent in steel and an extension of service life of monopiles by up to 30 percent."**

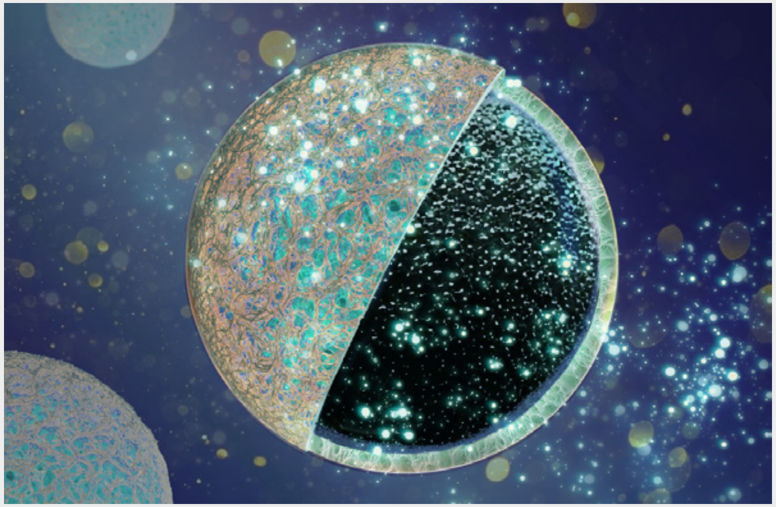
3D scans enable the precise capture of geometries of individual samples and entire components.

High Performance Anodes for Sodium-Ion Batteries

Sodium-ion batteries are considered a promising and sustainable alternative to lithium-ion batteries. However, high storage losses during the first charging cycle have so far hindered the development of improved anodes. The irreversible loss of storage capacity results from a chemical reaction between the anode and the electrolyte, during which electrolyte molecules decompose at the anode and penetrate its pores. This process only stops once a stable and protective film has formed on the anode.

To address this issue, a BAM team developed an innovative core–shell design for the anode. “We realized that in sodium-ion batteries, large storage capacities and efficient film formation cannot be achieved with a single material,” explains Tim-Patrick Fellinger, an energy materials expert. The scientists coated the anode particles (core) with an ultrathin layer (shell) that acts like a filter: it allows the desired sodium ions to pass through while keeping disruptive electrolyte molecules out. This enables the battery to maintain its performance over many charging cycles.

The materials developed already achieve an initial efficiency of 82 percent – without the coating, it is 18 percent. Further development of the anode material will take place at the Berlin Battery Lab (BBL), a collaboration between BAM, Helmholtz-Zentrum Berlin, and Humboldt-Universität zu Berlin, which brings together the top expertise of all three research institutions in the field of sustainable battery technologies.



A very thin layer around the core acts like a filter: it allows sodium ions to pass through but keeps electrolyte molecules out.

At the research filling station, technologies of a digital quality infrastructure are tested under real-world conditions.

Real-World Laboratory Hydrogen Refueling Station Opens

In July 2025, BAM opened a nationally unique digitally monitored research hydrogen refueling station at its Test Site for Technical Safety. The facility makes it possible to develop innovative technologies for quality assurance across all technical processes involved in hydrogen infrastructure systems under real operating conditions, and to test them together with industry and research partners.

“In collaborative projects with industry and the scientific community, we aim to address research questions related to quality and safety,” explains Frank Wille, coordinator of BAM’s Focus area Energy. “At the same time, the research refueling station serves as an ideal real-world laboratory for hydrogen infrastructure, allowing us to test all components of future digital quality assurance.”

The pilot project is supported by the Digital Quality Infrastructure Initiative and is embedded in BAM’s Hydrogen Competence Center, where research focuses on the safety of modern hydrogen technologies.

Energy | **Infrastructure** | Environment | Materials | Chemistry and Process Engineering

Infrastructure

Saving bridges instead of tearing them down

A prestressing steel bar under UV light. The team is creating artificial cracks to test its fatigue behavior.

Between renovation and new construction: Researchers at BAM provide the scientific basis for determining the remaining service life of prestressed concrete bridges – thereby securing economic value.

Germany faces a huge challenge: thousands of prestressed concrete bridges, built between the 1950s and 1980s, are at risk from hydrogen-induced stress corrosion cracking – a type of damage that also led to the collapse of the Carola Bridge in Dresden. This initially causes microscopic cracks in the prestressing wires embedded in the concrete, threatening the integrity of these structures. Over time, these cracks can grow to single broken wires, which can ultimately lead to the failure of the entire structure's load-bearing capacity.

Today, if such cracks are discovered during an inspection, it is often unclear how load-bearing the bridge still is. "Local cracks in individual prestressed wires do not necessarily mean an immediate risk of collapse," explains Gino Ebell, an expert in bridge safety who was also involved in investigating the cause of the Dresden accident. "We lack robust data on how such pre-existing damage develops under traffic loads over the years. Currently, bridges are often closed, demolished, or expensive monitoring systems are installed prematurely – without it being clear whether this is necessary or whether reinforcement measures would suffice."

Science-based decision-making

Gino Ebell's team wants to create a pioneering science-based decision-making method in order to be able to realistically assess the remaining service life of endangered bridges.

The scientists are combining measurements on real bridges with laboratory tests. In autumn 2025, they took specific samples of individual prestressed wires from a busy prestressed concrete bridge near Werder (Brandenburg) in cooperation with the Brandenburg State Road Authority. "We want to determine how high the tension on the material is without traffic load and whether there are already any cracks," explains Maxine Fabian, a member of the team. "We measure how the tension on the tensioning wires in the structure changes when different types of vehicles pass over it at different speeds."

This data serves as the basis for laboratory tests in which the fatigue behavior of prestressed steel is simulated. "We also use real wires from prestressed concrete bridges that have already been demolished," says Maxine Fabian. "We deliber-

In 2025, the behavior of the prestressing wires under various traffic loads was examined on a heavily used bridge near Werder.

In addition, the team extracted prestressing steel tendons from the structure (l.) and subjected them to load tests in the laboratory (below).

The entire data set will ultimately provide a reliable basis for decision-making by authorities and those responsible: Can a prestressed concrete bridge that is at risk remain open despite previous damage? Is a monitoring system such as the acoustic emission measurement used by BAM sufficient? Or is immediate reconstruction necessary?

But BAM's impact goes far beyond acute preservation: we are shaping the future of construction. Thanks to a test procedure for prestressed steel wires developed by the team, which is now firmly established in technical standards, every new prestressing steel must be tested using the procedure developed by BAM before it can be approved. In this way, BAM is transforming past experience into a permanently resilient transport infrastructure.

ately damage them at specific points, creating small cracks, and observe their behavior during cyclic load tests."

Data-based safety instead of blanket closures

All results are entered into a database of damage patterns and structural data. The researchers want to use this to derive threshold values: at what point has a crack grown so large that there is a risk of the prestressed wire breaking? Historical data on air pollution is also entered into the database. "We now know that hydrogen-induced stress corrosion cracking was often triggered during the construction of a bridge – as was the case with the Carola Bridge in Dresden," explains Gino Ebell. "The cause was acid rain resulting from air pollution: sulfur dioxide from the air, in combination with condensation on the exposed prestressed steel, triggered a complex chemical reaction that first led to cracks and, years later, to breaks and ultimately to the failure of the structure."

Tests based on historical measurement data

To better understand these processes, the team is simulating various levels of sulfur dioxide pollution in the atmosphere in a newly developed test chamber based on historical measurement data and investigating their effects on prestressed steel.

Infrastructure

Textile-reinforced concrete in fire tests

In BAM’s fire testing facility, textile-reinforced concrete slabs are tested for their fire resistance.

Lightweight construction saves materials and CO2. But what happens when such components are exposed to fire? Two research projects are investigating this critical safety issue – and testing how innovative lightweight construction can withstand high temperatures.

Lightweight, slim components made of so-called textile-reinforced concrete are considered the future of construction: they save material, are corrosion-resistant, and enable resource-efficient designs. However, reliable data on their load-bearing capacity at high temperatures is still lacking. Recent events have highlighted the importance of robust fire protection in construction. This is where two BAM research projects come in.

Using innovative testing methods, the team examines the load-bearing capacity of textile-reinforced concrete in case of fire.

Carbon fibers instead of steel

"We want to understand how textile-reinforced concrete behaves under extreme heat and how we can ensure its load-bearing capacity in the event of a fire," explains Ahmad Eiz Eddin, one of the two project coordinators. "With these insights, we can enable the use of textile-reinforced concrete in residential and office buildings in the future."

Traditional solid construction relies on steel reinforcement bars to bear tensile forces. In textile concrete construction, corrosion-resistant carbon fiber meshes are utilized for reinforcement. This approach allows for much slimmer cross-sections, saving concrete and reducing mass.

"However, the filigree construction poses special challenges for fire protection," emphasizes Richard Fürst, head of the FiReC³ project. Slim cross-sections heat up much faster than solid components. With rising temperatures, the polymer matrix surrounding the carbon fibers softens. This weakens the bond between the concrete and the carbon reinforcement, which significantly reduces the load-bearing capacity in the event of a fire – potentially causing structural failure.

Fire resistance in a practical test

To prevent the failure of textile-reinforced concrete during fires, BAM researchers are analyzing the effect of high temperatures on the material properties of the carbon reinforcement and the reduction in the bond with the concrete. The teams are developing innovative test methods to do so.

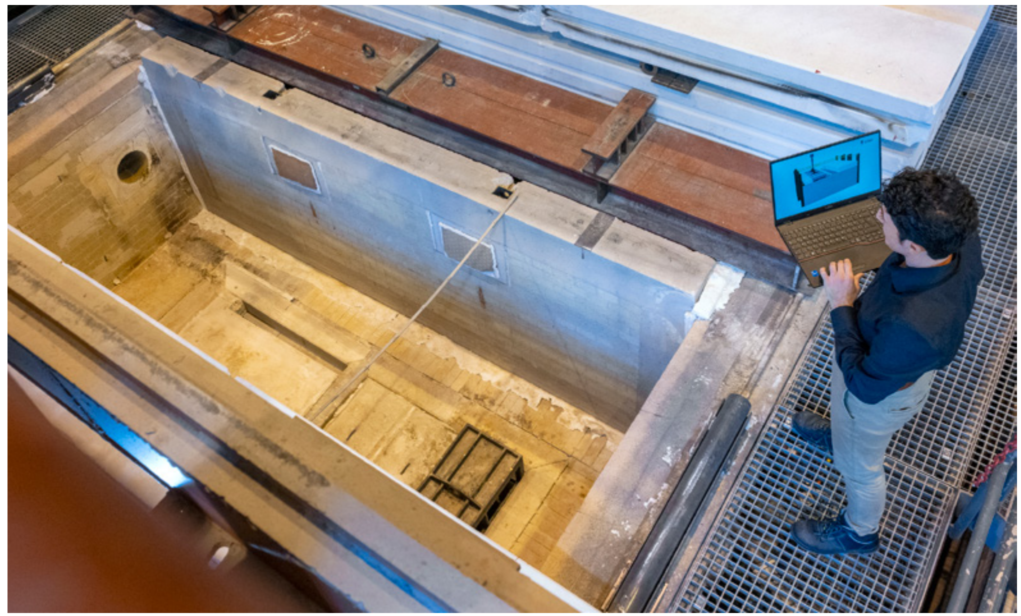
In the CaPreFloor project, coordinated by Eiz Eddin, material tests are being carried out on small and medium-sized test specimens made of textile-reinforced concrete. The team is also conducting fire tests on full-scale slabs to investigate fire resistance under realistic conditions. Four point bending tests reveal the components' load-bearing characteristics while heated simultaneously. The aim: lightweight ceiling systems that withstand fire for 90 minutes – a common requirement in building construction.

Richard Fürst is pursuing a similar approach in his research into beams made of textile-reinforced concrete in the FiReC³ project. The focus is also on material properties in the high-temperature range and the development and testing of lightweight load-bearing components made of textile-reinforced concrete. His work also includes structural designs for fire resistance and the assessment of environmental performance over the entire life cycle of the component.

To increase the fire resistance of the components, the researchers are pursuing several strategies: for example, intumecent coatings that foam up in the event of a fire and thermally shield the textile-reinforced concrete component, as well as the addition of polypropylene fibers to prevent concrete spalling in the event of a fire. They are also developing design rules for construction practice to calculate the load-bearing capacity of textile-reinforced concrete components in the event of a fire.

In the long term, the findings will be incorporated into standards and guidelines. "We want to close existing knowledge gaps," says Eiz Eddin, "in order to expand the scope of application of the new lightweight construction method and enable the safe use of textile-reinforced concrete in building construction."

Coated carbon fibres.



The ceiling testing furnace before the fire test.

Double Recognition for BAM Spin-off "Spree Monitoring"

Spree Monitoring, a spin-off from BAM, received the prestigious Berlin Brandenburg Innovation Award in 2025 and, in January 2026, the top prize in the Berlin-Brandenburg Business Plan Competition. The team was honored for its novel solution for continuous bridge monitoring based on coda wave interferometry (CWI). The Innovation Award jury emphasized that the technology enables a permanent "fitness check" for bridge infrastructure, supporting targeted, needs-based, and predictive maintenance – an important contribution to safeguarding critical transportation structures. When awarding the top prize in the Business Plan Competition, the jury highlighted the "societal relevance" of the business idea. The award was presented, among others, by Brandenburg's Minister of Economic Affairs, Daniel Keller. "We are extremely pleased with both awards. They confirm our vision of making infrastructure safer and more sustainable through intelligent monitoring," said Daniel Fontoura Barroso of Spree Monitoring. Spree Monitoring is supported by the EXIST funding program of the Federal Ministry for Economic Affairs and Energy. At the same time, the team has access to BAM's outstanding research infrastructure during the start-up phase.

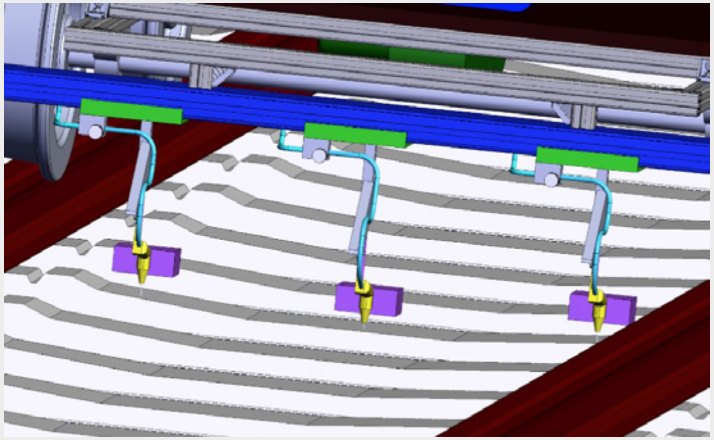
The Spree Monitoring team at the Berlin Brandenburg Innovation Award ceremony.

The Berlin Brandenburg Innovation Award is presented annually by the Senate Department for Economic Affairs, Energy, and Public Enterprises of the State of Berlin and by the Ministry for Economic Affairs, Labor, Energy, and Climate Action of the State of Brandenburg. In 2025, Spree Monitoring was among the six award recipients selected from more than 100 submitted applications.

Air-coupled Method Detects Internal Damage in Railroad Sleepers

The approximately 80 million concrete railroad sleepers in Germany's rail network undergo regular visual inspections. However, during visual track inspection, cracks inside the sleeper body – one of the most common types of damage – cannot be detected or reliably assessed. This makes it difficult to efficiently plan repair measures and the routine replacement of sleepers. A solution to this problem is the so called air-coupled impact echo method, an advancement of the standard impact echo technique. Scientists at BAM investigated the applicability of this method on behalf of the Federal Railway Authority. The conventional method uses mechanical excitation: a tiny hammer strike sets the entire concrete body into vibration, and the frequency is measured. Intact railroad sleepers vibrate above 10.5 kilohertz. If the value drops significantly below that threshold, it is a clear indication of internal cracking – but the test takes around ten minutes. The air-coupled impact echo method replaces the hammer with a concentrated ultrasonic air jet emitted from a nozzle. The advantage: no physical contact with the railroad sleeper is required. This enables continuous testing, for example from an inspection train – within just a few milliseconds.

"The method we tested in the laboratory could theoretically be used at speeds of up to 80 kilometers per hour. This would allow rapid, automated, large-scale inspection of railroad sleepers," says Christoph Strangfeld, an expert in non-destructive testing methods. This would improve the planning of maintenance measures and increase the operational efficiency of the rail network. The method will now be tested on a rail inspection trolley and could, in the future, enhance safety in railway infrastructure.

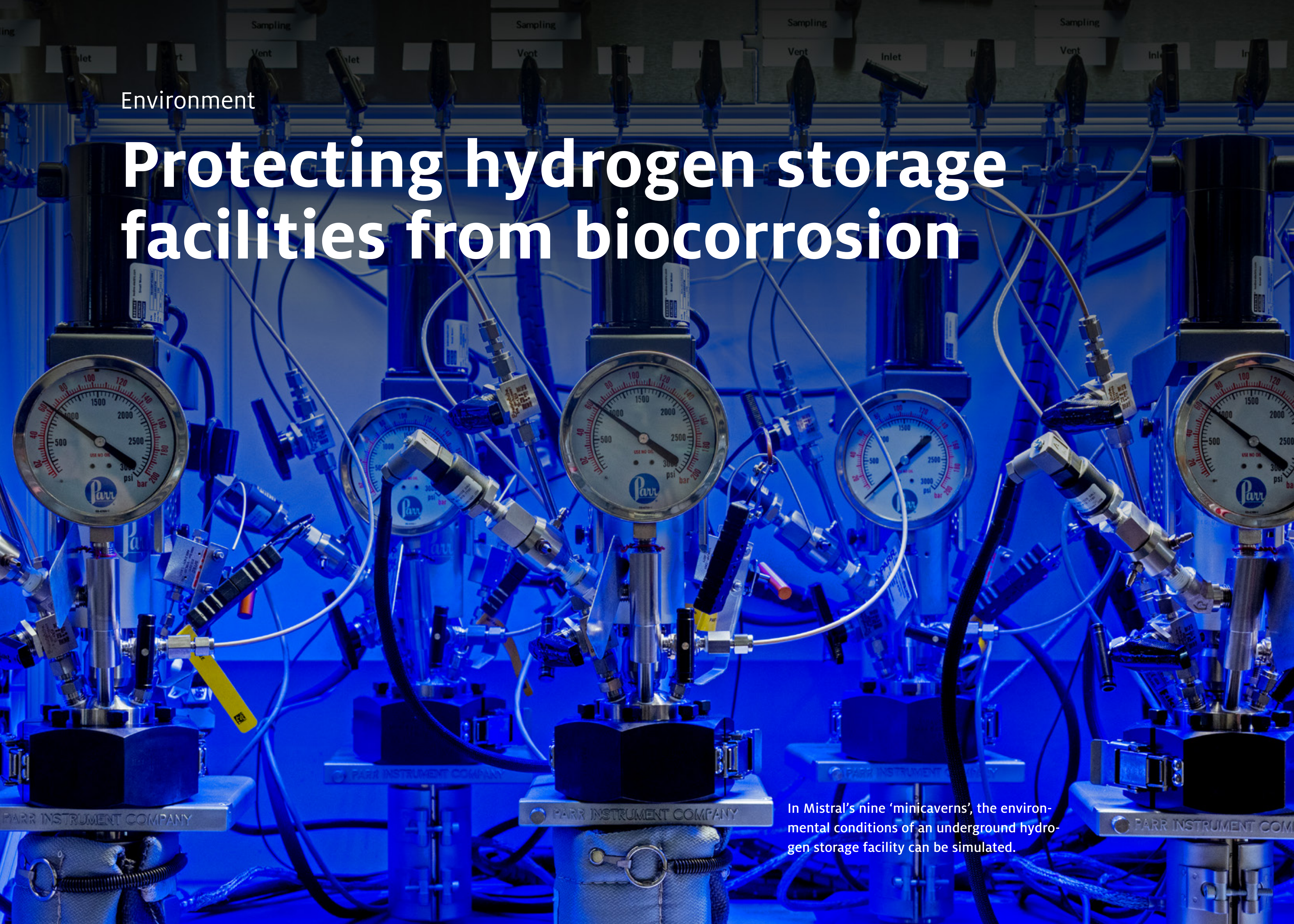


The method enables the inspection of railroad sleepers from a measuring vehicle – within milliseconds.

Energy | Infrastructure | **Environment** | Materials | Chemistry and Process Engineering

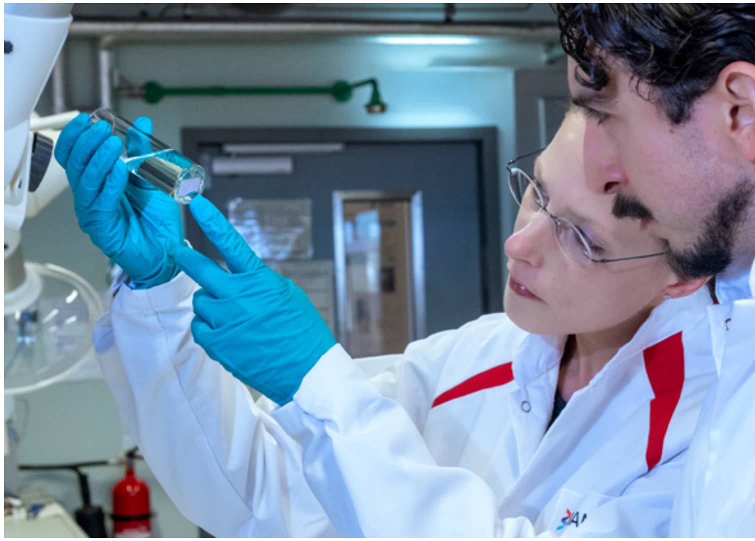
Environment

Protecting hydrogen storage facilities from biocorrosion



In Mistral’s nine ‘minicaverns’, the environmental conditions of an underground hydrogen storage facility can be simulated.

Microorganisms in hydrogen caverns pose a risk: they consume the energy source and can damage pipes. The new Mistral system makes it possible for the first time to study the biochemical processes in greater detail and develop countermeasures.

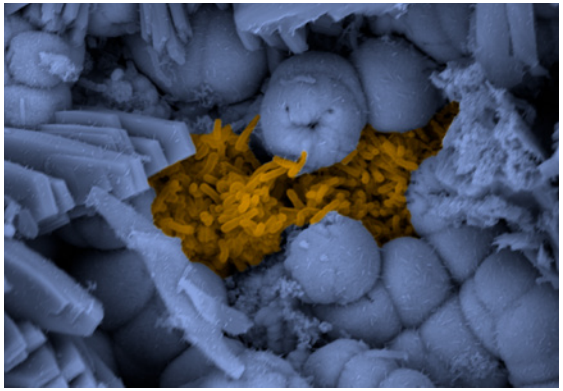


In the future, green hydrogen is to be stored increasingly in underground salt caverns. The cavities, which are up to 1,500 meters deep, are considered particularly safe against leaks and offer significantly more storage capacity than above-ground tanks. However, there is an unexpected danger: microorganisms—tiny single-celled organisms that colonize the warm, humid caverns in their billions. The conditions there are ideal for them, and they use hydrogen as "food" and a source of energy.

Up to 15 percent loss due to microbes

"Studies show that microbes in caverns could consume 10 to 15 percent of the stored hydrogen," explains Andrea Koerdt, an expert in biocorrosion. "This doesn't just mean economic losses. During their metabolism, the microorganisms also produce gases such as methane, which contaminate the hydrogen and can later damage fuel cells or turbines. To avoid this, complex purification processes are carried out when extracting hydrogen. Hydrogen sulfide is particularly critical – a highly corrosive gas that attacks pipes, risers, valves, and seals inside the cavern.

Material samples are deliberately exposed to microbes that produce, for example, methane in order to test them for corrosion processes.



For two or more weeks, the samples are exposed to pressures of up to 80 bar and to hydrogen or water mixtures.

Such damage would be extremely difficult to repair at depth."

Little research has been done on the biological processes that take place under these extreme conditions. "We have no experience yet with storing hydrogen underground in such quantities, concentrations, and under extreme pressure," adds Koerdt's colleague André Abilio. Previous laboratory tests have been conducted in autoclaves, which do not allow for adjustments to pressure, temperature, or gas mixture during operation. When the autoclave is opened at the end of a series of tests, the sudden drop in pressure destroys all microbes – reliable findings for real conditions are lacking.

"Mini-caverns" as a simulation platform

To better understand these processes and develop counterstrategies, Koerdt and Abilio designed the "Mistral" system: a simulation platform for high-pressure experiments with hydrogen. Nine containers made of certified steel serve as "mini-caverns" and provide space for material samples made of metal, polymer, or elastomer materials. They can be filled with hydrogen and microbial cultures at up to 80 bar. A sophisticated system of supply lines and high-pressure valves makes it possible to take samples or add substances during operation – without reducing the pressure in the container. For the first time, it is now possible to observe over a period of weeks how microbial communities develop in a hydrogen environment, which metabolic products are produced, and how they damage materials. "We can also use the supply lines to add precisely measured doses of biocides and test whether they inhibit microorganisms that produce hydrogen sulfide, for example," explains André Abilio.

The findings will help companies that operate hydrogen caverns – for example, in selecting suitable materials for pipelines, developing non-corrosive coatings, and even devising targeted biocide strategies. Collaborations with energy suppliers such as RWE are already in the planning stage.

Mistral's potential extends beyond hydrogen storage: the steel structures of offshore wind turbines are also at risk from corrosion in deep water, where high pressure and microbes interact. Microorganisms can also become a problem for underground repositories for high-level radioactive waste. "With Mistral, we can investigate how pressure and microbiology influence each other," says Koerdt. "In this way, we are helping to develop solutions to important technical challenges of the energy transition."

Environment

A key role for old concrete

Laser-induced breakdown spectroscopy can be used to determine which elements are present in a given concrete.

Concrete is the most widely used building material worldwide – and at the same time one of the most harmful to the climate. Most concrete components are crushed after their service life. A current research project aims to demonstrate how load-bearing columns and walls can be reused in a resource-efficient manner.

When buildings are demolished today, concrete columns, walls, and slabs are usually shredded, at best, reused as low-grade fill material, for example in road construction or landscaping. Reuse in a load-bearing function is still rare. "If we no longer regard concrete as a disposable material but as a valuable resource within a circular economy, we could significantly reduce the carbon footprint of the construction sector," explains Ernst Niederleithinger, project manager at BAM.

He and his team are part of a Collaborative Research Centre funded by the German Research Foundation and coordinated by Ruhr University Bochum. More than 50 researchers from civil engineering, architecture, mechanical engineering, and computer science share a common goal: rapidly and reliably assessing load-bearing concrete components such as columns, walls, and slabs after demolition and enabling their reuse in new buildings.

Scanning for re-use instead of shredding

But how can reinforced concrete elements weighing several tons be tested efficiently and safely? The BAM team relies on a combination of non-destructive testing methods. The Torrent permeability tester, for example, measures the air permeability of concrete – a key indicator of durability and potential corrosion risk. The denser the material, the better the steel reinforcement is protected against damaging ingress processes. Additional information on near-surface material quality is obtained within seconds using a rebound hammer, which provides an indication of surface hardness.

Ultrasound and radar methods are used to look inside the components. Ultrasonic waves propagate well only in intact material and are particularly sensitive to fine cracks, voids, and structural changes, allowing a precise assessment of internal material quality. The electromagnetic waves of a radar device can be used to reliably locate metallic objects such as reinforcing bars or tension channels. Only the combination of both methods yields a comprehensive three-dimensional picture of the component: ultrasound reveals fine defects, while radar exposes the hidden internal structure.

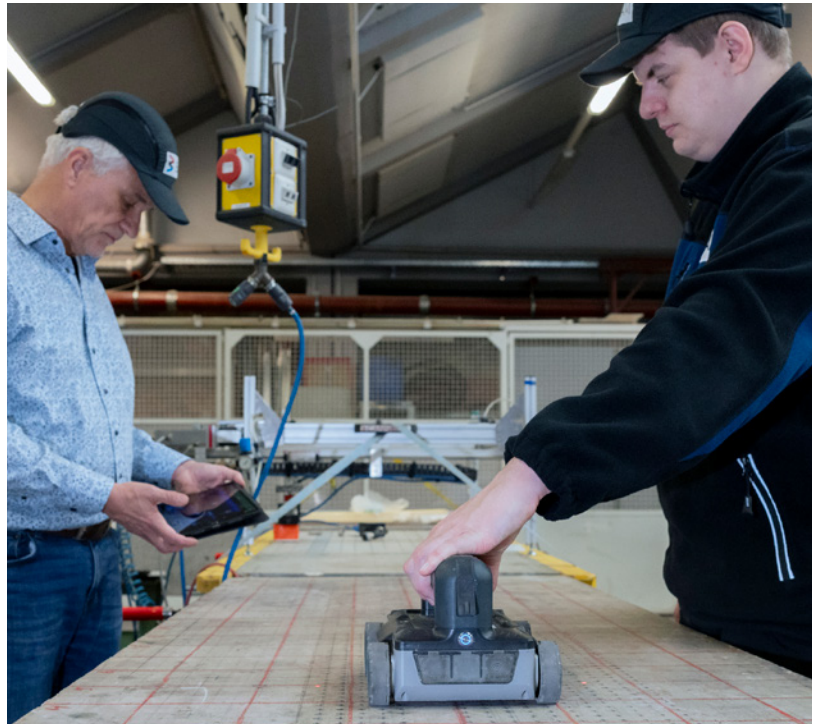
Based on the precise multi-element analysis, it is possible to determine for which purpose a concrete component can be reused.

"If we no longer regard concrete as a disposable material, we could significantly reduce the carbon footprint of the construction sector."

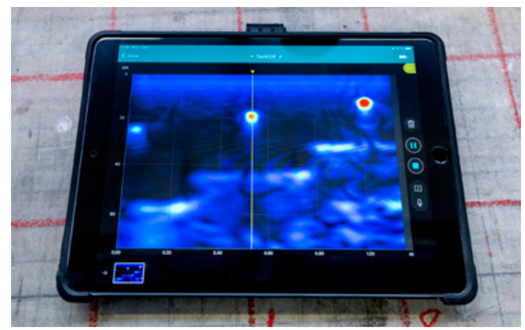
Chemical information is added using laser-induced breakdown spectroscopy (LIBS), a modern technique for elemental material analysis. Short, high-energy laser pulses remove minute amounts of material from the surface and generate a plasma whose emitted light is characteristic of the elements present. The resulting emission spectrum reveals, for example, cement constituents or potentially harmful substances such as chlorides.“ LIBS allows us to detect the presence and content of multiple elements simultaneously – rapidly and with minimal material damage,” explains Sabine Kruschwitz, a LIBS expert. “The method is mobile and enables multi-element analysis that cannot be achieved in this form with conventional methods.”

From scan to classification

The collected data is integrated into classification models that assign quality and durability classes to reclaimed components. Engineers are thus provided with a robust basis for decision-making when evaluating different reuse scenarios. Reused elements must, of course, comply with current design standards for new construction – a challenge that remains. “Our long-term objective is an automated system that enables a precise and economical assessment of previously used concrete components, thereby paving the way for a truly circular construction industry,” says Ernst Niederleithinger. ▬



Testing air permeability with the Torrent tester shows how susceptible a concrete is to corrosion risks.



New Recycling Process for Phosphorus Recovery

In October 2025, in the presence of the Bavarian Minister of Science, Germany's most advanced facility for phosphorus recovery was opened in Altenstadt (Upper Bavaria), which converts sewage sludge into high-quality fertilizer. The plant uses a process developed by BAM.
The Emter GmbH facility processes up to 50,000 tons of dried sewage sludge annually and converts it into 15,000 tons of highly effective phosphate fertilizer. This marks the first large-scale industrial implementation of a unique German recycling process for phosphorus at Emter's plant in Altenstadt.
"With this highly efficient technology, we are making an important contribution to the circular economy and to securing the phosphorus supply in Germany," says Christian Adam (BAM), who has overseen the project with his team in recent years.
"We make use of what creates the future. Our collaboration with BAM enabled us to implement an innovative process on an industrial scale – one that sets new standards for sustainable sewage sludge utilization and phosphorus recovery," explains Johann Emter, Managing Director of Emter GmbH.
The fertilizer produced will be used entirely within the region of Bavaria. This creates a closed material cycle – from wastewater treatment to sewage sludge processing to agricultural application.

The facility for phosphorus recovery in Altenstadt, Bavaria.

PFAS Detection in 15 Minutes

Until now, detecting PFAS has been complicated, expensive, and only possible in a laboratory – too slow for a rapid response. Researchers at BAM have developed a compact sensor system that can detect PFAS directly on-site in aqueous samples – quickly, reliably, and cost-effectively.
The new method delivers results in less than 15 minutes and can detect even small amounts of the chemicals. The system works with a combination of tiny fluorescent particles and a microfluidic platform – a miniature pocket-size laboratory. "The combination of materials science and microfluidics opens up new pathways for monitoring remediation and washing processes in environmental management – not only for PFAS but also for other pollutants," says Knut Rurack, an expert in chemical and optical sensing at BAM.

The detection method combines fluorescent particles with a microfluidic platform – a pocketsized minilab.

Energy | Infrastructure | Environment | **Materials** | Chemistry and Process Engineering

Materials

Accelerated glass development through automation

The robot performs the entire melting process fully automatically.

Digitalization and automation are revolutionizing glass research: The GlasAgent project is accelerating processes, integrating recycling, and opening up new perspectives for sustainable high-performance glasses.

Glass is a key material for many high-tech applications – from displays and touchscreens to light-emitting diodes, glass ceramics, and fuel cells. In view of dynamic technological developments, specialty glasses must be continuously optimized. However, the development of new glasses often takes three to five years and requires hundreds of melting tests before the right composition is found – an enormous time and cost factor for industry and research. This is exactly where the GlasAgent project comes in: it aims to accelerate this process and eliminate a major bottleneck in the glass industry.

Digitization of complex material development

The aim is to digitize the entire development process and also integrate the aspect of recycling in order to accelerate glass development overall and make it more precise and sustainable. The research project is part of the MaterialDigital platform initiative, which promotes digitization in materials science and involves leading German research institutes in the field of materials science alongside BAM. The platform is funded by the Federal Ministry of Research, Technology, and Space.

“The challenge with glass as a material is to link simulation, databases, and real melting processes in such a way that an intelligent cycle is created,” explains Stefan Reinsch, glass expert at BAM. To this end, the project team is working with science and industry to develop a largely autonomous software: the GlasAgent.

In the future, material requirements, such as temperature resistance, optical properties, or chemical stability, will be able to be formulated using an input tool, supported by optimized physical, thermodynamic, and AI models. Based on this, simulations calculate initial proposals for the composition of the desired glass. These can then be produced in BAM’s automated glass melting system and automatically analyzed for important properties such as composition, density, homogeneity, and residual stresses. The results are fed back into the algorithm – a continuous optimization process.

Glass consists of simple basic components – their composition determines its suitability as a high-performance material.

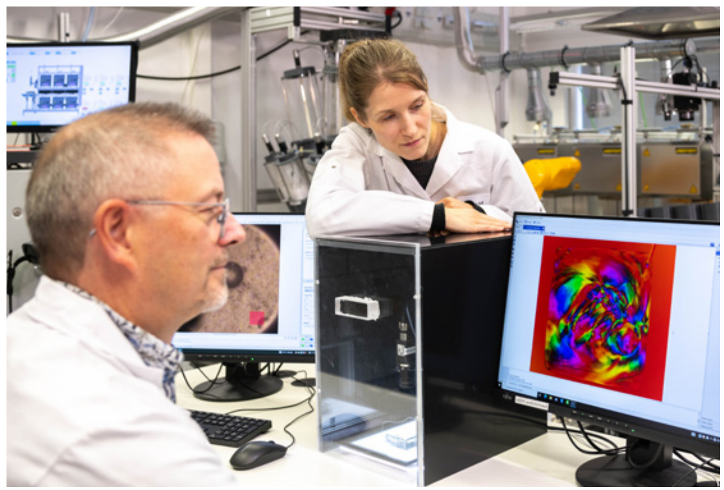
The automatic cooling process after melting is particularly challenging from a technical perspective. “Glass must not cool too quickly, otherwise stresses arise that make further processing difficult,” explains Tina Waurischk of the BAM team. For this reason, the plant already integrates models and sensors that predict and control the optimum cooling program. This ensures that the glass is stress-free and usable.

High-performance materials with recycled glass

In general, glass is a very environmentally friendly material – it can replace plastics based on harmful PFAS in many applications, for example. However, only a small proportion of high-performance glass is currently recycled, partly because it has to meet very specific requirements. In the future, GlasAgent should make it possible to incorporate a higher proportion of recycled glass into new high-quality products in a targeted and precisely dosed manner. “This would be an important contribution to resource conservation and to improving the carbon footprint of high-performance glass,” says Stefan Reinsch.

Alongside BAM, nine partner institutions are involved in the project, including Schott AG as consortium leader, PRALL-TEC GmbH as a globally active recycling company, Gesellschaft für Technische Thermochemie und -physik mbH (GTT), LTB Lasertechnik Berlin GmbH, the Fraunhofer Institute for Production Technology IPT, and the universities of Jena, Clausthal, and Rostock.

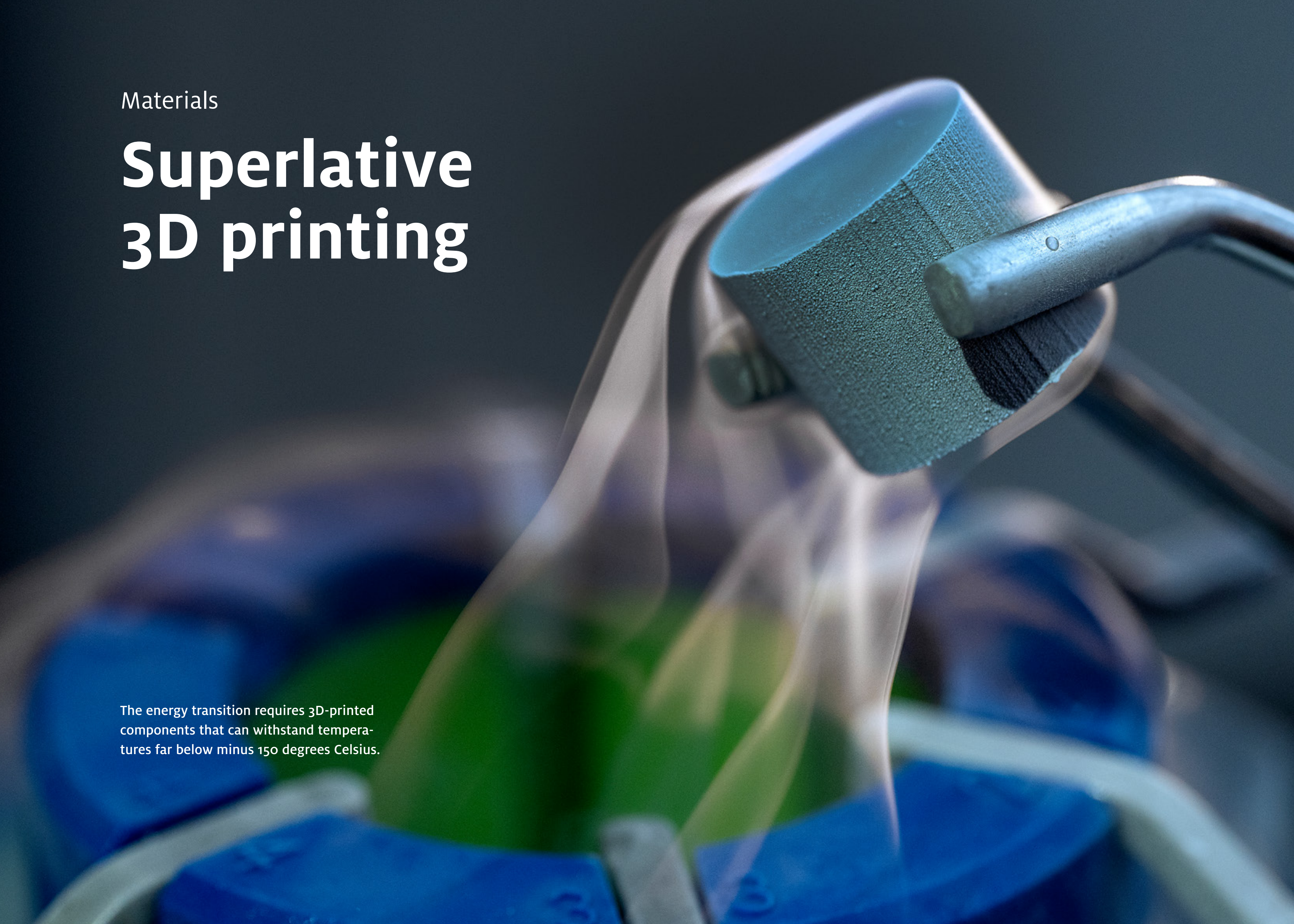
The results will later be incorporated into standardization and accelerate the transfer to industrial practice. “With this project, we are laying the foundations for a new type of glass development. This not only increases efficiency but also opens up further areas of application for high-performance glasses,” says Tina Waurischk.



The cooling process is particularly demanding – if the temperature drops too quickly, residual stresses can remain in the glass.

Materials

Superlative 3D printing



The energy transition requires 3D-printed components that can withstand temperatures far below minus 150 degrees Celsius.

What if components from a 3D printer were so small and precisely designed that they allowed light to pass through? Or so robust that they functioned reliably even in extreme cold? This is what two junior research groups at BAM are working on.

Additive manufacturing allows complex components to be manufactured layer by layer in a resource-efficient and flexible manner. This is indispensable in industries such as aerospace, energy technology, and optical and medical applications. But the demands are increasing: today, components must not only be precise, but also extremely robust – from tiny structures for optical systems to durable components for the hydrogen economy.

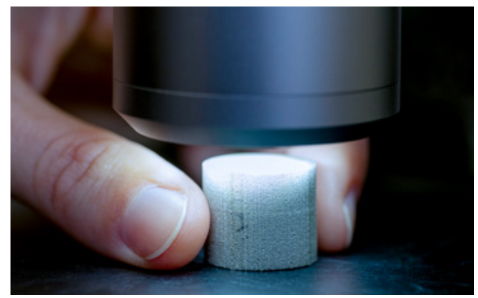
Transparent ceramics for high-tech applications

Transparent ceramics have unique properties: they are heat-resistant, chemically durable, and at the same time tranparent. This makes them ideal for optical applications such as fiber optics or sensors. However, 3D printing of such materials in the micro and nano range is challenging. Two-photon polymerization (2PP) technology plays a key role here. In this process, a laser cures a material only where two photons are absorbed simultaneously – at the tiny focal point. This creates extremely fine structures inside the material, with precision down to the nanometer range.

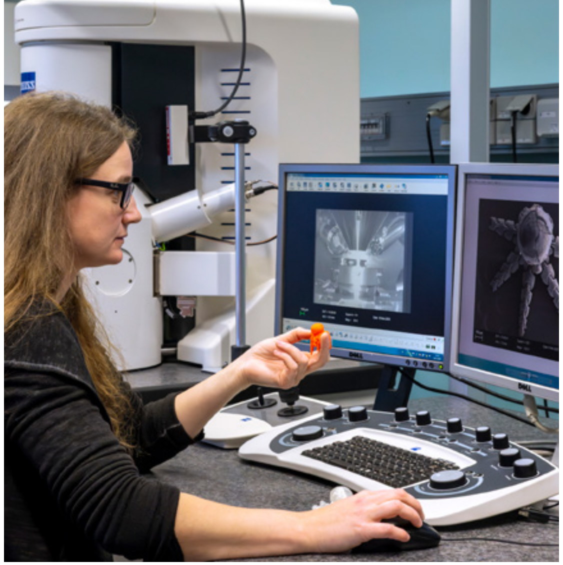
The TransNanoAF junior research group headed by Johanna Müller-Elmau has developed special transparent "inks" for this purpose, which remain transparent despite the ceramic particles they contain. The small particle size of only a few nanometers is crucial. "The smaller the particles, the less light is scattered. This results in a robust, transparent ceramic," explains the scientist. This technology can be used to produce structures ranging from the micro to the millimeter range – as small as the dot on an "i." Such precision enables new designs for optical components such as light guides. At the same time, it opens up prospects for individualized medical technology. The German Federal Ministry of Education and Research is funding the project with €1.9 million over five years as part of its NanoMatFutur program. BAM is providing support in the form of state-of-the-art laboratory and IT infrastructure as well as additional funding.

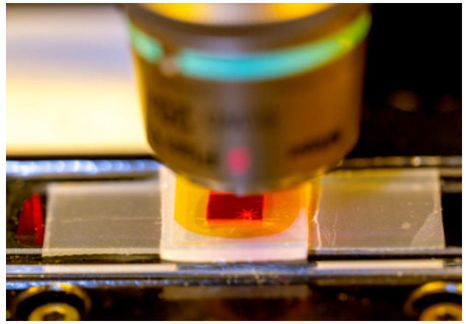
Robust metals for the energy transition

While ceramics involve micrometer-range manufacturing, the Low Temperature Additive Manufacturing junior research group focuses on addi-



The team investigates the mechanical behavior of additively manufactured metallic materials at extremely low temperatures.





Transparent inks can be used to print filigree structures in the micrometer range.

tively manufactured metal components that are used under extreme conditions, such as in the hydrogen industry. There, materials must function reliably even at temperatures well below freezing. “The energy transition requires materials that are reliable even at cryogenic temperatures,” explains Daniela Schob, head of the group.

3D printing in extreme cold

Her team combines 3D printing, material testing, computer simulations, and artificial intelligence to thoroughly evaluate the performance and safety of the components. To do this, the researchers cool 3D printed metal samples to cryogenic temperatures. They then test how the material behaves in this extreme cold, whether it deforms or breaks more easily. In this way, they hope to better assess how reliably such components will function later in hydrogen plants and where their limits are.

“In these cryogenic tests, we not only see how suitable a material is, but above all whether it remains stable and safe even under extreme conditions. This is precisely what is crucial for hydrogen systems,” says Schob.

The group is the result of a collaboration between BAM and the Brandenburg University of Technology (BTU) Cottbus-Senftenberg. The team benefits from the excellent laboratory equipment available at both partners. Both BAM junior research groups demonstrate how 3D printing can advance future technologies in extreme environments.

Materials Scientist Reza Darvishi Kamachali Receives ERC Consolidator Grant

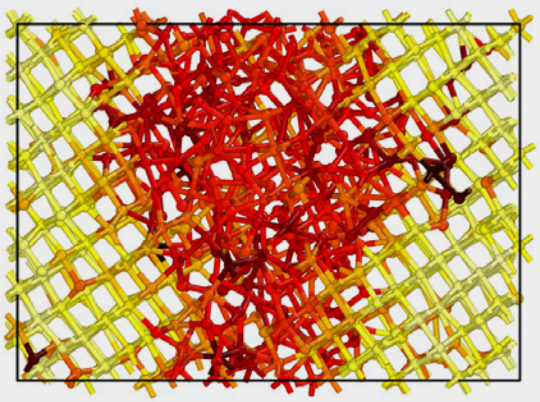
In December 2025, Reza Darvishi Kamachali of the Materials Engineering Department at BAM was awarded a Consolidator Grant from the European Research Council (ERC) – one of the most prestigious European funding programs for outstanding scientists. His project “Assessing Microstructure Phase Maps (AMASE)”, which focuses on the behavior and development of advanced high-performance materials, will receive €2 million in funding over the next five years.
In this project, Kamachali is developing new methods for the consistent calculation of thermodynamics and kinetics of material defects in materials. The goal: to predict how defects in real-world materials rearrange, interact, and stabilize each other, and how their “landscape” determines the performance limits, service life, and safe application of advanced materials. “The predictability of such defects drastically shortens development time in materials research, especially for demanding applications in the automotive, battery, and aerospace industries,” says Reza Darvishi Kamachali, who, in addition to his work at BAM, also holds the Chair of Materials Modelling at the Institute of

Prof. Dr.-Ing. Reza Darvishi Kamachali

Materials Physics at the University of Münster. “In this way, AMASE drives a digitally accelerated innovation cycle for high-performance materials, enabling safer, more durable, and more reliable components for demanding applications.”

Safe Nanomaterials

Their surfaces play a crucial role in determining how nanomaterials function, how they interact with their environment, and how safe they are. These surface structures are often complex and frequently difficult to characterize under practical, realworld conditions. To address this challenge, two studies published in 2025 analyzed different types of nanoparticles commonly used in the life sciences and in consumer products. The studies systematically compared conventional and newly developed measurement techniques as well as combinations of methods.
The result: Only a targeted mix of methods – such as optical techniques, electrochemical methods, qNMR (quantitative nuclear magnetic resonance), and Xray photoelectron spectroscopy – provides a complete and reliable picture of particle surfaces. "Our studies show how important it is to combine different analytical methods to assess the actual functionality and safety of nanomaterials," explains Ute Resch Genger, an expert in nanomaterials at BAM.



The software independently generates new material structures.

BAM and Oxford Develop Simulation Software

Materials research is increasingly relying on digital methods to develop new materials – for example, for more powerful memory chips, innovative battery components, or sustainable construction materials. However, the underlying simulation models require high-quality training data, and researchers still have to perform many steps manually.
To address this, researchers at BAM, together with the University of Oxford, have developed the open source software platform autoplex. Autoplex automates the entire process: the software independently generates new material structures, performs quantum mechanical calculations, and creates a trainable model from them – all within a repeatable and scalable workflow.
"With autoplex, we have already been able to efficiently and reproducibly model complex material systems such as silicon dioxide or memory materials for microelectronics applications – with significantly reduced manual effort," says Janine George, head of BAM's Digital Materials Chemistry division, who developed the software together with her team and the research group of Volker Deringer at the University of Oxford.

Energy | Infrastructure | Environment | Materials | **Chemistry and Process Engineering**

Chemistry and Process Engineering

Reliable detection of unknown PFAS

PFAS are contained in many batteries, especially in the electrolyte. Their durability makes them an environmental concern.

PFAS are currently indispensable in many technologies, but at the same time they pose a growing environmental problem. BAM is developing new analytical methods to reliably identify PFAS. This creates a robust basis for regulation, product design, and environmental protection.

Per- and polyfluoroalkyl substances (PFAS) are dubbed "forever chemicals." They are extremely stable, water- and grease-repellent, and are found in numerous products – from cosmetics, food packaging, and outdoor jackets to semiconductors, fuel cells, and batteries for electric cars. The reason: PFAS increase the performance and service life of materials. But it is precisely this stability that becomes a problem when they enter the environment.

A virtually vast class of substances

PFAS now form a huge class of substances with thousands of variants. However, manufacturing companies do not always disclose which compounds they use in their products. Even substances that are already known are difficult to analyze – and detecting previously unknown PFAS compounds is even more complicated. In order to improve analysis in this area, BAM is developing reference materials for PFAS and rapid tests for on-site sample analysis, as well as filters made of nanomaterials to remove these forever chemicals from wastewater and incineration methods for safe disposal.

Juliane Scholl and Jan Lisec from the Organic Trace and Food Analysis department have set themselves the goal of developing detection methods specifically for PFAS in lithium-ion batteries. Fluorinated compounds are the key to long-lasting, heat-resistant batteries. They are found in many batteries, albeit often only in tiny quantities. Finding them is particularly challenging in aged batteries, where they are hidden in a complex mix of hundreds of other substances. "These 'battery' PFAS are now appearing in soil and water," explains Juliane Scholl. "This makes it urgently necessary to be able to detect them reliably."

The BAM team relied on two different but complementary approaches: target and non-target analysis. Target analysis specifically searches for known PFAS compounds. Reference substances serve as a kind of "fingerprint." Juliane Scholl extracted the electrolyte fluid, which was often barely present, from a large number of used batteries. Using mass spectrometry, all the molecules contained were broken down into fragments and the mass of the individual fragments was then determined. "Based on the results, we

Through mechanical shaking, PFAS are extracted and purified from the samples and thus prepared for analysis in the mass spectrometer.

> **“PFAS from batteries are now appearing in soil and water.”**

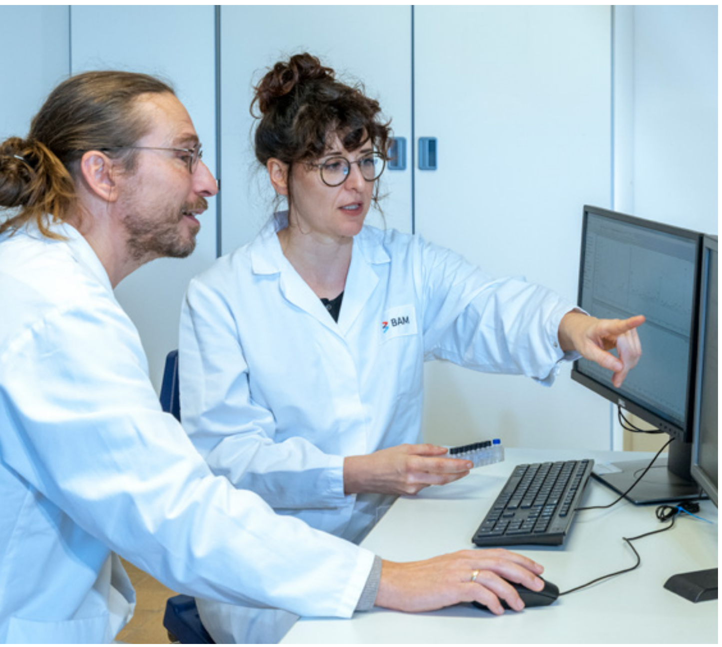
were able to detect 19 commonly known PFAS substances in lithium-ion batteries,” said Scholl.

Detecting the unknown

But what about PFAS for which there are no reference substances available? Non-target analysis came into play to track down these completely unknown compounds. “We used particularly precise mass spectrometry and evaluated the data using special methods to identify unknown PFAS. In doing so, we look for typical characteristics such as small deviations in the measured mass and fragments of molecules that contain many fluorine atoms. With the help of algorithms, we search the data specifically for patterns that indicate fluorinated compounds,” explains Jan Lisec. In this way, the team was able to detect a further 33 PFAS substances in the lithium-ion batteries examined.

Particularly noteworthy: the BAM scientists also found PFAS that had apparently developed from other fluorinated compounds during the use of the battery – i.e., they were not contained in the original product. “These transformation products are particularly relevant because they have not been taken into account in any analytical considerations to date,” says Juliane Scholl.

The methods developed are not limited to batteries and can also be applied to other complex materials. “Our goal is to establish methods for determining PFAS in a wide variety of materials and concentrations,” explains Jan Lisec. “Then we can provide data for an informed discussion about necessary regulations and the safe handling of these persistent chemicals.”



The team was able to detect more than 50 different PFAS compounds in spent lithium batteries.

Chemistry and Process Engineering

New formula for more efficient dangerous goods testing

Dangerous goods packagings, such as this steel drum for transporting solvents, must pass a drop test before approval.

A 900-kilogram foundation just to test an 18-kilogram fiberboard box? What sounds absurd is often an expensive reality in dangerous goods transport. A BAM project aims to change this with a formula that frees testing processes from unnecessary regulations.

Germany is a hub for international dangerous goods transport: around 280 million tons of dangerous goods are transported here every year. Not only tankers play a role in this, but increasingly also the general cargo business with fiberboard boxes for lithium batteries or steel drums for chemicals. While transport volumes are increasing, an international regulation for dangerous goods, which applies to Europe and a total of over 50 countries worldwide, is slowing down the industry. It stipulates unrealistic drop tests for every type of packaging.

Previous standard hardly feasible for companies

A dangerous goods container is dropped from a certain height onto a foundation. According to the standard, this must have an "unyielding" surface in order to cause maximum damage and must have at least 50 times the mass of the packaging to be tested, including its contents. "The standard is hardly feasible for many manufacturing companies or involves high costs," explains Nikolaos Lengas, an expert in safe transport of dangerous goods at BAM. "For example, they have to build foundations weighing tons for testing cardboard boxes for batteries.

Nikolaos Lengas conducted a research project, the results of which are now available as a dissertation, to investigate whether the mass ratio is really the decisive factor in achieving the required "unyielding" impact surface. To this end, he conducted over 100 drop tests with a corrugated fiberboard box, such as those used for hazardous substances in powder or granulate form, smaller containers of chemicals, or batteries, as well as with a steel drum in which solvents, for example, are transported. Both containers weighed exactly 18 kilograms when filled. He dropped them onto three different steel impact surfaces corresponding to 15, 30, and 50 times the mass of the packaging.

For the test series, Nikolaos Lengas dropped the plastic-filled drum onto three different impact surfaces.

Sensors and high-speed cameras recorded the forces developed, the duration of the impact, and the degree of deformation of the packaging and foundations. “The two containers reacted completely differently,” reports Lengas. “Whether the impact surface was 15, 30, or 50 times heavier than the container made little difference.” This proved that the standard requiring a foundation 50-times heavier is outdated.

A formula for safe testing

At the same time, the BAM scientist developed numerical models to determine the decisive parameters for safety testing of dangerous goods packagings. It became apparent that the design of the foundation, its rigidity, and stability are also essential aspects. If, for example, it deforms elastically on impact or dissipates energy into the ground – instead of into the container – this significantly changes the test results. And even a very heavy foundation can give way if it is poorly constructed.

Nikolaos Lengas’ detailed calculations and investigations led him to conclude that a mass ratio of 1:3 can be perfectly adequate for the safety testing of fiberboard boxes, provided that the impact surface is sufficiently rigid and energy transfer into the ground is taken into account. Lengas ultimately developed a formula to help companies evaluate their existing test foundations. “The idea is that in the future, we will no longer blindly demand 50 times the mass, but instead check whether a foundation has the necessary rigidity,” says the researcher. This would allow companies to save costs in the future while still ensuring safety.

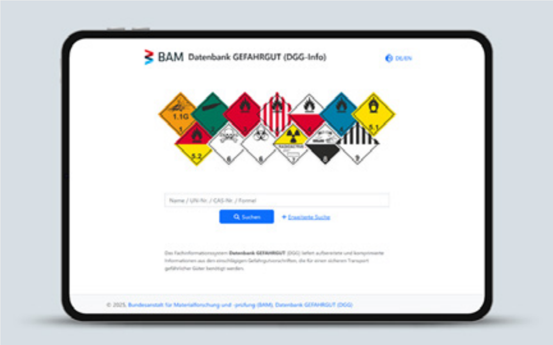
With a view to adapting the international standard, further full-scale tests are planned. The aim is to develop a reference method that modernizes the current dangerous goods regulations and makes them more practical. “We don’t want to water down the rules, we want to make them more precise,” emphasizes Lengas. “Ultimately, it’s about balancing safety and economic efficiency.”

The result: It is not the hardness of the impact surface alone that is decisive for the drop tests, but its design and stability.

New EU Standards for Civilian Explosives

BAM, together with its partners, has revised and updated 57 European standards for civilian explosives. The aim of these new regulations is to enhance safety levels, promote technological innovation, and strengthen the free movement of goods within the European single market.
Civilian explosives are used in many areas: in the construction of tunnels and railway lines, in the extraction of metals for batteries and other key technologies, and in controlled building demolitions in urban environments. Outdated or inconsistent technical requirements can have serious consequences – ranging from safety risks on construction sites to delays and cost overruns in major infrastructure projects.
The revised standards ensure uniform safety requirements across Europe. An explosive manufactured in Spain, for example, can now be used in Germany under identical technical and safety-related conditions. Alongside BAM, the standardization efforts involved the German Institute for Standardization (DIN), the European Committee for Standardization (CEN), as well as European manufacturers, users, market surveillance authorities, and conformity assessment bodies.

At the Test Site for Technical Safety,
BAM examines civilian explosives.



The online database provides comprehensive information on dangerous goods regulations.

Hazardous Materials Database Available Free of Charge

As part of its open source strategy, BAM made its GEFAHRGUT (DGG) database freely accessible online in 2025. This step represents an important contribution to digital transformation and standardization in the field of hazardous materials.
The database provides curated information from the regulations governing the transport of dangerous goods by road, rail, inland waterways, sea, and air. Its primary target groups are authorities and companies that plan, conduct, or monitor hazardous materials transport and wish to integrate regulatory data into their own applications.

Through its involvement in national and international committees, BAM has access to all relevant information regarding the development of regulations in hazardous materials law. Regular updates are essential, as the dangerous goods regulations are revised every two years. Until now, much of the DGG content was only available for a fee. Information on individual substances can now be accessed either via the DGG Info user interface or downloaded as a complete dataset.

Anita Schmidt Receives the 2026 German Dangerous Goods Award

In February 2026, Anita Schmidt was honored with the German Dangerous Goods Award. Presented by the editorial team of the trade journal “gefährliche ladung”, the award is considered the most important distinction in the field of dangerous goods safety. It recognizes outstanding individual achievements that significantly contribute to improving safer handling, transport, or regulation of hazardous materials.
In her award speech, Dr. Claudia Elif Stutz, State Secretary at the Federal Ministry of Transport, emphasized that Schmidt’s scientific career has been shaped by “curiosity, excellence, and perseverance.” The expertise she brings to the further development of global regulations enjoys “worldwide recognition.”

Anita Schmidt heads BAM’s division for the Safety of Dangerous Goods Packaging and Batteries, which focuses, among other things, on applied research related to innovative battery materials and second life applications. At the United Nations level, she represents Germany on behalf of the Federal Ministry of Transport in the UN Sub-Committee of Experts on the Transport of Dangerous Goods. There, she played a key role in advancing a new classification system for lithium batteries. In addition, Schmidt is an expert in the safety assessment and approval of all types of dangerous goods packaging, including packaging for the transport of chemical substances and other risk relevant products.

Dr. Anita Schmidt

BAM at a glance

1480 Staff

55 Nationalities

38 Trainees

110 PhD students

19 Professorships

76 Lectureships

550 Refereed publications

900 Lectures

40 New patents

39 Certified reference materials

180 Million € Basic funding

22 Million € Third-party funding

4 Research facilities in Berlin/Brandenburg

(Figures for the 2025 calendar year, partially rounded)

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Phone: +49 30 8104-0
E-Mail: info@bam.de
Web: www.bam.de

Editorial team
Oliver Perzborn (head), Ralf Berhorst (concept, project management, text), Janina Buchholz (text), Katja Dallmann (text), Dora Kolar-Bosnjak, Julia Päpke (photography), Kristin Dathan, Karina Fast, Jennifer Postler (layout), Daniel Ristow and Clara Seitz (video content/e-magazine)

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The cover graphic shows an anode (Berliner Schwarz™) for sodium-ion batteries developed by BAM: A protective layer prevents inclusions and thus increases performance.

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