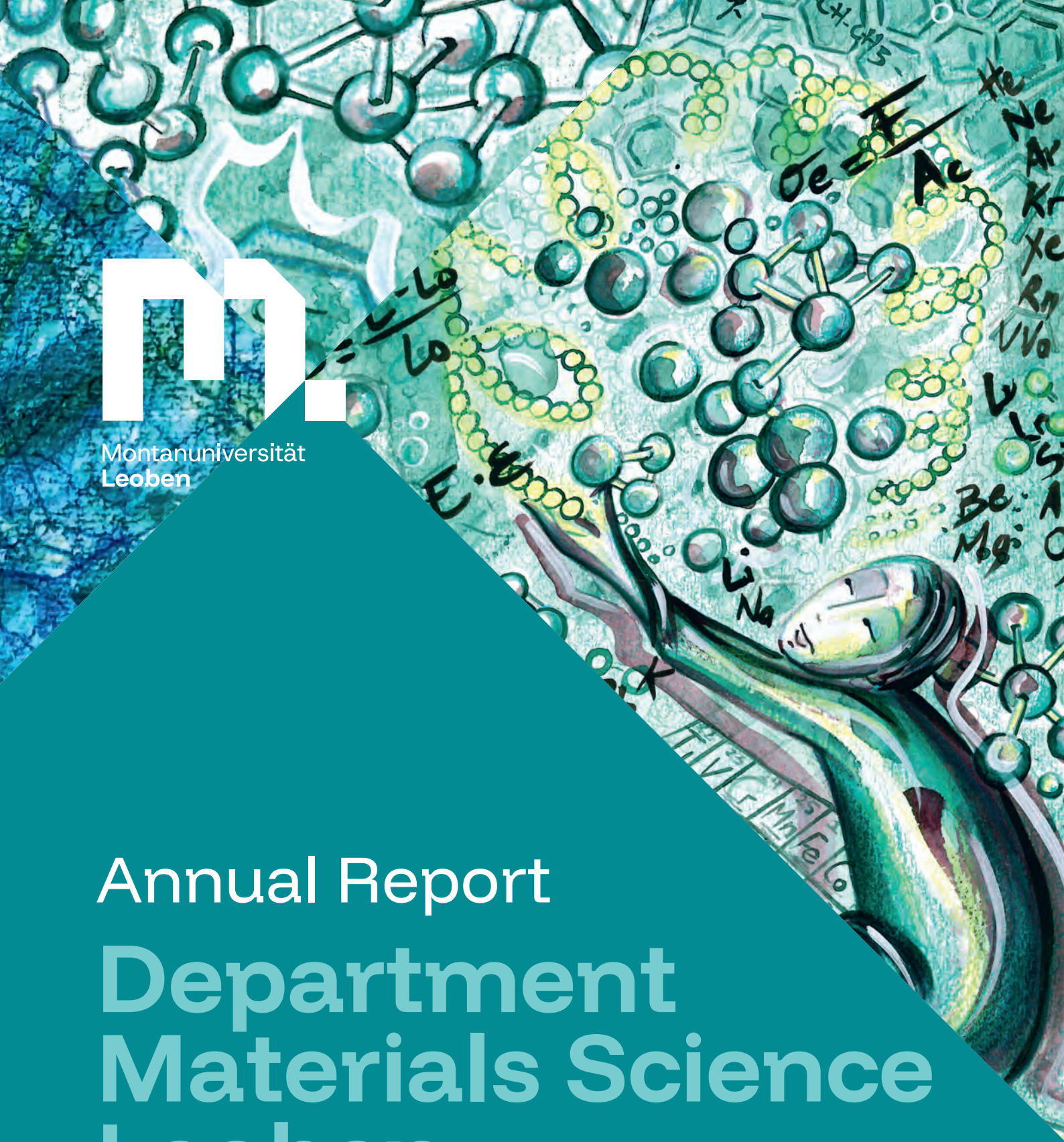


Montanuniversität
Leoben

Annual Report

Department Materials Science Leoben 2025

Materials Science

Preface

Dear colleagues and friends of the Department of Materials Science!

We are proud to present the highlights of the Department of Materials Science from the year 2025 in this annual report. It's show time for our materials, processes, characterization methods and dissemination activities. In our continuous attempt to develop better and more responsible material concepts for our future generations we are facing the current global trends: Digitalization, artificial intelligence, quantum technologies, circularity, de-carbonization and a changing world order. Materials play a central role in the ongoing transformation, and continuous adaptation and development are a must for the department. In this connection we also welcome our new head of the department, Daniel Kiener, who takes over the work of his predecessor, Christian Mitterer, to whom we express our deepest gratitude for all the excellent work carried out over the years.

To keep research at the highest level and push new research capabilities, the department has invested in new equipment, including a new cryogenic environmental focused ion beam, a dual-beam focused ion beam scanning electron microscope and a nanoscale 3D printer. In addition, two new furnaces for growth of silicon carbide single crystals were installed, which enlarge the research portfolio of the department with respect to gas-phase deposition techniques and wide band gap semiconductors for power electronics applications.

Due to the continuous work of our research teams in acquiring new projects, revenues over the recent years show a stable progression. A highlight this year has been the opening of a new CD Lab on sustainable hard coating, which will provide new impulses to the department combining thin film processing and machine learning in a unique fashion. Furthermore, a number of prizes were acquired by our young researchers which document the fruitful working environment in the department and make us confident that the restructuring and modernization of our curricula was the right choice. The university was successful in increasing the number of international students, which confirms our ambition to establish the location of Leoben as one of the main materials research and education hot spots in Europe. International visibility is also achieved via our dissemination activities in form of research articles and organization of seminars and conferences that are also highlighted in this report.

Before we leave you to enjoy the following pages, we take the opportunity to thank our collaborators, industrial partners and our team members, for their great support and efforts in the year 2025. We are looking forward to an equally interesting and successful year 2026.

Prof. Dr. Raul Bermejo

Prof. Dr. Jürgen Eckert

Prof. Dr. Daniel Kiener

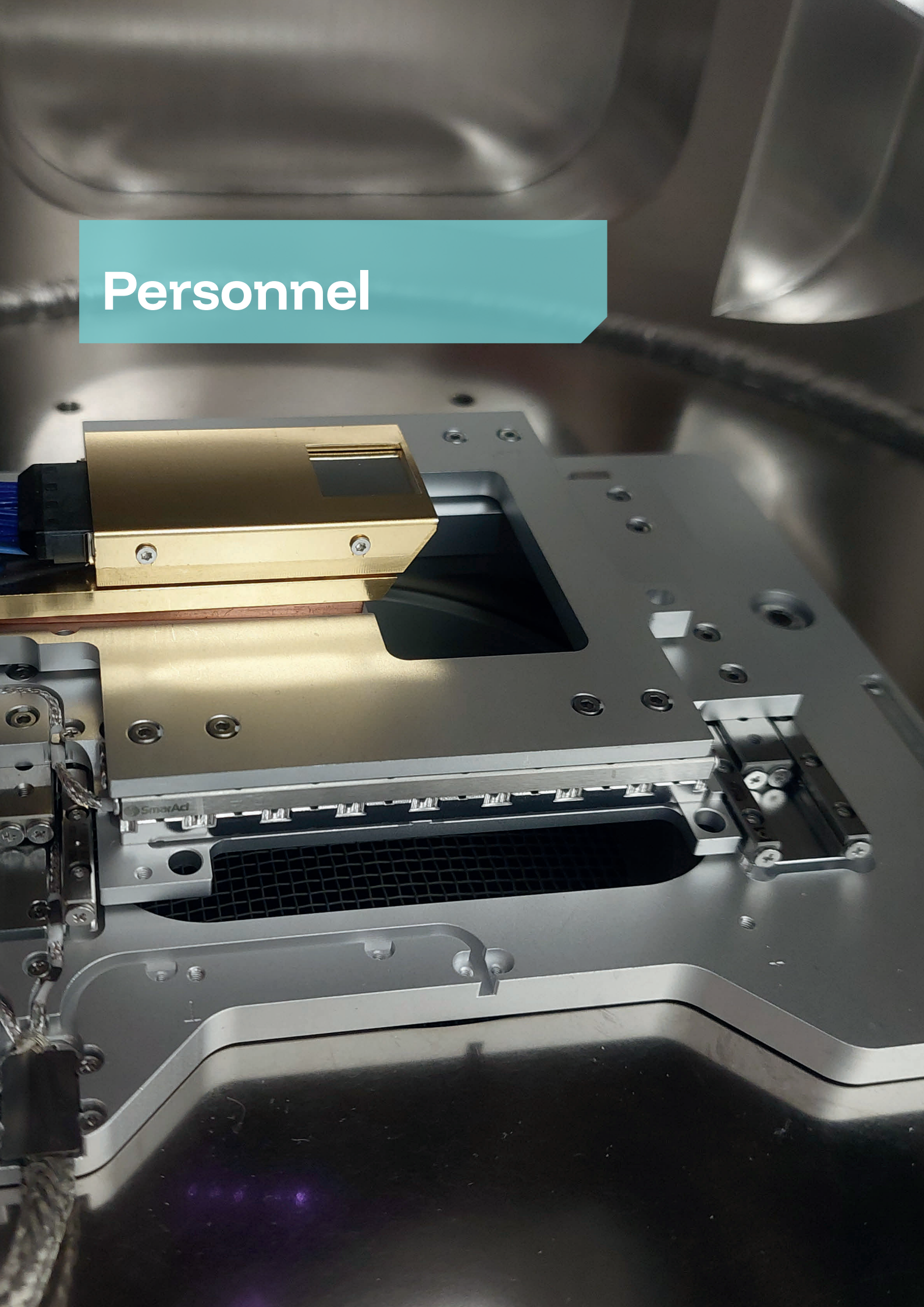
Prof. Dr. Christian Mitterer

Prof. Dr. Lorenz Romaner

Prof. Dr. Ronald Schnitzer

Table of content

Personnel



Personnel

Head of department and chairs

Daniel Kiener, Univ.–Prof. Dr.
Head of department

Raul Bermejo Moratinos, Univ.–Prof. Dr.
Chair of Structural and Functional Ceramics

Jürgen Eckert, Univ.–Prof. Dr. Dr.h.c.
Chair of Materials Physics

Christian Mitterer, Univ.–Prof. Dr.
Chair of Functional Materials and Materials Systems

Ronald Schnitzer, Univ.–Prof. Dr.
Chair of Physical Metallurgy

In 2025, 164 people were employed at the Department of Materials Science. The expenses for 56 employees were covered by federal funds, 108 employees were financed by third-party projects.

Chair of Functional Materials and Materials Systems

Management

Christian Mitterer, Univ.-Prof. Dr.
Chair

Nina Schalk, Ass.Prof. Dr.
Deputy Chair / Group leader

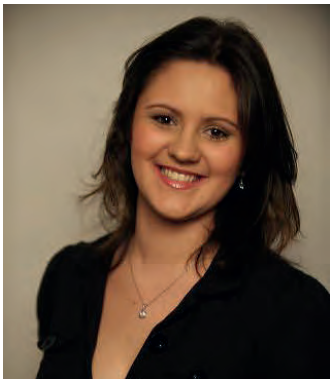
Rostislav Daniel, Assoz.Prof. Dr.
Group leader

Verena Maier-Kiener, Ass.Prof. Dr.
Group leader

Michael Tkadletz, Dr.
Group leader

Office management / Technicians

Fabian Gusterhuber
Apprentice



Sabrina Hirn
Surface engineering

Walter Kopper
Materials testing

Karl-Heinz Pichler, Ing.
Electrical engineering

Cornelia Schnedl
Office management

Regina Stangl
Office management

Susanne Strasak, Bakk.phil.
Office management

Angelika Tremmel, MA
Office management

Scientific staff

Matthias Bartosik, Dr.
PostDoc

Charlotte Cui, Dr.
PostDoc

Kimberly Filzmoser
Student assistant

Alexander Gollenz, BSc.
Graduate student

Christian Hofer, Dipl.-Ing.
PhD student

Anna Hofer-Roblyek, Dr.
PostDoc

Anna Jelinek, Dr.
PostDoc

Gaatha Kainikkara, MSc.
PhD student

Magdalena Kirchmair, Dipl.-Ing.
PhD student

Lukas Kölbl, Dr.
PostDoc

Fabian Konstantiniuk, Dr.
PostDoc

Nikolaos Kostoglou, Dr.
PostDoc

Anna-Lena Krabichler-Mark
Student assistant

Marco Kucher, BSc.
Graduate student

David Lebner
Intern

Lea Lumper-Wimler, Dipl.-Ing.
PhD student

Nafsika-Maria Mouti, MSc.
PhD student

Saeideh Naghdali, MSc.
PhD student

Serena Naicker, MSc.
PhD student

Olayinka Okunoye, Dott. Mag.
PhD student

Maximilian Schiester, Dipl.-Ing.
PhD student

Velislava Terziyska, Mag.
Senior scientist

Susanne Wenger
Student assistant

Stefan Zeiler, Dipl.-Ing.
PhD student

Alexander Zettl
Student assistant

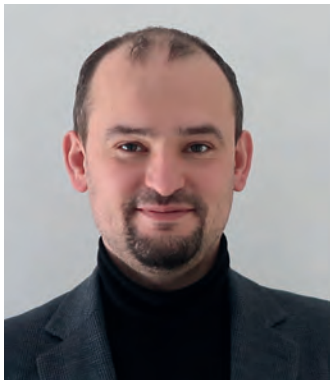
Chair of Physical Metallurgy

Management

Ronald Schnitzer, Univ.–Prof. Dr.
Chair

Lorenz Romaner, Univ.–Prof. Dr.
Deputy Chair / Group leader

Sabine Bodner, Ass.Prof. Dr.
Group leader



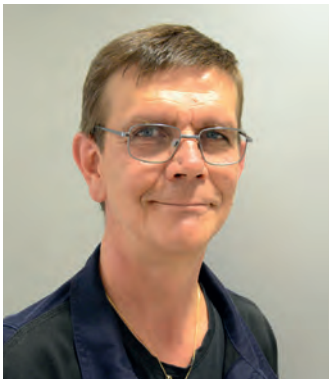
Oleksandr Glushko, Dr.
Group leader

David Holec, Priv.–Doz. Dr.
Group leader

Oliver Renk, Dr.
Group leader

Office management / Technicians

Thomas Fischer, Ing.
Thermomechanical characterization



Alfred Gajsek
Workshop

Gerhard Hawranek
Scanning electron microscopy

Bruno Krajnc, Ing.
Materials testing

Alfons Lontschar, Ing.
IT administration

Silvia Pölzl
Metallography

Cornelia Schnedl
Office management

Regina Stangl
Office management

Katharina Stoschka
Metallography

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Angelika Tremmel, MA
Office management

Scientific staff

Wolfgang Archer, Dipl.-Ing.
PhD student

Tom Baumann
Student assistant

Florian Brandstetter, BSc.
Graduate student

Christoph Dösinger, Dipl.-Ing.
PhD student

Johannes Frischmuth
Intern

Gamsjäger Aaron
Student assistant

Marek Gocnik, Dipl.-Ing.
PhD student

Maximilian Graf, Dipl.-Ing.
PhD student

Celine Halkali, Dipl.-Ing.
PhD student

Lukas Hatzenbichler, Dipl.-Ing.
PhD student

Maureen Hiesberger
Student assistant

Johanna Hofer, BSc.
Graduate student

Jitka Holcova, Mgr.
Scientific staff

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PhD student

Stefan Kardos, Dipl.-Ing.
PhD student

Neha Kobzina
Intern

Nikolaus Kostwein, Dipl.-Ing.
PhD student

Marco Kucher
Student assistant

Andreas Landefeld, Dr.-Ing.
PostDoc

Klemens Lechner, Dipl.-Ing.
PhD student

Nico Mandlberger
Student assistant

Martin Matas, Ph.D.
PostDoc

Jonathan Moravec, BSc.
Graduate student

Mathias Muthsam, BSc.
Graduate student

David Obersteiner Dipl.-Ing.
PhD student

Shafi Omer
Student assistant

Stefan Pfundner, BSc.
Graduate student

Stefanie Pichler, Dipl.-Ing.
PhD student

Zahra Rajabzadeh, MSc.
PhD student

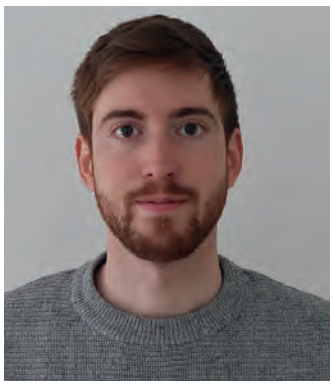
Zaher Ramadan, Dr.
PostDoc

Alexander Reichmann, Dipl.-Ing.
PhD student

Amin Reiners-Sakic, Dipl.-Ing.
PhD student

Daniel Schrittwieser, Dipl.-Ing.
PhD student

Benjamin Seligmann, Dipl.-Ing.
PhD student

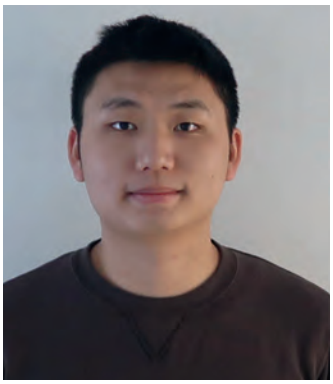


Tobias Spitaler, Dipl.-Ing.
PhD student

Kiranbabu Srikakulapu, MTech Dr.-Ing.
PostDoc

Innozenz Steffny, Dipl.-Ing.
PhD student

Bayram Tan
Student assistant



Jing Tang, MSc.
PhD student

Lorenz Taucher, Dipl.-Ing.
PhD student

Romina Troger
Student assistant

Simon Urich
Student assistant

Clement Vincely, MSc.
PhD student

Lukas Wanisch
Student assistant

Chair of Materials Physics

Management

Jürgen Eckert, Univ.–Prof. Dr. Dr.h.c.
Chair

Jozef. Keckes, Univ.–Prof. Dr.
Deputy Chair / Group leader

Anton Hohenwarter, Dr.
Group leader

Daniel Kiener, Univ.–Prof. Dr.
Group leader

Office management / Technicians

Herwig Felber, Ing.
Technical/
Electrical engineering

Silke Kaufmann
Metallography

Daniela Keckesova, Ing.
Technical assitance

Lisa Schutting
Metallography

Antonio Vukovic
TEM preparation

Sabine Wilfling
Office management

Jasmin Wimmer
Metallography

Scientific staff

Markus Alfreider, Dr.
PostDoc

Atacan Asci
Student assistant

Michael Burtscher, Dr.
PostDoc

Srikanth Chaganti, MSc.
PhD student

Paola Dorner
Student assistant

Edmund Dürrer
Student assistant

Adam Elbataioui, MSc.
PhD student

Felix Ferk
Student assistant

Julia Gröger
Student assistant

Sepide Hadibeik Neishaboori, Dipl.-Ing.
PhD student

Patrick Hiebler
Student assistant

Sibrah Kashif, BSc.
Graduate student

Julius Keckes, Dipl.-Ing.
PhD student

Peter Kunnas, Dr.
PostDoc

Kevin Kutlesa, Dipl.-Ing.
PhD student

Lukas Lang, Dipl.-Ing.
PhD student

Hannah Lichtenegger, Dipl.-Ing.
PhD student

Michael Meindlhumer, Dr.
PostDoc

Nicole Ofner, Dipl.-Ing.
PhD student

Philipp Payer, Dipl.-Ing.
PhD student

Thomas Pogrielz, Dipl.-Ing.
PhD student

Philipp Reithofer
Student assistant

David Ringler
Student assistant

Felix Römer, Dipl.-Ing.
PhD student

Lukas Schweiger, Dipl.-Ing.
PhD student

Florian Spieckermann, Dr.
PostDoc

Juraj Todt, Dr.
PostDoc

Felix Unterbuch-schachner
Student assistant

Lidia Valdes-Llorente, Dipl.-Ing.
PhD student

Stanislav Zak, Dr.
PostDoc

Tobias Ziegelwanger, Dipl.-Ing.
PhD student

Chair of Structural and Functional Ceramics

Management

Raul Bermejo Moratinos, Univ.-Prof. Dr.
Chair

Tanja Lube, Ao.Univ.-Prof.
Deputy Chair / Group leader

Peter Supancic, Ao.Univ.-Prof. Dr.
Group leader

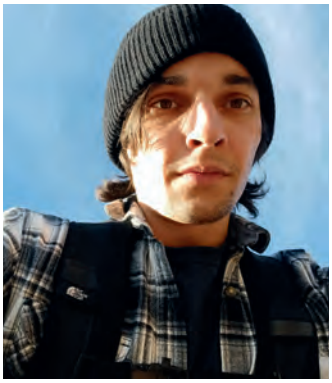
Barbara Putz, Ass.-Prof. Dr.
Group leader

Office management / Technicians

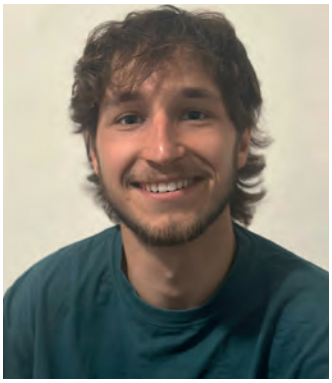
Ronald Binder, Ing.
Workshop

Sarah Kohlbacher
Office management

Scientific staff



Hunter Elwell
Student assistant

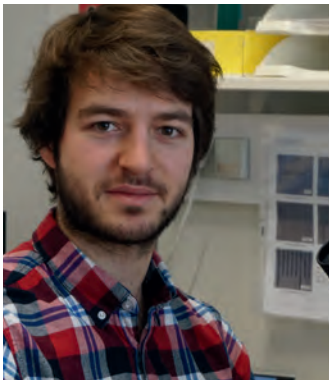


Florian Fehleisen
Student assistant

Yves Godai, BSc.
Graduate student

Manuel Gruber, Dr.
PostDoc

Dominik Gutnik, Dipl.-Ing.
PhD student



Viktor Haipl, BSc.
Graduate student

Mahima Haque, BSc.
Graduate student

Walter Harrer, Dr.
Senior scientist

Jacob Hungerford
Student assistant

Abdullah Jabr, Dr.
PostDoc

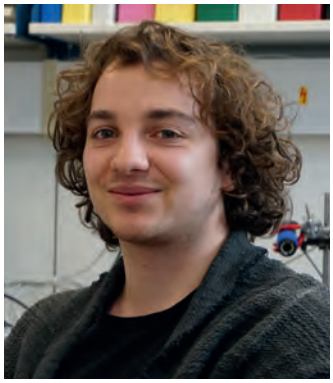
Arijit Jana, Mtech.
PhD student

Tobias Jüptner, BSc.
Graduate student

Irina Kraleva, Dipl.-Ing.
Senior scientist

Josef Kreith, Dr.
Senior scientist

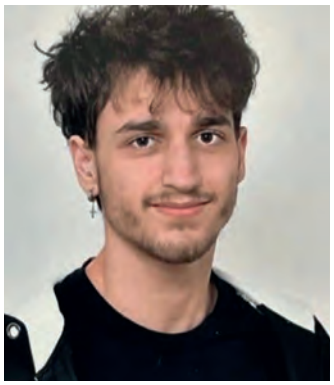
Samuel Long, BSc.
Graduate student



Maximilian Munz, Dipl.-Ing.
PhD student

Roman Papsic, Ing.
PhD student

Tobias Prötsch, Dipl.-Ing.
PhD student



Raphael Safran
Student assistant

Josef Schlacher, Dr.
PostDoc

Maximilian Staudacher, Dr.
PostDoc

Leonie Sucic
Student assistant

Retired / emeritus university professors

Helmut Clemens, Univ.-Prof.i.R. Dr.
Retired / emeritus university professors

Robert Danzer, em. o.Univ.-Prof. Dr.
Retired / emeritus university professors

Albert Kneißl, Univ.-Prof.i.R. Dr.
Retired / emeritus university professors

Visiting scientists

Andreou, Panagiotis
University of Cyprus, Cyprus

Bednarova, Stanislava
Masaryk University, Brno, Czechia

Cheng, Wenjuan
Roma Tre University, Italy

Christodoulou, Georgia Maria
University of Cyprus, Cyprus

Evans, Abigail
University of Cambridge, United Kingdom

Mattia Grumi
Spanish Council for Scientific Research (CSIC), Spain

Han, Bo
China Scholarship Council, China

Kyriacos, Ioannou
University of Cyprus, Cyprus

Lei, Yang
Shenzen University, China

Li, Zhe
Harbin Institute of Technology China

Liao, Shansi
Shanghai University, China

Liu, Xiaoming
Shandong University, China

Nayak, Ganesh
RWTH Aachen, Germany

Ondracka, Pavel
Masaryk University, Brno, Czechia

Sevecek , Oldrich
Brno University of Technology, Czech Republic

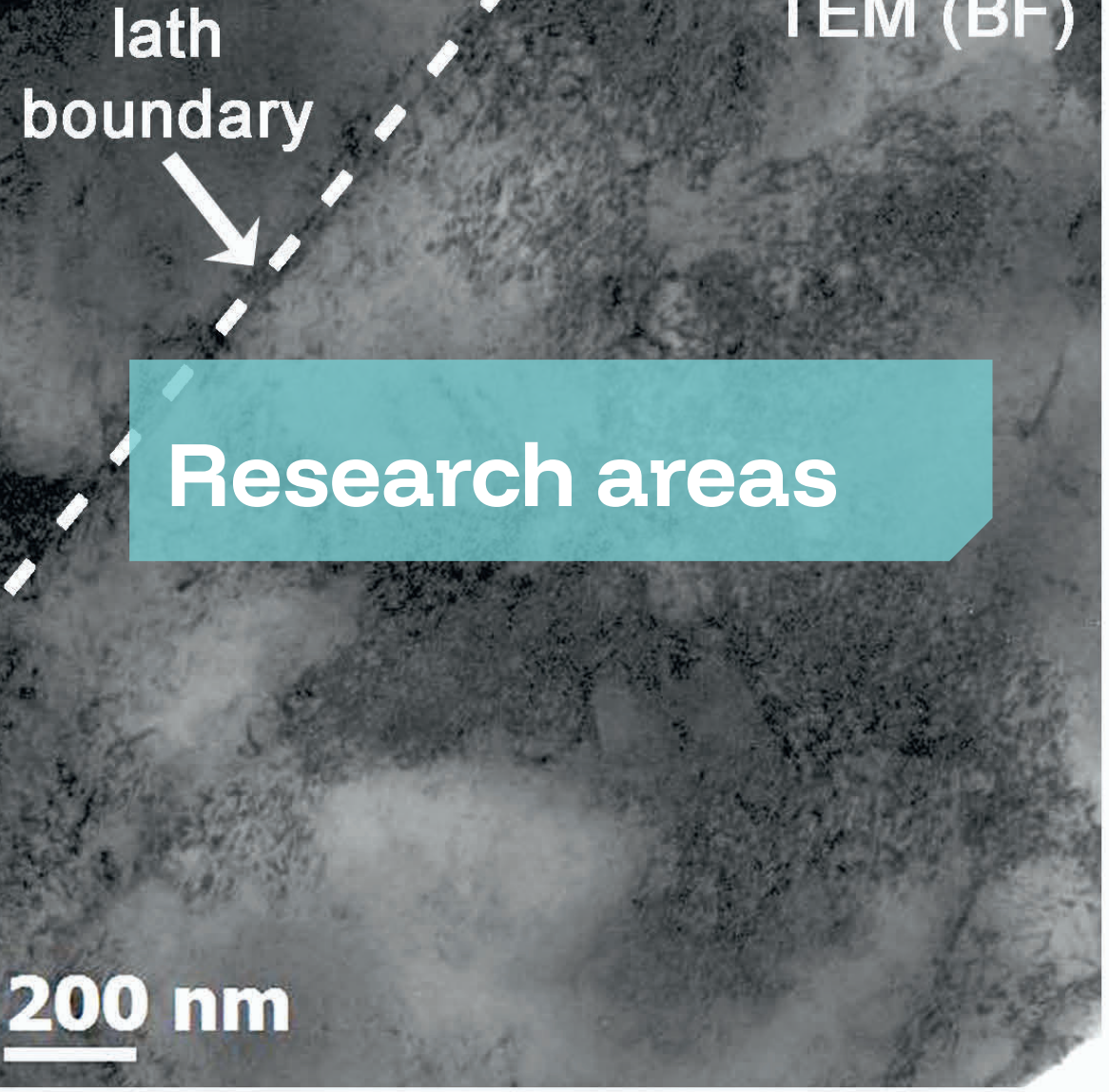
Van Bommel, Tobias
Ecole européenne d'ingénieurs en génie des matériaux (EEIGM), France

Zenisek, Jaroslav
Masaryk University, Brno, Czechia

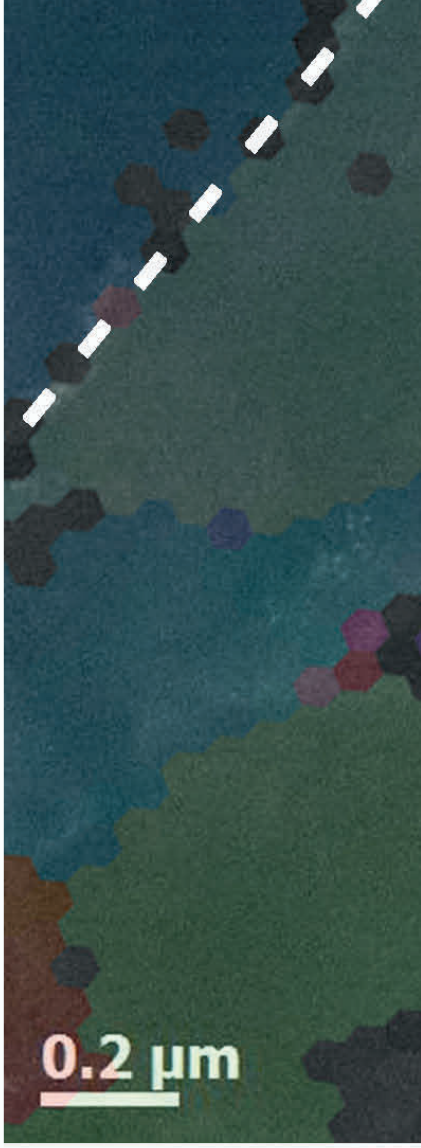
Zhang, Chaojun
Harbin Institute of Technology China

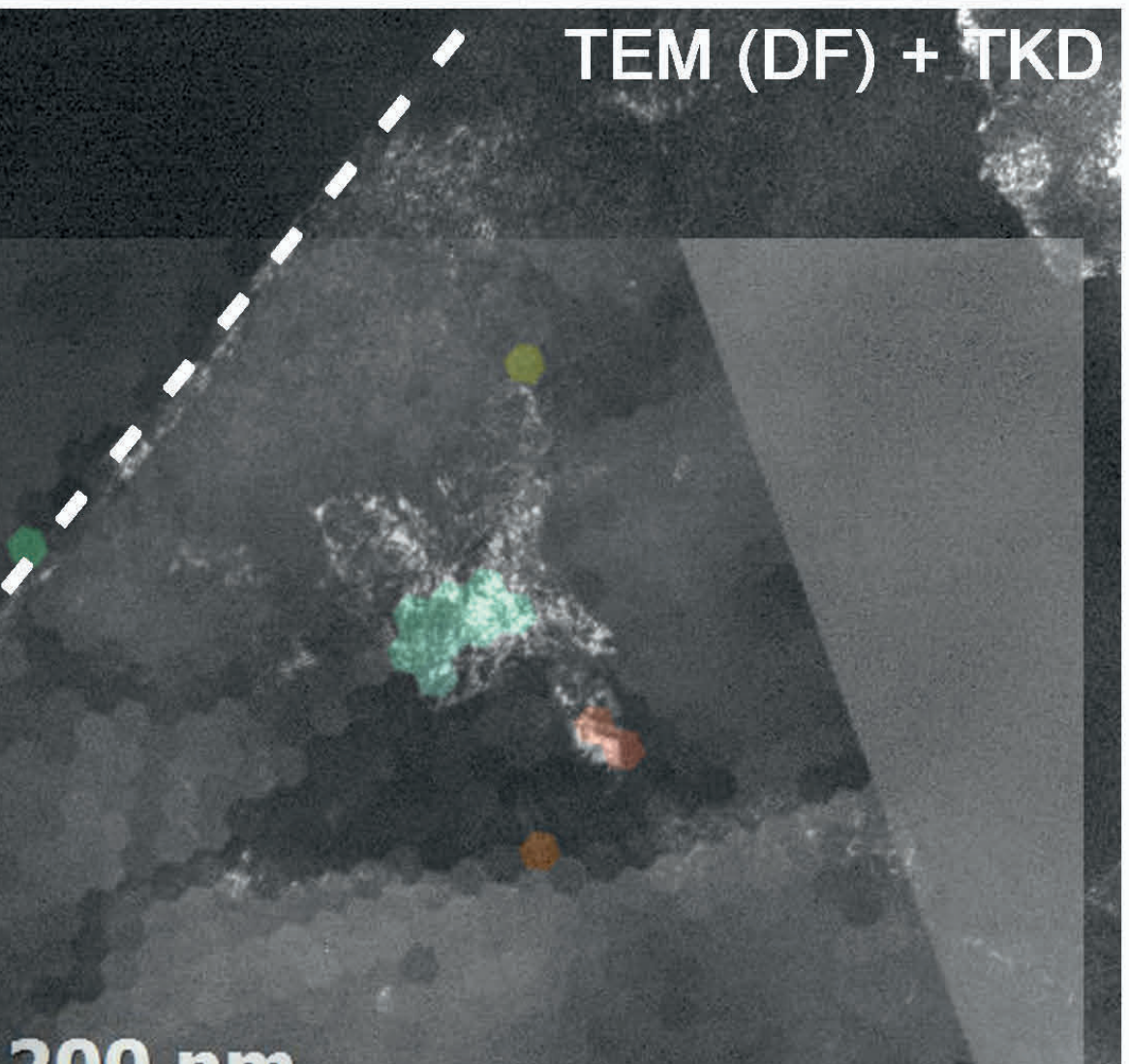
Zhang, Rui
Jilin University, China

Zhang, Jiyao
Shandong University, China



Research areas

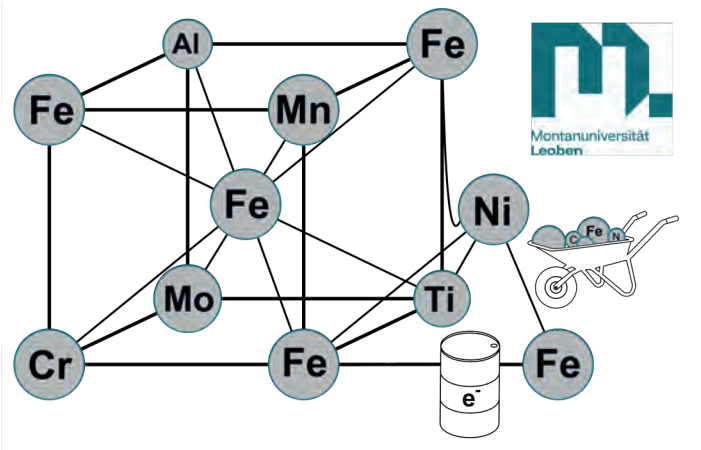




Mission statement

Within the **Department of Materials Science**, research is done at the **highest international level**, to achieve a detailed understanding of the structure and the properties of materials and material systems. In teaching, students are **integrated as early as possible** in research activities, to gain new insights by **joint research** of supervisors and students.

The obtained findings are **transferred to the society** via publications, to establish a solid knowledge basis for future applications. **International visibility** of the Materials Science area at **Montanuniversität Leoben** stems from a **supercritical size**, which necessitates the **completeness in methods** available to us and in the materials classes covered.



Materials Science
We construct our future.

Chair of Functional Materials and Materials Systems

At the Chair of Functional Materials and Materials Systems, four working groups are established, each led by dedicated group leaders: Advanced Surface Engineering (Nina Schalk), Materials for Microelectronics (Rostislav Daniel), Advanced Micro- and Nanostructure Characterization (Michael Tkadletz; jointly operated with the Chair of Physical Metallurgy), and Scale-Bridging Materials Testing under Extreme Conditions (Verena Maier-Kiener).

A central research focus of the chair is the design and synthesis of advanced functional materials through surface activation, modification, and the deposition of coatings, thin films, and nanoparticles using plasma-assisted vacuum technologies. The chair operates a unique portfolio of vapor deposition systems ranging from laboratory to industrial scale. These include magnetron sputter deposition systems (DC, pulsed DC, and HiPIMS) and cathodic arc deposition for coating and thin film synthesis, magnetron sputter inert gas condensation for nanoparticle production, and plasma-based surface modification systems. In addition, the chair operates two high-temperature furnaces for SiC crystal growth.

This experimental infrastructure is complemented by facilities for microstructural analysis as well as mechanical and tribological characterization. The chair maintains a comprehensive range of materials testing equipment that bridges length scales from macro-mechanical testing to advanced micro- and nanomechanical testing. This includes a unique suite of in-situ and operando nanoindentation systems capable of performing micromechanical tests in temperature ranges from −150 °C to 1000 °C, as well as under controlled electrochemical environments. In addition, the chair employs advanced simulation tools for deposition process modelling and materials design.

Further characterization and modelling capabilities are available through close collaboration within the Department of Materials Science and with other chairs at Montanuniversität Leoben. Current research activities include the development of tribological coatings for tools and components in automotive and aerospace applications, functional thin films for microelectronics, engineered surfaces for energy conversion and storage as well as medical applications and the controlled growth of SiC crystals by physical vapor transport.

A highlighted 2025 publication advanced multifunctional coating design by demonstrating that elemental simplicity can deliver both mechanical robustness and antibacterial functionality within a single material platform. Published in Materials & Design, the study introduces a sustainable coating strategy based solely on Zr and Cu. Hierarchical Zr–Cu–N multilayers were fabricated via combined non-reactive and reactive sputtering without external heating, enabling scalable low-temperature processing from a minimal material palette. The architecture integrates elastic ZrCu metallic glass, hard ZrN, and tough ZrN–Cu nanocomposites. Engineered interfaces promote crack deflection and suppress dislocation motion, achieving a rare combination of high hardness and damage tolerance. Optimizing Cu to 10 at.% maintains hardness comparable to brittle monolithic ZrN while adding ductility and toughness, and replacing top ZrN layers with ZrN–Cu further improves fracture resistance and elasticity without hardness loss. Beyond mechanical performance, the coatings show durable antibacterial activity: a ZrN–Cu–coated door handle retained ~90% efficacy against E. coli after 60 days of daily use. This work establishes a sustainable pathway toward wear-resistant, antimicrobial coatings for high-traffic environments.

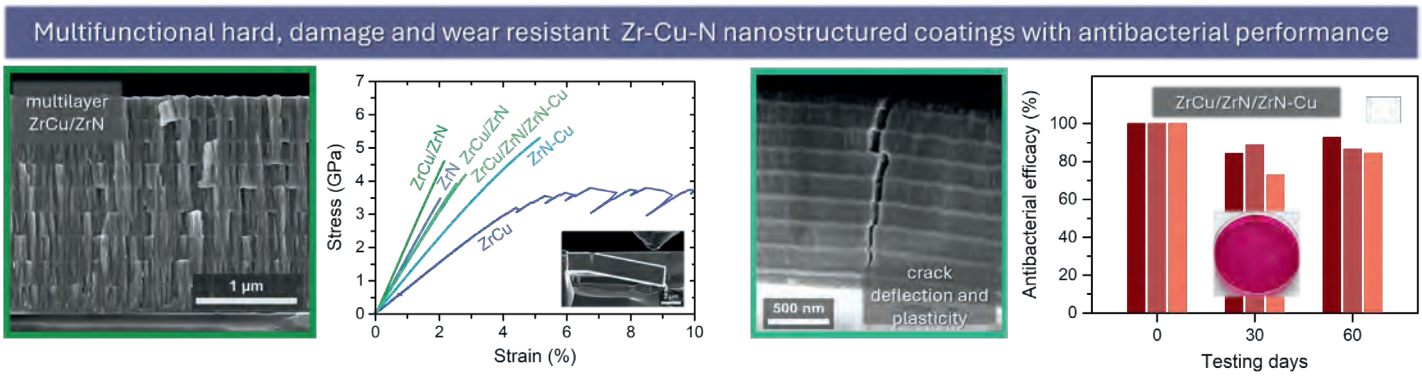


Fig.: Hierarchical Zr–Cu–N multilayer architecture enabling the combination of high hardness, enhanced damage tolerance, and durable antibacterial functionality [R. Daniel, T. Ziegelwanger, M. Zitek, M. Červená, S. Haviar, M. Meindlhumer, P. Baroch, J. Keckes, P. Zeman – Materials & Design 254 (2025) 114037, https://doi.org/10.1016/j.matdes.2025.114037].

Chair of Physical Metallurgy

Research on structural materials at the Chair of Physical Metallurgy comprises the investigation of the processing–structure–properties relationship of metallic materials, with a focus on advanced steels, titanium alloys as well as refractory metals. High-resolution characterization methods, such as atom probe tomography (APT), are used to obtain qualitative and quantitative information about the morphology, composition and distribution of phases. Moreover, the behavior of modern materials under process and application conditions is investigated by using in-situ diffraction and scattering methods.

Strong expertise in multiscale structural analysis of metallic materials is synergetically connected with modern computational materials science methods. The expertise of the chair lies in combining quantum-mechanical simulations, molecular dynamics simulations, thermokinetic modeling and machine learning to predict physical properties of bulk crystal phases and their extended defects such as grain boundaries, dislocations, or nanostructures.

One specific research focus within the last year was the investigation of the effect of increased contents of tramp and trace elements in advanced steels. This increase results from the transformation of the production routes in the steel industry from blast furnaces to electric arc furnaces, enabling an increased use of scrap and thus significantly reduced CO_2 emissions in the manufacturing process. It was found that tramp elements not only slow down the phase transformation kinetics, but also lower the phase transformation temperatures. In addition, it has been observed that impurity elements inhibit the growth of austenitic grains by accumulating at the grain boundaries at high temperatures. One of the most crucial phenomena associated with enhanced scrap usage is a decrease in notched impact toughness due to segregation of Sn, Sb and Cu to grain boundaries. At the nanoscale, the segregation behavior of individual elements was systematically studied with APT for different heat treatments. The figure below clearly shows the different behavior of elements that are not intentionally alloyed in the steel. For example, Sn and Sb exhibit a very strong segregation behavior and thus have an embrittling effect above certain limit contents. P, on the other hand, shows a significantly lower tendency to segregation, and elements such as Cr are evenly distributed in the material even after long heat treatment.

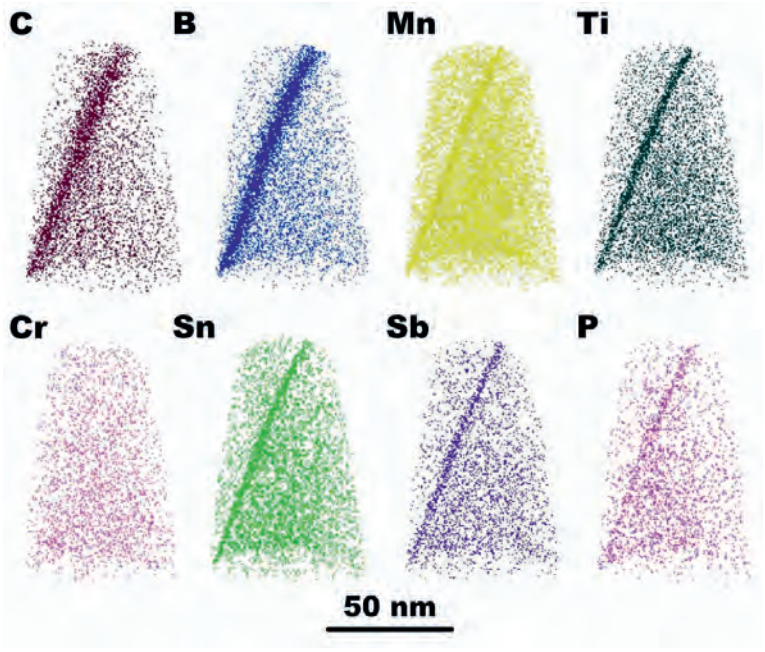


Fig.: APT measurement of an alloy with increased contents of trace elements showing the segregation behavior of individual elements at a grain boundary. Sn, Sb and B, for example, show a strong tendency to segregation, while Cr is evenly distributed in the matrix [N. Kostwein, C. Kickinger, O. Glushko, R. Schnitzer – Journal of Materials Research and Technology 38 (2025) 4908–4916, https://doi.org/10.1016/j.jmrt.2025.08.260].

Chair of Materials Physics

The activities of the Chair of Materials Physics are closely linked to its partnering Erich Schmid Institute (ESI) of Materials Science of the Austrian Academy of Sciences. Currently, eight research groups and one junior research group are active at both institutions. Research activities focus on the characterization of structural materials (e.g. steels, composites and bioinspired materials), miniaturized material systems for information technology (flexible electronics, advanced thin films and functional ceramics), materials for energy and high temperature applications, as well as nanocrystalline and amorphous bulk materials (e.g. metallic glasses). During the last year, research on interface properties of nano- and microscale materials in various systems (metallic, ceramic, organic) for application in flexible electronics or hard coatings were continued.

Ongoing research focuses on mitigating the structural failure of components and enhance the longevity of modern structural materials. Therefore, there is a need to quantitatively assess their resistance against catastrophic failure using advanced *in situ* methods. This resistance is governed by processes dissipating energy at the tips of cracks during their propagation and are commonly described by the J-integral, model, which yields a single scalar energy release rate for elastic-plastic materials. However, to quantitatively determine the J-integral most often only limited information channels, e.g. external load and displacement, are used in conjunction with constitutive models from continuum mechanics.

In a current research endeavour, a multi-method experimental scheme to analyze the nanoscale stress and strain distributions in two near-identical fracturing microcantilevers made by focused-ion-beam milling from nanocrystalline CoCrFeMnNi processed by high-pressure torsion was developed. One cantilever was deformed *in situ* using a customized indentation setup at the ID13 beamline of the ESRF (Fig. a), while the other was fractured in situ in a scanning electron microscope (Fig. a). The collected stress and strain data were then used to quantitatively evaluate the J-integral and compare it with conventional approaches commonly applied in materials testing (Fig. b). This demonstrates that X-ray nanodiffraction and scanning electron microscopy combined with *in situ* micromechanical testing exposes the inherent limitations of traditional fracture mechanics models when expanded for confined volumes on miniturized structures.

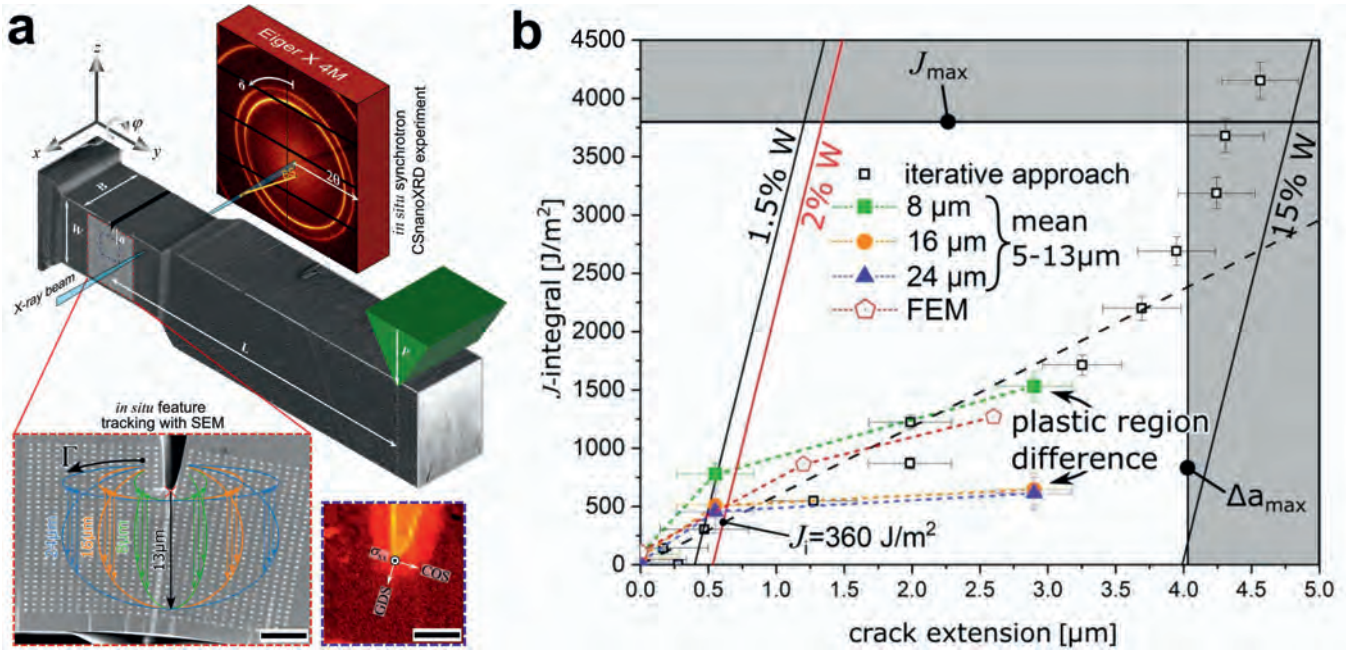


Fig.: A schematic visualization of *in situ* synchrotron and *in situ* SEM experiments is given in (a). J-integral data obtained from the iterative and combined approaches (b) [M. Meindlhumer, M. Alfreider, N. Sheshi, et al. – Commun Mater 6, 35 (2025), https://doi.org/10.1038/s43246-025-00752-z].

Chair of Structural and Functional Ceramics

The Chair of Structural and Functional Ceramics (ISFK) aims to provide engineering solutions to the ceramic industry with primary focus on structural and functional applications. The research fields cover ceramic processing, material and system characterization as well as process simulation, with special focus on electro-ceramics. Student engagement in (fundamental / applied) research projects at the chair and participation in national and international conferences is also a key educational aspect of ISFK.

The work with industrial partners has evidenced the need for special testing techniques, e.g. for strength and toughness testing of thin discs or plates, as well as for small balls or cylinders (e.g. for roller bearings). A strong competence of the Institute is the development of testing methods for mechanical characterization of ceramics, which has led to several standards, today common practice in the ceramic industry. One example for such a special strength test is the ball-on-three-balls (B3B) test, which was developed at ISFK. This test enables the strength testing of particularly small and inexpensive samples.

The chair is also well known for its work on fracture statistics, lifetime prediction and reliability analysis. Failure analysis of ceramic materials and components is one of the main topics investigated at ISFK. This includes brittle fracture, subcritical crack growth and creep, but also more specific types of failure such as edge chipping and thermal shock. The knowledge obtained from failure analyses and fractography of specimens represents often the starting point for further work.

The chair's special methodological competences also lay in the electro-mechanical characterization of electro-ceramic components upon thermo-electrical loads, with special focus on understanding and modelling the non-linear behaviour of many ceramic components and systems. Models on different size scales – from atomic to macroscopic scales – have been developed and integrated to describe the component behaviour. Especially the results of this work has led to a completely new knowledge, e.g. about the behaviour of strongly non-linear electrical resistance in functional ceramics.

A new research line at the chair has been encouraged by an ERC-Grant aiming to designing and manufacturing bio-inspired structures with high reliability. The working fields "Design and Manufacturing" and "Characterization of Multi-Material Systems" with a strong focus on microelectronics have gained importance in the research landscape of the ISFK. Pioneer work in stereolithographic 3D-Printing of ceramics is a new feature at the chair, which enables the fabrication of parts with tailored microstructure (see Figure) and opens new paths for the architectural design of ceramic composites with enhanced properties.

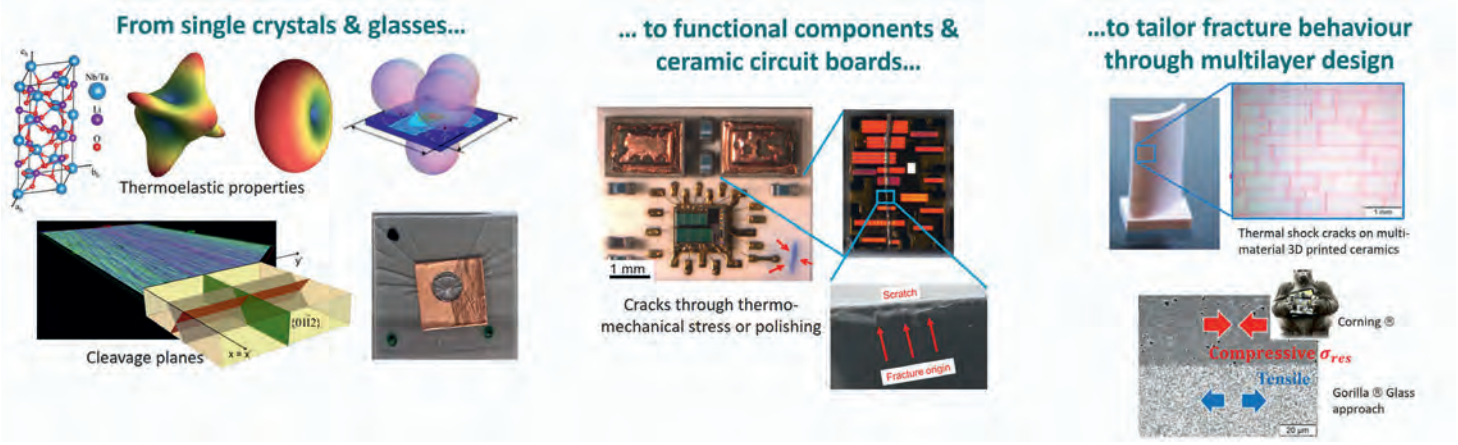


Fig.: Understanding fracture in brittle materials

Investments

Investments

Cryogenic environmental focused ion beam (FIB) workstation

In the CEMPER project (Correlative Chemical, Electrical, and Mechanical Properties of operational Energy-Related materials) the Erich Schmid Institute (ESI) together with partners from the Chair of Material Physics (CMP), Montanuniverstät Leoben, has expanded its characterization possibilities to include a cryogenic environmental focused ion beam (FIB) workstation (Thermo-Fischer Helios plasma FIB) with chemical analysis tools such as secondary ion mass spectroscopy (SIMS, ToF-Werk) and energy dispersive spectroscopy (EDS, ThermoFischer), as well as the related cryo-transfer system for cryo-transmission electron microscopy (TEM) investigations. The new infrastructure, competitively funded by the 2023 FFG Infrastructure Program, will increase our knowledge of the combined electro-mechanical-chemical behavior of materials and the interfaces in energy- or hydrogen-related applications. For example, one could experimentally evaluate the mechano-chemical incompatibilities of interfaces in lithium batteries or hydrogen storage capabilities of steels and high entropy alloys. The new infrastructure is open for users outside ESI/CMP on a proposal basis since winter 2025.

State-of-the-art multiphoton lithography system for nanoscale 3D printing

Recently, a Nanoscribe Quantum X system was installed at the Chair of Materials Physics.This additive manufacturing tool is the world's first Two-Photon Grayscale Lithography (2GL®) system, enabling the direct fabrication of complex microstructures with nanometer resolution, through multi-photon polymerization. Whether for micro-mechanics, micro-optics, photonics, or biomedical devices, this method delivers ultra-smooth surfaces, freeform geometries, and production-ready throughput with lateral resolution below 200 nm and vertical resolution of 100 nm at a maximum working area of 50 × 50 mm^2. Ready-to-print resin materials range from biocompatible and highly compliant (silicone-like) to hard and stiff (acrylate-like) polymers, offering a range of refractive indices for tailored optical properties, with the additional possibility to use self-formulated polymer solutions.

Furnaces for SiC single crystals growing

In 2025 two furnaces for growing 6-inch SiC single crystals were installed at the Department of Materials Science. The furnaces operate based on the physical vapor transport (PVT) concept and inductively heat the crucible containing the SiC powder and the seed crystal to temperatures of up to 2500K. The vacuum in the growth chamber can be reduced to 10^{-5} mbar and backfilled with Ar and N_2 to control the gas transport process. With this equipment new research possibilites are enabled regarding fundamentals of SiC crystal growth, crystal defect engineering and construction of digital twins based on physical simulation and machine learning.

Acquisition of a Dual-Beam FIB/SEM Zeiss Crossbeam 550

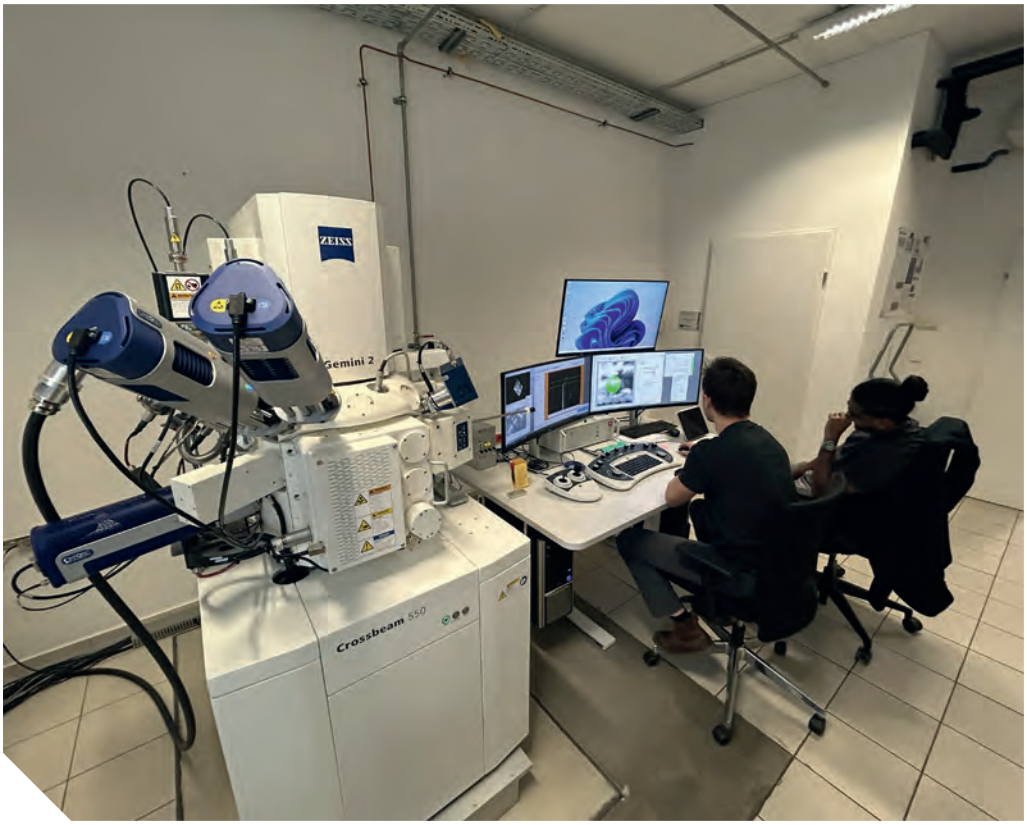
At the end of the summer, the Chair of Physical Metallurgy was able to realize a major and cost-intensive investment. A dual-beam focused ion beam scanning electron microscope (FIB-SEM), the ZEISS Crossbeam 550, was successfully commissioned following training and installation.

In addition to the ion column, which enables precise site-specific preparation of microstructural constituents for further microstructural, mechanical, or chemical analysis, the microscope is equipped with an electron column (double condenser) that allows continuous control of accelerating voltage and probe current. Together with two EDX detectors and one EBSD detector for chemical and crystallographic analysis, this allows for entirely new insights into the microstructure of materials and their relation to properties. The EBSD detector can process up to 6000 Kikuchi patterns per second, allowing the analysis of large sample areas. This will also make it possible to perform the previously very time-consuming analysis of local strains over larger regions. Additionally, a detector configuration was selected that offers significantly improved indexing results when analyzing crystallography in transmission.

A windowless EDX detector now allows for an improved analysis of light chemical elements such as boron, but, thanks to its high sensitivity at low accelerating voltages, also the chemical analysis of very small phases or precipitates (>100 nm).

The instrument has already been successfully used for first measurements and represents a strategically important investment in the field of high-resolution analytics and sample preparation. Combined with the atom probe tomography lab located at the chair, this will further strengthen one of the department's core competences.

We are excited to turn the improved research and analytical capabilities of the Crossbeam 550 into new scientific insights.



Budget

Revenues

At Austrian universities, revenues are structured as follows:

1. **Global budget**
2. **Third-party funds**
    a. Funded projects
    b. Contract research

Global budget

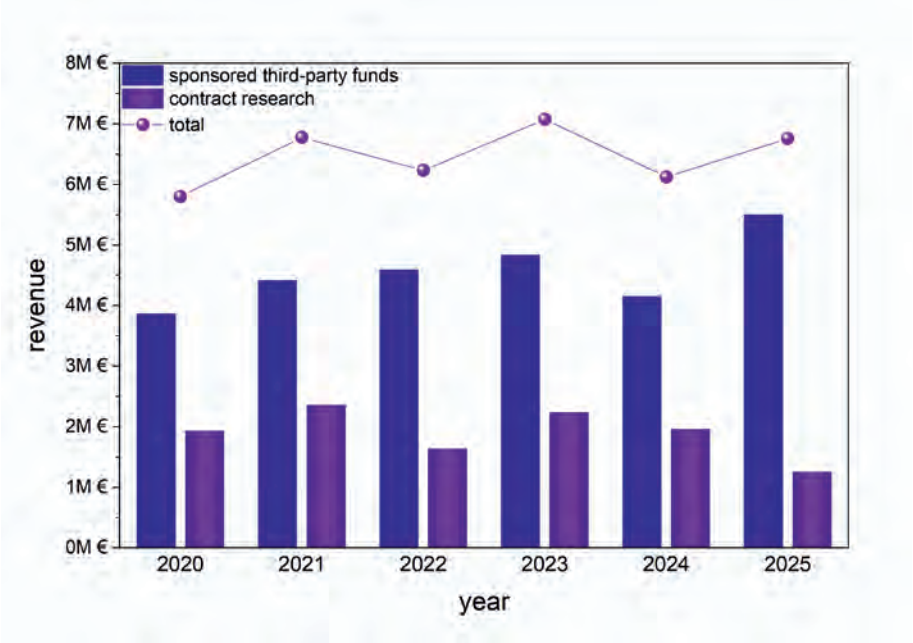
This endowment is to cover **current operating expenses for research and teaching** (incl. travel expenses, telephone, office supplies, copies for teaching and minor purchases for research operations; excl. university-funded positions)

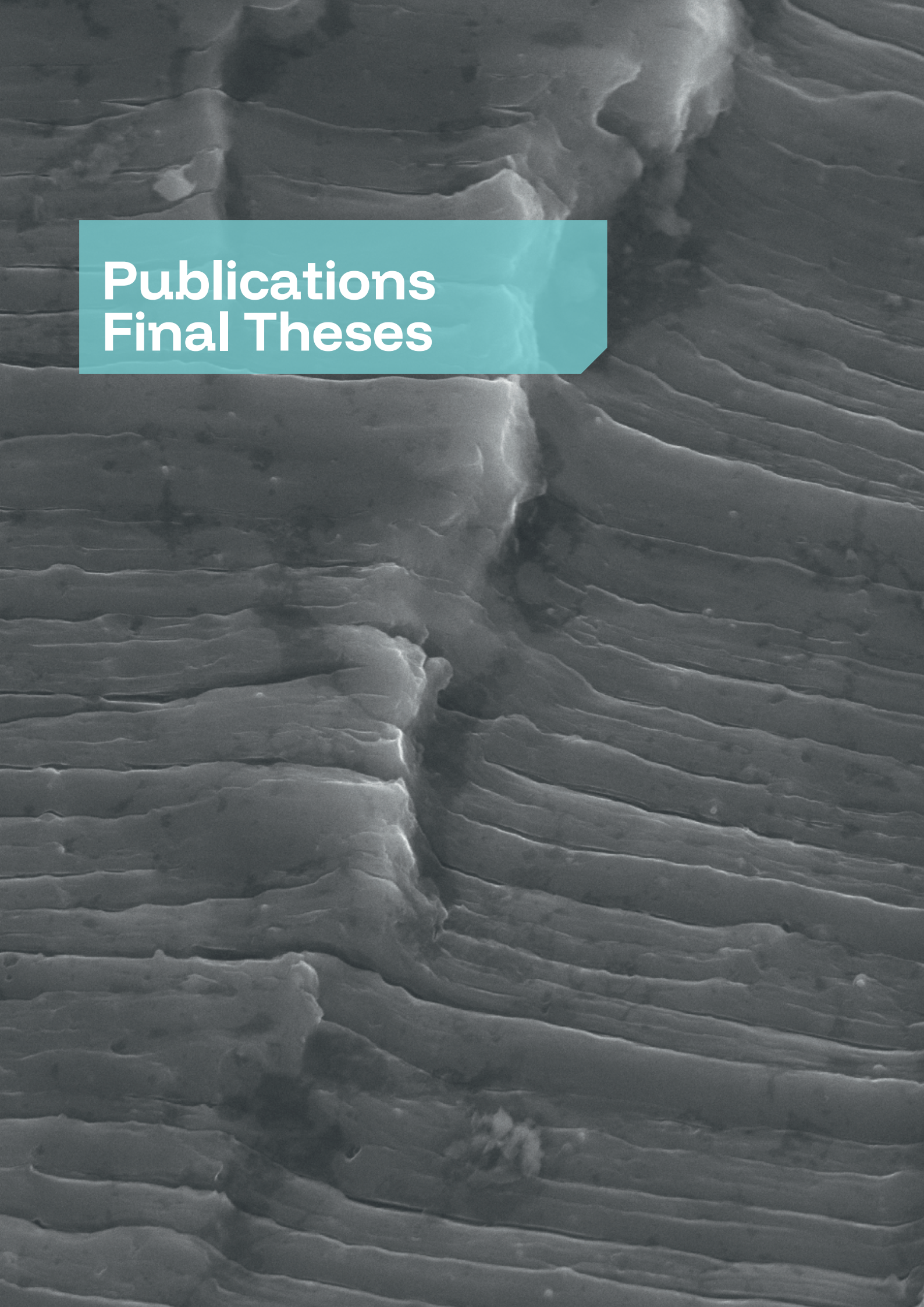
Third-party funds

Due to extensive third-party funding activities, the department managed to keep the revenue of the budget year 2025 at a **high level** compared to previous years.

The budget from **funded projects** amounted to: € 5.502.900,–.

The budget from **contract research** amounted to: € 1.257.000,–.





Publications
Final Theses

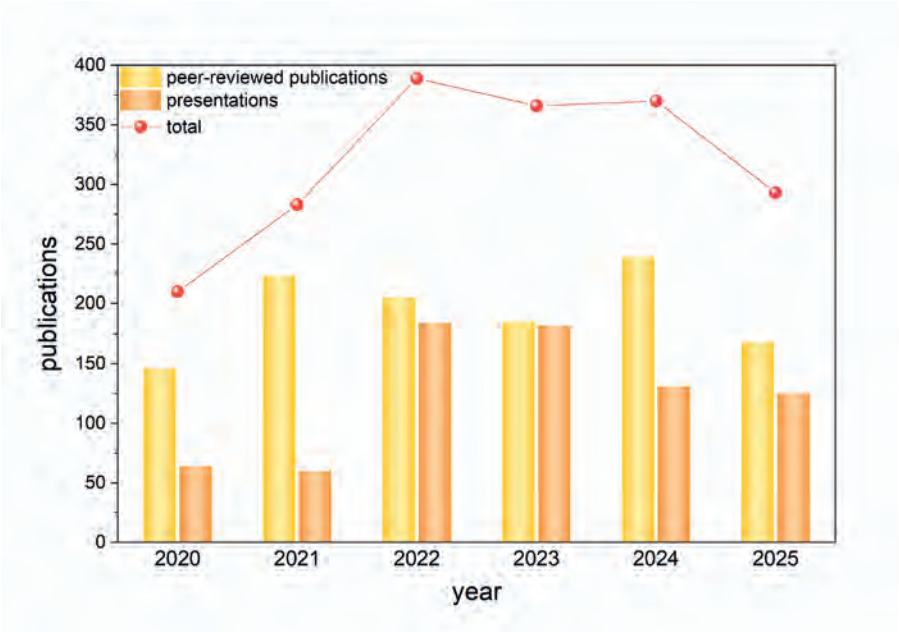
Publications and presentations

In line with the vision of the Department of Materials Science to conduct **basic research of industrial relevance,** it is a natural endeavor to publish the research results obtained in high-ranking journals and to present them at international conferences.

In particular, this should also give **young scientists** the opportunity to **present themselves** to the international scientific community and to gain experience in publishing. Despite the department's intensive cooperation with industrial partners, where often non-disclosure agreements are necessary, the research results obtained were made available to the public in 2025 in **168 articles** in scientific journals and **125 presentations** at scientific events. With this, the department contributes significantly to the SCI indexed publication activity and thus to the visibility of the research activities of the Montanuniversität Leoben.

The following figure shows the **development of publications and conference contributions** over the **last 6 years**.

In the following a list of highlight publications is given. A detailed list of publications is available on the research portal of the Montanuniversität Leoben at **pure.unileoben.ac.at**



Chair of Functional Materials and Materials Systems

Daniel, R., Ziegelwanger, T., Zitek, M., Cervena, M., Haviar, S., Meindlhumer, M., Baroch, P., Keckes, J., Zeman, P., Multilayer design of sustainable multifunctional Zr–Cu–N coatings: A route for enhanced mechanical and antibacterial performance, Materials and Design 254 (2025) 114037.

Lumper-Wimler, L., Ruess, L., Kappacher, J., Schillinger, W., Maier-Kiener, V., Metastability matters: Exploring hardness and conductivity in bell bronze alloys, Materials and Design 259 (2025) 114791.

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Pristáš, G., Gruber, G., Bačkai, J., Košuth, F., Kölbl, L., Bures, R., Fáberová, M., Gabáni, S., Onufriienko, O., Vorobiov, S., Mitterer, C., Flachbart, K., Impact of annealing and hydrogenation on the superconducting transition temperature of (TiNbMoTaW)Nx high entropy alloy nitride films, Solid State Sciences 161 (2025) 107851.

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Schaffar, G. J. K., Burtscher, M., Taylor, A., Schrittwieser, D., Tscharnuter, D., Kiener, D., Imrich, P. J., Maier-Kiener, V., From nano-twinning to the glide of full dislocations: Micropillar compression tests on silicon up to 900 °C, Materials and Design 258 (2025) 114730.

Schiester, M., Waldl, H., Rice, K. P., Hans, M., Primetzhofer, D., Schalk, N., Tkadletz, M., Effects of laser wavelength and pulse energy on the evaporation behavior of TiN coatings in atom probe tomography: A multi-instrument study, Ultramicroscopy 270 (2025) 114105.

Stock, S., Trost, C. O. W., Seyffertitz, M., Selinger, J., Gupta, R. K., Tampaxis, C., Steriotis, T., Rebholz, C., Mitterer, C., Paris, O., Kostoglou, N., Transforming breakfast bio-waste into hydrogen storage materials, International Journal of Hydrogen Energy 114 (2025) 519–533.

Chair of Physical Metallurgy

Gehringer D., Romaner L., Holec D., Segregation to grain boundaries in disordered systems: An application to a Ni–based multi–component alloy, Materials & Design (2025) 114074.

Hatzenbichler L., Gocnik M., Haslberger P., Galler M., Stark A., Glushko O., Keckes J., Schnitzer R., Alteration of phase transformation behavior and prior austenite grain structure due to elevated tramp element concentrations in a hypoeutectoid steel, Steel Research International (2025) 2500172.

Holub G., Hofer S., Obermüller T., Rueckert E., Romaner L., Instance segmentation pipeline for etch pit detection and prismatic slip characterization on silicon carbide substrates, Engineering Applications of Artificial Intelligence 160 (2025) 111881.

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Reichmann A., Kainz Ch., Schalk N., Spitaler T., Burtscher M., Romaner L., Decomposition and segregation phenomena in PVD TiBN coatings, Materials & Design (2025) 114912.

Reiners–Sakic A., Reichmann A., Dösinger Ch., Romaner L., Holec D., Interstitials as a key ingredient for P segregation to grain boundaries in polycrystalline α–Fe, Scripta Materialia 268 (2025) 116864.

Schrittwieser D., Rinnhofer N., Obersteiner D., Pahr H., Glushko O., Schnitzer R., Retained austenite in multipass high–strength weld metal with a yield strength exceeding 1100 MPa, Journal of Materials Research and Technology 36 (2025) 6499–6505.

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Tang J., Renk O., Tkadletz M., Site–specific femtosecond laser ablation: The pathway to high–throughput atom probe tomography characterization, Materials Characterization 219 (2025) 114618.

Chair of Materials Physics

Cui, Z. L., Si, D. K., Zhang, J. L., Gao, Q. W., Gong, J. H., Wang, X. Q., Song, K. K., Han, X. L., Zhang, K., Mu, Y. K., Jia, Y. D., Şopu, D., Zhang, Z. Q., Ramasamy, P., Qiao, J. C., Song, W. D., Wang, G., Zhang, L. C., Eckert, J., Advancing the mechanical performance of chemically complex alloys through strategically engineered bamboo inspired multi stage heterostructures, Composites Part B: Engineering 302 (2025) 112547.

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Meindlhumer, M., Alfreider, M., Sheshi, N., Hohenwarter, A., Todt, J., Rosenthal, M., Burghammer, M., Salvati, E., Keckes, J., Kiener, D., Resolving the fundamentals of the J integral concept by multi method in situ nanoscale stress strain mapping, Communications Materials 6 (2025) 35.

Moravcik, I., Alfreider, M., Wurster, S., Schretter, L., Zadera, A., Pernica, V., Čamek, L., Eckert, J., Hohenwarter, A., Stabilization of mechanical strength in a nanocrystalline CoCrNi concentrated alloy by nitrogen alloying. Materials Science and Engineering: A 924 (2025) 147757.

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Yu, X., Bian, X., Liu, C., Wang, Q., Şopu, D., Kiener, D., Li, Y., Wu, G., Wu, Y., Yang, Y., Eckert, J., Wang, G., Oxygen nanoclustering evades inverse Hall Petch softening, Nature Communications 16 (2025) 10602.

Ziegelwanger, T., Reisinger, M., Petersmann, M., Van Petegem, S., Rodriguez Lamas, R., Todt, J., Meindlhumer, M., Keckes, J., Yildirim, C., Intragranular strain and mosaicity in Cu thin films during fast thermomechanical fatigue, npj Materials Degradation 9 (2025) 79.

Chair of Structural and Functional Ceramics

Gruber, M., Kreith, J., Lohrasbi, S., Bermejo, R., Supancic P., Estimation of residual stresses in single crystal sapphire wafers through eigenmode analysis, Scripta Materialia 259 (2025) 116538.

Hofer, A.-K., Reveron, H., Chevalier, J., Bermejo, R., Enhanced damage tolerance of Ce-TZP ceramics through a layered architectural design, Journal of the European Ceramic Society 45 (2025), 117427.

Jabr, A., Ribul, E., Salamon, D., Bermejo, R., Understanding the lower fracture resistance of cold sintered ceramics, Journal of the European Ceramic Society 45 (2025) 116968.

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Jana, A., Schlacher, J., Kraleva, I., Egger, A., Bucher, E., Bermejo, R., Tailoring strength and ionic conductivity in zirconia-based solid oxide electrolytes using a multimaterial approach, Journal of the American Ceramic Society 108 (2025) e20632.

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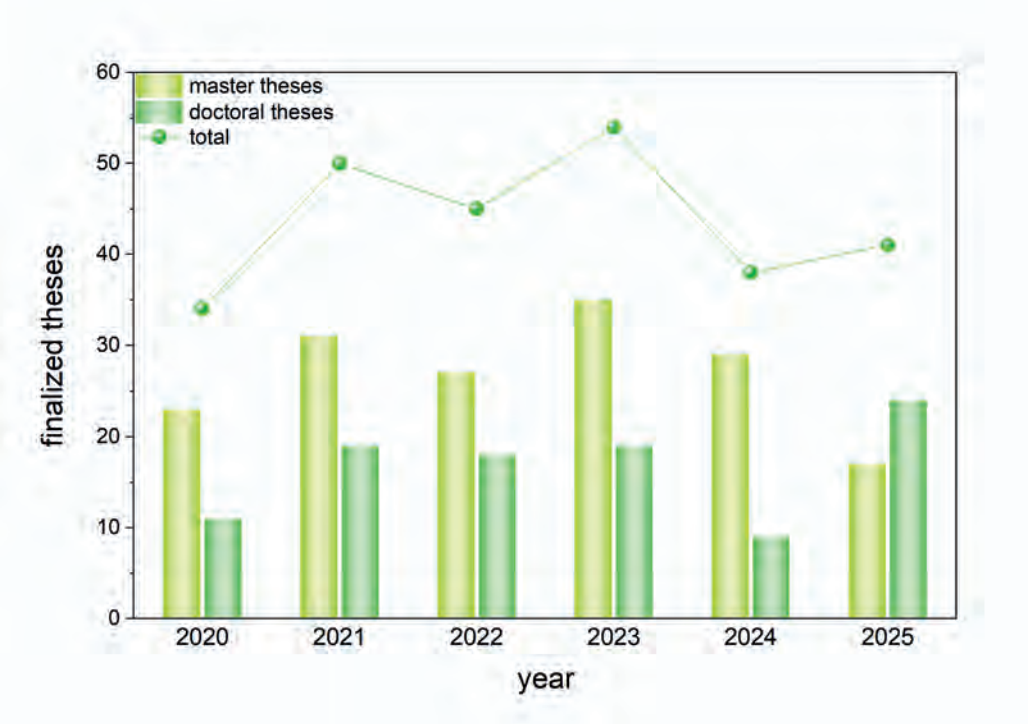
Staudacher, M., Lube, T., Schwarzer-Fischer, E., Abel, J., Reichel, M., Lorenz, N., Long, S., Fehleisen, F., Scheithauer, U., Strength limiting defects in Additively Manufactured Ceramics, Open Ceramics (2025) 100858.

Master and doctoral theses

The following figure shows an overview of the **completed diploma/master** and **doctoral theses** of the **last 6 years:**



Master theses

In 2025, **17 students** completed their theses.

Archer, Wolfgang
High resolution characterization of pearlitic steels with increased copper content

Asci, Atacan
Evaluating the effects of laser dicing on the residual stress and mechanical properties of silicon and silicon carbide wafers

Gass, Daniel
Environmental subcritical crack growth in coldsintered ZnO

Golesch, Armin
Microstructural characterization of continuous casting rollers with overlay welded layer

Grasberger, Rudolf
Characterisation of strength and defects in carbon rings

Hofer, Christian
Towards new approaches for APT specimen preparation with fs-laser ablation

Hofer, Johanna Cornelia Irmgard
The effect of boron on a Cr-Mo-V hot-work tool steel

Jarnot, Jens Tiemo
Mitigating the hardness drop due to divorced eutectoid transformation in pearlitic steels: Influence of the cooling rate

Koravitsch, Maximilian Alexander
Modification of wettability by surface structures created by fs-laser ablation on Si

Krug, Christian
A study on femtosecond laser ablation and fracture toughness of silicon nitride ceramics

Mehrabi, Mahdieh
Synthesis of thin films within the system silver niobate tantalate by reactive d.c. magnetron sputtering

Pfundner, Stefan Mathias
Influence of alloying elements on the oxidation resistance of near-α-titanium alloys for wire arc additive manufacturing

Reichel, Hannah Antonia
Enhancing the resistance of steel against adiabatic shear band formation by alloy selection and heat treatment improvement

Reindl, Philipp
Fracture mechanics characterization of rotating anode components

Steffny, Innozenz Ernst
Investigation of dendritic arm spacing in FeTi-Cu

Straßburg, Marco
Sample preparation and mechanical characterization of nanoporous activated carbon materials

Vratanar, Andreas
Correlation between microstructure and lifetime of metallic materials in semiconductor application

Doctoral theses

In 2025, 24 doctoral students were awarded doctorates in montanistic sciences.

Angermann, Martina
Lead-free high-energy density thin film capacitors

Brescakovic, Drazen
Enhancing the fracture toughness of brittle materials through the targeted insertion of material inhomogeneities

Dösinger, Christoph Alexander
Data-driven modelling of grain boundary chemistry

Jabr, Abdullah
Understanding the effect of processing conditions on the properties of cold sintered ceramics

Jelinek, Alexander
Fabrication and testing of microstructures and composites by means of multi-photon lithography

Kobald, Alexander Maximilian
Lead-free dielectric thin films for energy storage: Process-structure-property relationships

Kobald, Herbert
Lead-free Relaxor Ferroelectric Thin Films: Design, Processing, and Characterization for Advanced Energy Storage Capacitor Applications

Kölbl, Lukas
Reactive sputter deposition of silver niobate-based thin films for lead-free dielectric capacitors

Lumper-Wimler, Lea Andrea
From metastable states to functional materials properties: Novel phase transformation in Cu-based alloys

Moitzi, Franco
Ab initio design of alloy materials

Neumüller, Daniela
Hydrogen evolution electrocatalysts from pure metals to multicomponent alloys

Ofner, Nicole
Additive manufacturing of tool steels: Design of microstructure and mechanical properties by process parameter optimization

Papsik, Roman
Modelling of fracture in multi-layered ceramic composites

Pogrielz, Thomas
Impact of microstructure, stress, and phase composition on hydrogen permeation in duplex steel: A synchrotron X-ray diffraction study

Raznjevic, Sergej
Structural and dynamical properties of oxygen vacancy-enriched perovskite oxides

Roostaei, Milad
High strength biodegradable Mg-based materials for medical application

Schaffar, Gerald Josef Kamillo
Advancing the micromechanical characterization of silicon with a focus on high temperatures

Schweiger, Lukas
Novel pathways for solid-state hydrogen storage and hydrogen-mediated microstructure evolution

Sommerauer, Michael
Thermocyclic fatigue prevention in X-ray anode conversion layers—surface engineering and processing approaches

Walch, Lukas
Influences of microstructure on the crack growth behavior of high-speed steels

Xu, Qi
Mechanical properties modification and design of high entropy alloys studied based on Molecular dynamics simulations

Yüce, Eray
Development and characterization of Toxic-element free and biocompatible Ti-based metallic glasses

Zawodzki, Michael
Exchange bias of nanostructured materials processed by severe plastic deformation

Ziegelwanger, Tobias
Time- and space-resolved X-ray diffraction for stress analysis in semiconductor devices

Conferences Events

Organization of conferences

Members of the department were engaged in the organization of scientific conferences and other scientific events, as shown exemplarily in the next pages.

13. Gefüge & Bruch Tagung at the Montanuniversität Leoben (February 26-28, 2025, Leoben)

From February 26—28, 2025, the 13th "Gefüge & Bruch Tagung" took place in the old Aula of Montanuniversität Leoben, this time organized by Verena Maier-Kiener and Christian Mitterer from the Chair of Functional Materials and Material Systems with the help of many members of the department. This renowned event, which has been organized alternately by the Departments of Materials Science at Montanuniversität Leoben and Ruhr-Universität Bochum since 1976, once again brought together leading experts from science and industry.

Around 130 materials scientists and engineers from German-speaking countries came together to hear about the current state of research of microstructures and fracture in 34 invited lectures. The thematic spectrum ranged from nanostructured functional materials and microstructure modifications to material behavior under the influence of hydrogen, chemically complex material systems and fatigue-induced cracking to modern, recycling-friendly material concepts and innovative process routes for improving material properties. Local mechanisms of crack growth were also discussed in detail.

The lecture program was complemented by a poster exhibition with 27 scientific contributions and an accompanying sponsors' exhibition. A special highlight was the well-attended poster session in the "drawing room" of the Montanuniversität. In addition, the social evening in the picturesque Dominican courtyard of the Leoben City Shopping Center provided an ideal setting for professional and personal exchange.

The 13th Gefüge & Bruch Tagung successfully followed its predecessors and offered a high-caliber forum for interdisciplinary exchange. The participants are looking forward with great anticipation to the next edition, which will take place in Bochum in spring 2028.

New CD Laboratory for Sustainable Hard Coatings Opened (March 03, 2025, Leoben)

The new Christian Doppler Laboratory (CD Laboratory) for "Sustainable Hard Coatings" under the lead of Michael Tkadletz has been opened at the Department of Materials Science. The laboratory focuses on developing more environmentally friendly coatings for cutting tools. Funded by the Federal Ministry of Labour and Economy, it strengthens collaboration between academia and industry. Research priorities include energy-efficient manufacturing processes, reducing the use of critical raw materials, and optimizing hard coatings, for example through self-healing properties. The goal is to reduce CO_2 emissions while simultaneously improving coating performance. The industry partner, CERATIZIT Austria GmbH, contributes its expertise in industrial applications. Through innovative processes and the use of artificial intelligence, sustainable solutions are expected to be implemented more quickly in practice. The new CD Laboratory represents an important step for Montanuniversität and Austria as a hub for innovation and research.

4th Materials Science Colloquium (69. Metallkunde-Kolloquium)
(April 7-10, 2025, Lech am Arlberg)

In 2025, the 4th Materials Science Colloquium (69th Metallkunde–Kolloquium) once again brought together material researchers from academia and industry at an altitude of 1,444 metres above sea level to discuss recent developments and future trends in materials science. The focus topic of **"sustainable materials"** granted a versatile program that covered various scientific aspects of the circular economy and sustainable material production. As always, the intensive presentation schedule was accompanied by networking in a relaxed atmosphere of the Hotel Krone in Lech.

15th ASEM Workshop
(April 24-25, 2025, Leoben)

The 15th workshop of the Austrian Society for Electron Microscopy (ASEM), held on April 24–25, 2025, at the Montanuniversität of Leoben, brought together over 150 participants from academia and industry to showcase the latest innovations in electron microscopy. The event featured more than 80 contributions spanning materials science, life sciences, physics and chemistry, with insights into advanced techniques such as cryogenic electron tomography. Highlights included the prestigious Fritz Grasenick Award lectures delivered by Nikola Šimić and Bettina Zens.

Attendees engaged in vibrant discussions during poster sessions and lab tours, while sponsors showcased state-of-the-art instrumentation. The workshop served as a platform for scientific exchange, fostering collaborations that push the boundaries of microscopy. Special thanks go to the organizing committee, speakers, and sponsors for their contributions to this successful event.

MC 2025 (Microscopy Conference)
(August 31 - September 04, 2025, Karlsruhe)

At MC 2025 in Karlsruhe, microscopists from Leoben showed a strong presence. Daniel Kiener served as workshop organizer for WS 5: In-situ/operando TEM and SEM, shaping an agenda that highlighted cutting-edge methodologies for observing microstructural evolution under realistic conditions. He also contributed as a workshop invited speaker, sharing recent advances in correlative approaches and quantitative analysis. Beyond the workshops, together with Prof. Yolita Eggeler, Daniel Kiener acted as conference session organizer for MS02: Metals and Alloys, curating a program that connected fundamental mechanisms with application-driven performance. We are equally proud that Simon Fellner received a Best Poster Award at MC 2025, recognizing the clarity, innovation, and impact of his presented work. This distinction underscores our rigor and creativity to advancing microscopy-driven materials science.

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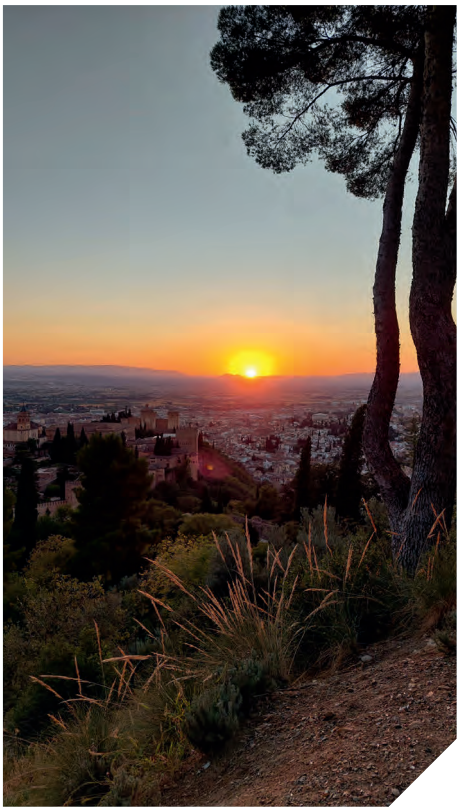


FEMS 2025 EUROMAT
(September 14-18, 2025, Granada)

From September 14–18, the 18th European Congress and Exhibition on Advanced Materials and Processes (EUROMAT 2026) took place in the beautiful city of Granada, Spain. The event brought together more than 4,000 materials scientists from around the world to present and discuss their latest research findings.

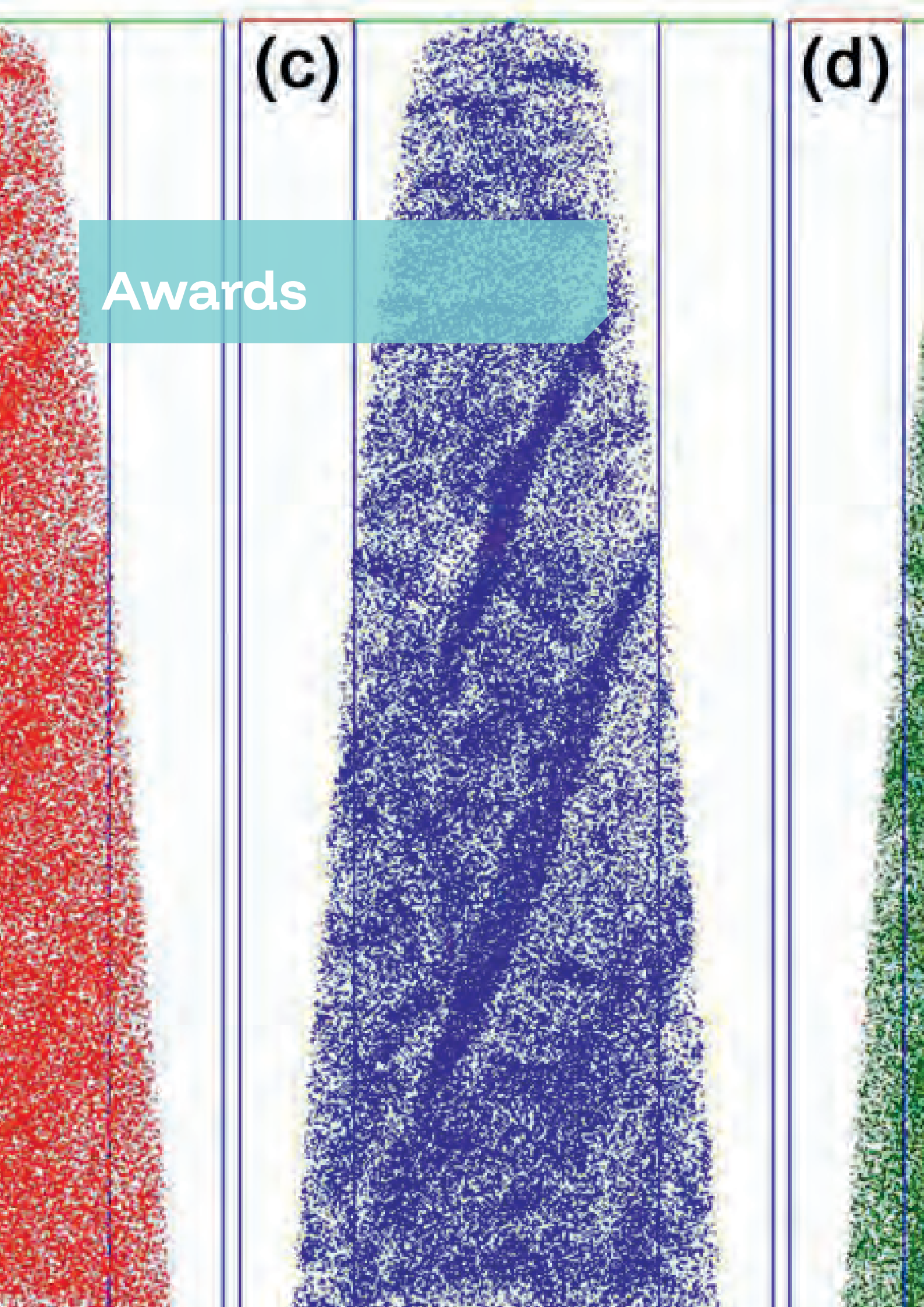
The Department of Materials Science was strongly represented at the conference. Members of the department attended the event, delivered keynote and contributed presentations, and organized several symposia, including sessions on “Advanced Steels” and “Mechanical Characterization and Modelling.”

In addition to the many stimulating scientific presentations and fruitful discussions, the conference also provided an excellent opportunity to experience the rich culture of Granada. Participants enjoyed the city during a guided tour and had the chance to visit the spectacular Alhambra, while also exploring Spanish history and cuisine.

8th International Conference Fracture Mechanics and Fractography of Advanced Ceramics

(October 06-10, 2025, Smolenice Castle, Slovakia)

The 8th International Conference "Fracture Mechanics and Fractography of Advanced Ceramics" took place from October 6–9 in Smolenice, Slovakia. The program committee, Tanja Lube (Montanuniversität Leoben) and Prof. Dr. Jan Dusza (Slovak Academy of Sciences, Kosice) welcomed participants from academic institutions in Europe and ceramic industry. The lectures about fracture analysis, materials testing and material characterization showed the current scientific developments and their applications in the industrial environment.



Awards

Prizes and awards

The scientific work of the department's employees met with a great response both nationally and internationally. It is gratifying to note that in particular numerous younger employees received awards for successful master's and doctoral theses. The following pages provide an overview of the awards received by members of the department during the reporting period.

Indian National Science Academy

Jürgen Eckert was elected as a Foreign Fellow of the Indian National Science Academy (INSA), New Delhi, for his pioneering contributions in the area of materials physics and metastable materials fabricated through non-equilibrium processing, providing a generalized understanding of phase formation and structure-property-correlations for metastable materials that serves as basis for developing advanced high-performance structural and functional materials for a variety of applications. This honors his fundamental research on amorphous, quasicrystalline and nanostructured materials, and on biomedical, energy and sustainable materials and advanced production techniques, emphasizing the value of fundamental research to technologies that improve the quality of life and environment.

भारतीय राष्ट्रीय विज्ञान अकादमी

Winner of the competition MUL:idea 2025: Team "Next-Gen Fuel Cell Tech" of our former collegue Fei-Fan Cai and our PhD Adam Elbataioui

The MUL:idea ideas competition was launched by the Rector of the Montanuniversität Leoben and is aimed at all creative minds at the university. In a thrilling final at the Startup Night "Business Queens" on May 21, 2025, six teams—three from the track for researchers and staff and three from the student track—presented their innovative ideas to a distinguished audience. The jury evaluated the submissions based on their degree of innovation, feasibility, and team competence.

The "Next-Gen Fuel Cell Tech" team impressed the jury with an innovative hydrogen fuel cell technology and won in the track for researchers and staff. Their novel gas diffusion electrodes (GDEs) reduce platinum consumption, significantly lower production costs, and increase the efficiency of the fuel cells. The team will receive € 5,000 in prize money and further support from the Center for Applied Technology Leoben (ZAT) in implementing their idea into a spin-off or startup.

Rector Peter Moser opened the finale together with ZAT Managing Director Remo Taferner and emphasized in his speech the importance of innovative strength and entrepreneurial thinking at the Montanuniversität: "With MUL:idea, we not only promote creative ideas, but also the courage to try new things and take on responsibility," said Rector Moser.

2nd ÖWGP Doctoral Awards 2025 for Abdullah Jabr

The Austrian Scientific Society for Production Engineering (ÖWGP) awarded the 2nd prize of the 2025 Doctoral Awards to Abdullah Jabr for their dissertation at the Chair of Structural and Functional Ceramics. Abdullah Jabr's dissertation "Understanding the Effect of Processing Conditions on the Properties of Cold Sintered Ceramics" advanced cold sintering, an energy-efficient method that lowers ceramic sintering temperatures from above 1000 °C to below 350 °C. His work improved structural integrity and demonstrated the method's scalability. The awards were announced on October 28, 2025 in Leoben.

Abdullah Jabr receives the "Award of Excellence 2025"

Abdullah Jabr has been awarded the prestigious Award of Excellence 2025 for his dissertation on the innovative cold sintering process for the energy-efficient production of ceramics. This national prize, awarded annually by the Austrian Federal Ministry for Women, Science and Research, is one of the highest honors for outstanding academic achievements by early-career researchers in Austria. The official award ceremony took place on December 10, 2025, at the "Aula der Wissenschaften" in Vienna. Since 2008, the Award of Excellence has recognized outstanding scientific achievements and emphasized the importance of cutting-edge research in Austria. In his dissertation titled "Understanding the Effect of Processing Conditions on the Properties of Cold Sintered Ceramics", Abdullah Jabr investigated a novel cold sintering process that enables ceramics to be produced at temperatures below 350 °C – significantly lower than the conventional processes, which typically require temperatures above 1000 °C. His work makes an important contribution to the development of sustainable material solutions and paves the way for new applications.

Rudolf Streicher Award to Daniel Kiener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On Friday, December 19, the third and final academic ceremony of 2025 took place in the Erzherzog Johann Auditorium at the Montanuniversität Leoben. During this event, Daniel Kiener from the Department of Materials Science/Chair of Materials Physics was awarded the Rudolf Streicher Science Prize 2025. This highly endowed science prize was awarded for the first time this year and recognizes outstanding scientific achievements in montanistic research. Daniel Kiener was selected as the winner by a high-ranking seven-member jury and the board of trustees of the Dr. Rudolf Streicher Private Foundation.

Extraordinary Research Awards for Leoben Material Scientists

At the DGM Day 2025 of the German Materials Society (DGM), held on October 22–23 in the auditorium of TU Chemnitz, the Montanuniversität Leoben achieved remarkable success.

Daniel Kiener received the DGM Prize 2025—one of the DGM's highest honors—in recognition of his outstanding contributions to nanomechanics and interface design of materials. Oliver Renk was honored with the Masing Prize 2025 for his excellent work in nanostructure fabrication, while Reinhard Pippan was awarded Honorary Membership of the DGM for his impressive lifetime achievements.

These three distinctions highlight the research excellence and international impact of materials science at the Montanuniversität Leoben.

“Wissenschaftspreis für Montanistinnen” to Magdalena Kirchmair

Since 2019, Montanuniversität Leoben has been awarding the Wissenschaftspreis für Montanistinnen to promote and focus on the work of young female researchers and thus strengthen women in STEM subjects. This year, Magdalena Kirchmair from the Chair of Functional Materials and Materials Systems was honored with the award for her Master’s thesis on “Development of high entropy alloy thin films for hydrogen permeation barriers”.

VACOM Sustainability Award of the German Vacuum Society presented to Lukas Kölbl

Lukas Kölbl was awarded second place in the VACOM Sustainability Award of the German Vacuum Society on June 3, 2025 for his recently completed doctoral thesis. Established in 2022, the award recognizes outstanding theses by early-career scientists in the field of vacuum technology that incorporate the principles of sustainability.

In his doctoral research, Lukas Kölbl focused on the development of environmentally friendly, lead-free ceramic layers based on silver niobate for dielectric thin-film capacitors used in energy storage applications. The award was presented during the German Vacuum Society’s Members’ Contact Day at the Karlsruhe Institute of Technology.

ESPRIT Fellowship to Michael Meindlhumer

In March 2025, Michael Meindlhumer from the Chair of Materials Physics received an ESPRIT grant from the Austrian Science Fund (FWF). The ESPRIT program aims to improve the skills and professional development of researchers at the beginning of their career by giving them the opportunity to lead an independent research project. As part of the project "The nanoscale stress field of interface cracks (InFraStress)", Michael Meindlhumer will for the first time quantitatively characterize the stress field of interface cracks in a realistic complex material composite. The nanoscale stress and strain fields of interfacial cracks will be quantified under deformation using scanning electron microscopy and *in situ* synchrotron X-ray nanodiffraction. In addition, the experimental data will be complemented by finite element model calculations. In combination, these techniques should lead to a deeper understanding of interfacial cracks and validate existing models, for the first time using quantitative nanoscale resolved stress data.

Franz Leitner Prize 2025 awarded to Jan Platl

©ASMET/ Christian Streili

Jan Platl has been awarded first prize in the PhD category of the Franz Leitner Prize 2025, for his research achievements in the field of welding. This prize is sponsored by the board of ASMET and the management of voestalpine Böhler Welding Austria GmbH and is awarded every two years following the decision of a jury. During his doctoral thesis at the Chair of Physical Metallurgy, Jan Platl investigated the crack mechanisms of high-alloyed additively manufactured tool steels and contributed significantly to the understanding of cracking formation and the microstructure development during solidification. Jan Platl's work focused on high-resolution material characterization using atom probe tomography and in-situ synchrotron radiation. The award ceremony took place at the ASMET Forum in May 2025.

Award for the best dissertation in materials research

Thomas Pogrielz was honoured for his dissertation, 'Impact of Microstructure, Stress, and Phase Composition on Hydrogen Permeation in Duplex Steel: A Synchrotron X-ray Diffraction Study".

Carried out at the Chair of Materials Physics in collaboration with the MCL, the work uses a novel method to provide key insights into hydrogen-induced processes in complex materials. It thus makes a significant contribution to the development of safe and sustainable solutions for energy, mobility and infrastructure technologies.

Third place in the student speech contest of the Austrian Ceramic Society for Tobias Prötsch

On April 3, 2025, the Austrian Ceramic Society (AuCerS) invited its members to its annual general meeting. More than 40 members got together in Vienna and discussed current topics in the field of ceramics. In the student speech contest, Tobias Prötsch from the Chair of Structural and Functional Ceramics achieved an excellent third place with his presentation "Towards strong and tough alumina-based ceramics through rapid sintering". In his work, Tobias Prötsch works with a non-conventional sintering method, enabling high heating rates and short dwell times, which allows a reduction from the overall sintering time from hours or days to the range of minutes. The outstanding benefit of this technique is the possibility of tailoring the microstructure of ceramics, resulting in enhanced strength and/or damage tolerance.

Two Best Graphical Abstract Awards from Shaping 9 Conference

The Montanuniversität Leoben was represented at Shaping 9 by four participants from the Chair of Structural and Functional Ceramics (ISFK). The Leoben participants had reason to celebrate right after the opening ceremony when the awards for the Graphical Abstract Contest were presented. Abdullah Jabr earned the 3rd prize in the Graphical Abstract Students Contest for his graphical abstract on "Understanding the Lower Fracture Resistance of Cold Sintered Ceramics." Tobias Prötsch won the 1st prize with his graphical abstract on "Tape Casting of Cr_2AlC MAX Phase for Multi-Material Designs." The Graphical Abstracts were evaluated by an international jury, and the authors were revealed only after the decision had been made. A special highlight was the award of the "Polish Ceramic Society Award" to David Salamon, in recognition of his contributions to the understanding and development of additive manufacturing.

WKO - Research scholarships awarded to Hannah Teuschl

Hanna Teuschl from the Chair of Physical Metallurgy received a research grant from the WKO Steiermark for her master's thesis, in which she investigated the influence of increased tramp element contents for green steel production. In particular, the scholarship holder used high-resolution atom probe tomography to investigate the segregation behavior of elements that occur due to the increased use of scrap in steel production. The scholarships were awarded on July 1 at a ceremony hosted by the WKO in Graz.

Teaching

Teaching

In addition to research, teaching is an equally important task of the university. It is the basis for the high quality education of our graduates, who will later not only contribute to the sustainable development of Austria as a location for industry and research, but will also successfully gain a foothold internationally.

Semester Hours (Hrs) Winter- and summer semester

Chair	Compulsory subject	Elective subject	Free subject
Chair of Functional Materials and Materials Systems	34	5	13
Chair of Physical Metallurgy	19,5	18	8
Chair of Materials Physics	20,8	23	52
Chair of Structural and Functional Ceramics	36	16	12

Exams

Chair	Number of exams
Chair of Functional Materials and Materials Systems	515
Chair of Physical Metallurgy	381
Chair of Materials Physics	286
Chair of Structural and Functional Ceramics	450

Outlook

Reflecting on global developments, 2025 was marked by President Trump's return to the White House and subsequent actions, including a surge of executive orders imposing worldwide tariffs, significant cuts to U.S. funding for national and international programs, and major shifts in transatlantic relations. These policies affected the American public and our scientific collaborators, with broad impacts for economic and scientific exchange. With U.S. elections approaching in the fall, 2026 is likely to remain politically volatile.

In response to these changing conditions, the EU must adapt its policies and strengthen strategic autonomy across critical domains. Priorities include energy security, access to critical resources, safety, and key industrial capabilities in engineering, microelectronics, pharmaceuticals, and AI. The new framework program emphasizes accelerated translation of research into industry by deepening academia–industry collaboration. This favorably aligns with a core strength of our department and may open new funding opportunities in a challenging economic environment. We also anticipate the announcement of the FTI Strategy 2030 and, ideally, increased Austrian research funding for the next period.

Advanced materials are widely recognized as a key enabler of Europe's prosperity. The Department of Materials Science will continue to conduct research at the highest level to advance materials and components and reinforce Austria's position as a center of research and innovation. To further expand collaboration and our network, we look forward to the launch of the Cluster of Excellence:

"Materials" at Montanuniversität Leoben.

Innovative ideas require talented people to educate, train, and work with. Our students are our most valuable asset, and we are pleased to welcome the first cohort of 13 students from the University of Hyderabad in the upcoming summer term and expect an intensified exchange within the Focus India framework and beyond. But meeting Feynman's challenge to understand and engineer materials from the bottom up also demands state-of-the-art experimental, analytical, and computational capabilities. In this spirit, we await the arrival of new equipment, including an atomic layer deposition system, a multiphoton-lithography 3D printer, and a new high-performance computing cluster in 2026. With these capabilities, the department will also initiate new research directions, such as defect-engineered materials for quantum sensing.

We are convinced that the many global challenges outlined at the outset can be met only through sustained, collective effort. As members of the Department of Materials Science, we will continue to emphasize to our students the essential value of a broad, diversified education in materials science, coupled with a respectful and inclusive mindset as a prerequisite for peace and prosperity. At the same time, we offer top-tier, multidisciplinary research expertise to our industry partners. Together, these commitments position us to develop responsible, innovative materials that address the socio-economic needs of today and of future generations.

Imprint

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Department Materials Science

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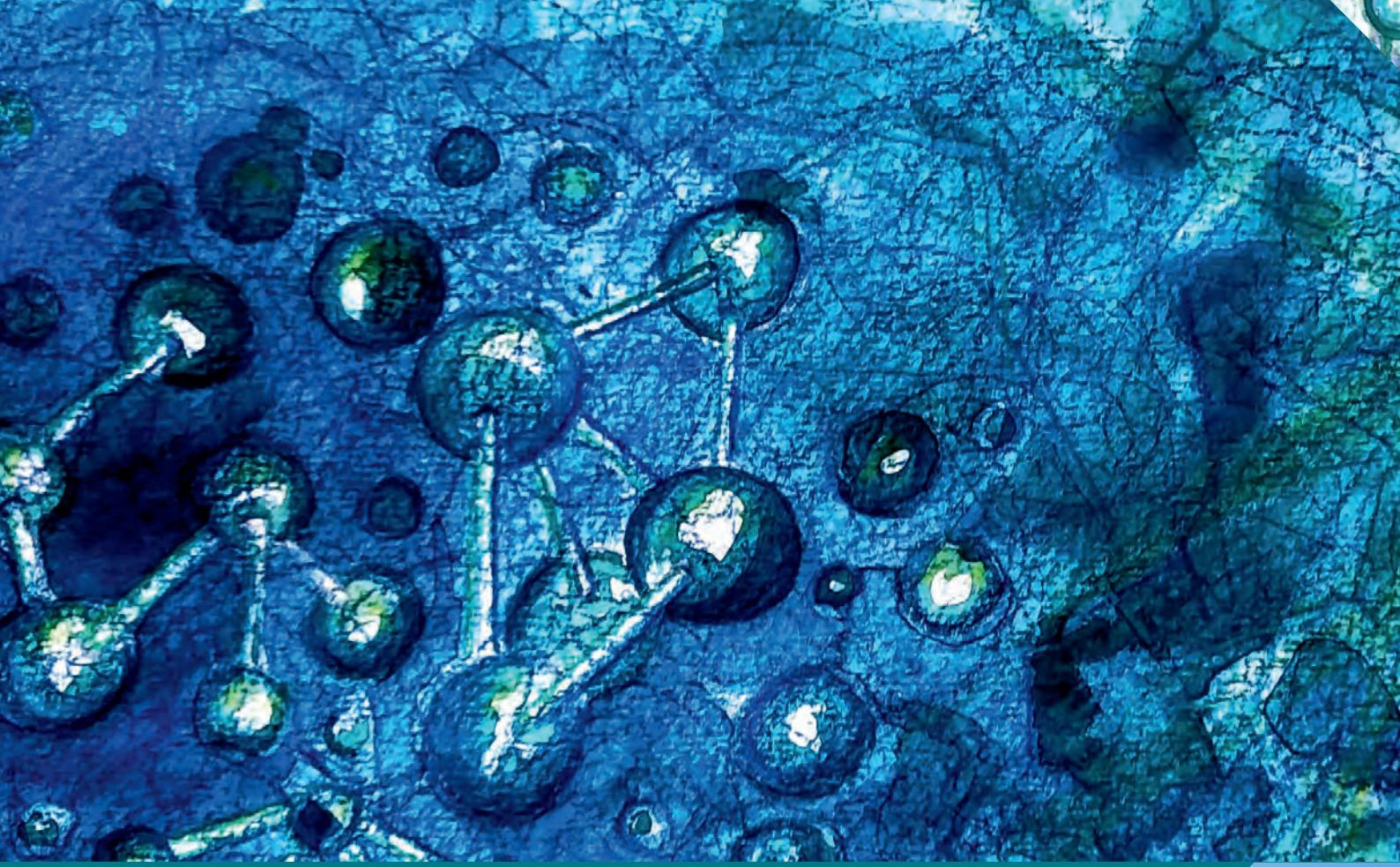

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