Training Course

Innovative Elemental Analysis for Materials Science and Engineering

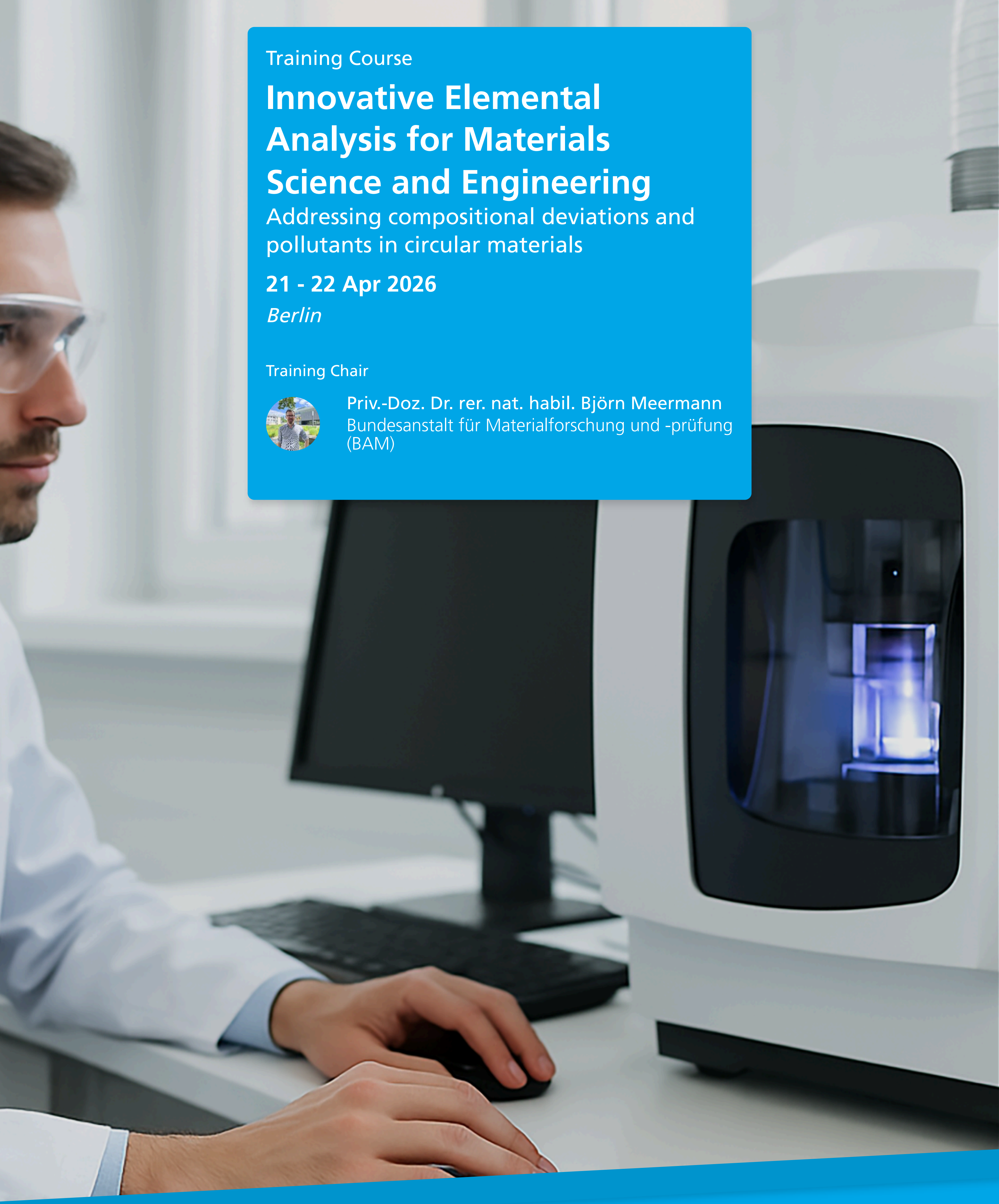
Addressing compositional deviations and pollutants in circular materials

21 - 22 Apr 2026

Berlin

Training Chair

Priv.-Doz. Dr. rer. nat. habil. Björn Meermann
Bundesanstalt für Materialforschung und -prüfung (BAM)



DGM

Training Course

Innovative Elemental Analysis for Materials Science and Engineering

Addressing compositional deviations and pollutants in circular materials

21 Apr 12:00 - 22 Apr 2026 15:00

Berlin

A circular economy is essential for climate protection and resource efficiency. Since 1970, global material use has tripled, and nearly half of CO_2 emissions are linked to resource extraction and processing. Developing sustainable materials and recycling strategies requires precise analytics to detect compositional deviations and trace pollutants, such as per- and polyfluoroalkyl substances (PFAS). This two-day workshop presents innovative elemental analysis techniques. The first day provides an overview of current methods, including Inductively Coupled Plasma-Mass Spectrometry/-Optical Emission Spectroscopy (ICP-MS/-OES), Atomic and Molecular Absorption Spectroscopy (AAS, MAS), X-ray Fluorescence Spectroscopy (XRF), Glow Discharge-Optical Emission Spectroscopy (GD-OES), and others. The focus then shifts to key methods relevant for solid sample and PFAS analysis, especially ICP-MS/-OES and AAS/MAS. The following methods will be discussed in more detail, but the concepts can be applied to similar ICP-MS/-OES and AAS/MAS methods: ICP-OES with Electrothermal Vaporization (ICP-ETV) and ICP-MS with Laser Ablation (LA/ICP-MS) for solid material analysis, and High resolution-continuum Source-Graphite Furnace Molecular Absorption Spectrometry (HR-CS-GFMAS) for contaminant analysis, such as PFAS. In addition to the theoretical foundations, the course will explore method selection strategies and practical use cases in materials science and engineering. Participants are encouraged to actively engage and share challenges from their own work. The second day is entirely dedicated to hands-on laboratory practice. Participants will work directly with ETV/ICP-OES, LA/ICP-MS, and HR-CS-GFMAS. This experience provides practical insights into the performance of these methods under real-world conditions. This experience will help them build confidence in selecting and applying these techniques to their own work. This course is designed for professionals and researchers in materials science, engineering, and environmental analysis who use advanced techniques to improve material quality, enable recycling, and develop safe, sustainable materials.

Training Chair

Priv.-Doz. Dr. rer. nat. habil. Björn Meermann
Bundesanstalt für Materialforschung und -prüfung (BAM)

Lecturer

Dr. Thibaut Van Acker
Ghent University

Dr. Thomas Vogt
TU Bergakademie Freiberg

Target group

The training course is suited for:

- Scientists, engineers and technicians working in research and development as well as industrial production, process and quality control.
- Managers and salespeople with a basic technical understanding who work in this or a related field and want to benefit from materials-oriented further training.
- People with a basic technical understanding who work in the field of materials characterization or in related fields and would like to benefit from materials-oriented further training.

Goals

Elemental analysis is essential for circular materials and resource-efficient production. This course provides the essential know-how to identify exact compositions, variations, and contaminants, such as PFAS, using advanced, industry-relevant methods.
Here are the key reasons why this course will benefit your company:

- **Overview of Elemental Analysis Methods:** Learn core techniques such as ICP-MS/-OES, XRF, AAS/MAS, and GD-OES as well as LA/ICP-MS, and discover how to select the right method for your needs.
- **Method Selection:** Learn to select the right method for your task to improve decision-making, reduce time to results, and optimize analytical costs and reliability.
- **Solid Materials:** Learn how to analyze elemental composition of solid materials using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) and ICP-Optical Emission Spectroscopy (ICP-OES) methods.
- **PFAS Detection:** Apply Molecular Absorption Spectrometry (MAS) methods to analyze PFAS content and assess environmental impact and circularity.
- **Spatially Resolved Analysis:** Determine the distribution of trace elements in metals, ceramics, alloys, and more using ETV and laser ablation.
- **Hands-On Practice:** Perform measurements yourself to gain practical insights into the performance, limitations, and data analysis of ICP-MS and MAS spectroscopy in lab conditions.
- **Operational Requirements and Robustness:** Evaluate throughput, operability, and cost-efficiency to implement techniques in your lab or production environments with confidence.
- **Discuss your specific practical application/problem with experts.**

Use this opportunity to advance your company's technology and gain a competitive advantage!

Organizational matters

The training materials will be handed out to participants on-site at the event location.

For accommodation, we recommend searching via common online booking platforms.

A joint dinner with the participants and the seminar instructors is planned for the first evening of the training.

Overview

21 Apr 2026 (Tue)

13:00	Overview of Elemental Analysis in Materials Science and Engineering
14:00	Inductively coupled plasma mass spectrometry (ICP) coupled with electrothermal Vaporization (ETV) for solid materials – fundamentals and applications
15:30	Inductively coupled plasma-mass spectrometry coupled with laser ablation (LA/ICP-MS) for solid materials – fundamentals and applications
16:30	High resolution-continuum source-graphite furnace molecular absorption spectrometry (HR-CS-GFMAS) for contaminant analysis (PFAS) – fundamentals and applications

22 Apr 2026 (Wed)

09:00	Hands-on Lab Practice

Program

21 Apr 2026 (Tue)

12:00 Pause

Welcome and Lunch Snack

13:00 Vortrag

Overview of Elemental Analysis in Materials Science and Engineering

Elemental analysis is a fundamental tool in materials science for identifying which chemical elements are present in a sample—and in what quantities. It answers the essential question: What is this material made of, and in what proportions? The elemental composition directly affects key material properties such as mechanical strength, corrosion resistance, electrical conductivity, and thermal stability. This session provides an application-oriented overview of key analytical techniques, including Inductively Coupled Plasma methods (ICP), X-Ray Fluorescence Spectroscopy (XRF), Atomic and Molecular Absorption Spectroscopy (AAS/MAS), Glow Discharge-Optical Emission Spectroscopy (GD-OES), Energy-Dispersive X-Ray Spectroscopy (EDS), and Combustion Methods for Carbon and Sulfur analysis. Each technique is introduced with its basic principles, capabilities, and limitations—illustrated through practical examples.

Participants gain a solid understanding of the methodologies and typical applications of each technique and learn how to select appropriate methods based on their analytical requirements. This serves as a valuable foundation for the subsequent modules.

Priv.-Doz. Dr. rer. nat. habil. Björn Meermann
Bundesanstalt für Materialforschung und -prüfung (BAM)

14:00 Vortrag

Inductively coupled plasma mass spectrometry (ICP) coupled with electrothermal Vaporization (ETV) for solid materials – fundamentals and applications

Inductively coupled plasma-Optical Emission Spectroscopy (ICP-OES) coupled with electrothermal vaporization (ETV) is a fast and efficient method to analyze high-tech materials directly — without time-consuming sample preparation. In industry, it is increasingly used for quality control of high-purity materials needed in electronics, batteries, pharmaceuticals, cosmetics, and specialized graphites. These materials often have strict purity requirements and demand precise testing beyond what standard methods can offer. This module shows how ETV can make quality control in production and incoming goods faster, more reliable, and easier to integrate into daily workflows.

Participants will learn how the method helps meet high standards, reduce turnaround time, and keep processes stable and efficient. The module focuses on practical examples and demonstrates how ETV has successfully moved from research into everyday industrial use, making it a valuable tool for modern production and testing labs. The knowledge can be transferred to other ICP methods.

Dr. Thomas Vogt
TU Bergakademie Freiberg

15:00 Pause

Break

15:30 Vortrag

Inductively coupled plasma-mass spectrometry coupled with laser ablation (LA/ICP-MS) for solid materials – fundamentals and applications

Laser ablation coupled with inductively coupled plasma-mass spectrometry (LA/ICP-MS) is the "go-to" method for (trace) element and isotopic analysis and allows for the rapid and direct analysis of the elemental composition of solid materials without the need for complex acid digestion. This microanalytical technique is ideal for analyzing hard-to-dissolve materials, such as metals, ceramics, alloys, and polymers. LA/ICP-MS combines high sensitivity, multi-element capability, and spatial resolution down to the micrometer scale, making it a powerful tool for characterizing materials and ensuring quality control. This module introduces the fundamentals of LA/ICP-MS, including sample preparation, calibration, tuning, and data acquisition.

Participants will learn to apply the method to tasks such as bulk analysis of steels and alloys, depth profiling of layered materials, elemental mapping of anodes, detecting metallic impurities in silicon carbide (SiC) and gallium nitride (GaN) wafers, and analyzing nanoparticles and microplastics. With its minimal sample preparation requirements and ability to resolve fine structures, LA/ICP-MS supports innovation and quality assurance in materials research and production.

Dr. Thibaut Van Acker
Ghent University

16:30 Vortrag

High resolution-continuum source-graphite furnace molecular absorption spectrometry (HR-CS-GFMAS) for contaminant analysis (PFAS) – fundamentals and applications

Per- and polyfluoroalkyl substances (PFAS) are among the most critical emerging contaminants. They pose major challenges for recycling, material development, and environmental protection. There are millions of different PFAS compounds, and they are highly persistent, bioaccumulative, and toxic. Their analysis is also notoriously complex due to their diverse properties. This module highlights how advanced elemental analytical methods contribute to safer and more sustainable material design, as well as support the transition to a circular economy. After an introduction to the principles of the circular economy, the challenges of recycling, and the role of analytical chemistry, the focus shifts to PFAS. Participants will learn about current analytical strategies, including target methods and sum parameters, such as extractable organically bound fluorine (EOF). The potential of High resolution-continuum source-graphite furnace molecular absorption spectrometry (HR-CS-GFMAS) for detecting PFAS as a sum parameter will be discussed, as this enables better risk assessment and improved material safety.

Participants will learn how analytical chemistry can help minimize pollutant release, ensure compliance, and develop CE-compliant materials by understanding and applying these approaches.

Priv.-Doz. Dr. rer. nat. habil. Björn Meermann
Bundesanstalt für Materialforschung und -prüfung (BAM)

19:00 Pause

Dinner

22 Apr 2026 (Wed)

09:00 Praktikavorführung

Hands-on Lab Practice

Day two of the workshop will take place in the laboratory: the theoretical principles taught will be put into practice; the performance of the techniques will be demonstrated using concrete applications. Attendees will have the chance to get in contact and discussion among each other. Furthermore, enough time will be provided to discuss individual aspects of elemental analytics, specific aspects of sample handling as well as general working principles of the techniques demonstrated.

In addition to methodological aspects, practical application questions are also in focus, such as:

- How many samples can be processed per day (speed and throughput)?
- How robust are the measurements under non-ideal conditions?
- Can the system be operated reliably by technical personnel without scientific training?
- What are the costs associated with measurement, instrumentation, and operation?

The following three modules will be offered, and each attendee has the chance to follow every module. They are offered in a rotating manner.

Module 1: Inductively coupled plasma-optical emission spectroscopy (ICP-OES) coupled with electrothermal vaporization (ETV) for solid materials – fundamentals and applications

Within Module 1, the working principle, optimization of ETV as well as online coupling of ETV with ICP-OES will be demonstrated. The trace metal analysis of graphite will be demonstrated. Afterwards, data assessment strategies will be demonstrated. Next to maintaining, some aspects related to trouble shooting will be highlighted.

Module 2: Inductively coupled plasma-mass spectrometry coupled with laser ablation (LA/ICP-MS) for solid materials – fundamentals and applications

Within Module 2, the working principles of LA and ICP-ToF-MS will be introduced. The online coupling with LA, tuning as well as sample preparation for laser ablation will be demonstrated. Afterwards, a slag sample will be spatially analyzed. The setup available in Division 1.1 – Inorganic Trace Analysis (ITALab) is high end equipment, allowing for fast scanning and "all elements all time" ICP-ToF-MS detection. The attendees will be introduced into iolite software for image assessment.

Module 3: High resolution-continuum source-graphite furnace molecular absorption spectrometry (HR-CS-GFMAS) for contaminant analysis (PFAS) – fundamentals and applications

Within Module 3, the working principle, optimization and trouble shooting in HR-CS-GFMAS will be introduced at the application example of PFAS. Upon sample preparation, and analysis, data assessment of the analyzed samples with be demonstrated.

Priv.-Doz. Dr. rer. nat. habil. Björn Meermann

Bundesanstalt für Materialforschung und -prüfung (BAM)

Björn Meermann, born in 1982, studied chemistry at the University of Münster and obtained his doctorate in 2009. This was followed by a postdoctoral period of almost two years at the University of Ghent (Belgium). In 2012 he joined the Federal Institute of Hydrology (BfG) in Koblenz as a research associate and postdoctoral researcher. Since June 2019, Björn Meermann has been Head of Division 1.1 "Inorganic Trace Analysis" (ITALab) at the Federal Institute for Materials Research and Testing (BAM) in Berlin. In 2024, he completed his "Habilitation" in Analytical Chemistry at TU Bergakademie Freiberg, where he was appointed a "Privatdozent" and holds a lectureship in Analytical Chemistry. Björn Meermann´s research focus is on the interface between materials and the environment and the life sciences. He investigates the release of elements/element species and (nano)-particles from materials into the environment as well as their possible uptake in organisms and cells - the long-term impact of (metal-based) materials on the environment is to be derived from this. His overarching research objective is on sustainable and safe by design materials to enable a sustainable transformation of our society towards a circular economy (CEco). Analytical techniques applied for his research are: hyphenated techniques (CE/, LC/, GC/ICP-MS), single particle/cell-ICP-ToF-MS and HR-CS-GFMAS for non-metal analysis.

Dr. Thibaut Van Acker

Ghent University

Thibaut Van Acker is a postdoctoral research fellow of the Research Foundation Flanders (FWO) in the Atomic & Mass Spectrometry – A&MS research unit of Ghent University, led by Prof. Frank Vanhaecke, and a visiting researcher at The Günther Group - Trace Element and Micro Analysis group (ETH Zürich). He pursued a Master's degree in Bioscience Engineering with a specialization in Environmental Technology, and first delved into analytical chemistry during his master's thesis, focused on developing new analytical methods to determine platinum group metals originating from automotive catalysts in road dust with tandem ICP-mass spectrometry. During his PhD, he focused on coupling laser ablation to ICP-mass spectrometry (LA-ICP-MS) for spatially resolved elemental analysis and he developed novel methods for multi-modal imaging of biological tissue in biomedical contexts. His current research is focused on both fundamental aspects of LA-ICP-MS and analytical method development to explore the capabilities of the technique for high spatial resolution elemental and isotopic mapping applications in challenging interdisciplinary contexts. Based on a number of hardware improvements, Thibaut has brought elemental mapping – i.e. the revelation of the 2- and even 3-dimensional distribution of elements across a sample – to another level. This can currently be accomplished at a pixel acquisition rate up to 1,000 Hz and a laser spot size down to 1 µm. So far, Thibaut is (co-)author of 38 publications in peer-reviewed international journals (h-index: 17 and 1,260 citations based on Google Scholar) and his work has been presented in > 90 lectures and posters on international conferences. He was awarded the 2023 European Rising Star Award for Plasma Spectrochemistry and the 2024 JAAS Emerging Investigator Lectureship Award. He also organized the 16th edition of the European Workshop on Laser Ablation (EWLA 2024) in Ghent, Belgium with over 190 participants from 25 different countries worldwide.

Dr. Thomas Vogt

TU Bergakademie Freiberg

Dr. Thomas Vogt is currently a senior scientist at the Institute of Analytical Chemistry at the Berakademie Freiberg. After completing an apprenticeship as an electrician due to his refusal to continue his schooling, his love of education returned and he studied applied natural sciences, specializing in environmental chemistry and biosciences. After a detour into organic chemistry, he found his home in analytical chemistry and has been working on solid analytical methods such as laser ablation and electrothermal vaporization as sample supply systems for ICP-MS and -OES since his diploma thesis. This was the focus of his doctorate in chemistry, in which he developed methods for process-accompanying at-line analysis for the material utilization of energy raw materials. In addition to the analysis of high-purity products such as graphites, these topics with a focus on in-process analysis still form the main field of his research. In particular, ETV coupled with optical spectroscopy and LIBS has been used in a wide range of research topics for industrial applications in recent years.

Book participation

DGM-Mitglieder

DGM-Nachwuchsmitglieder	€ 1,200.00 incl. VAT
DGM-Mitglieder	€ 1,500.00 incl. VAT

Reguläre Teilnahme

Reguläre Teilnahme	€ 1,600.00 incl. VAT

Contact person

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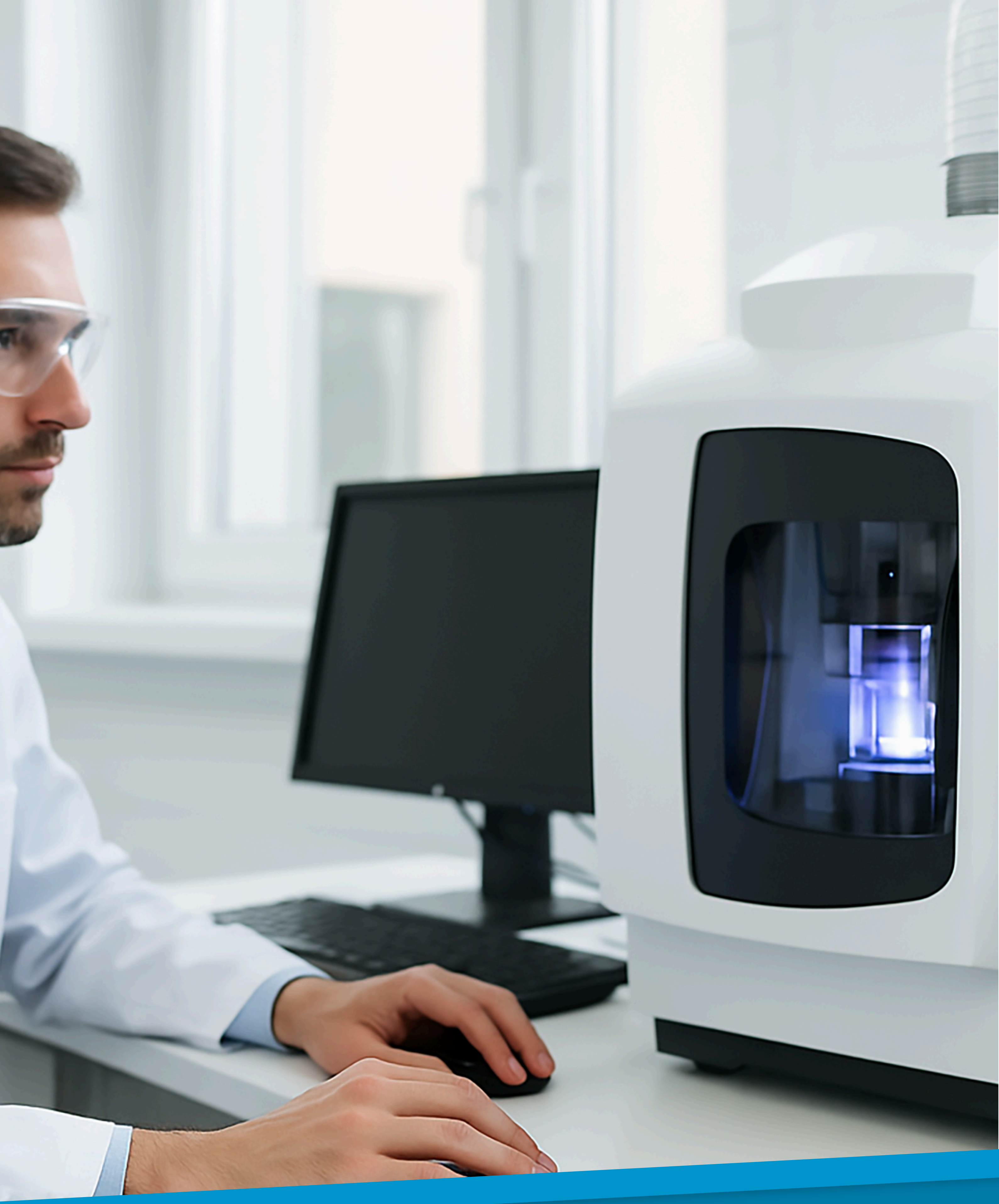
https://dgm.de/akademie/en/events/innovative-elemental-analysis-for-materials-science-and-engineering-2026

Venue

BAM Bundesanstalt für Materialforschung und -prüfung
Unter den Eichen 87
12205 Berlin



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