Austrian Centre for Electron Microscopy and Nanoanalysis (FELMI-ZFE)

Ilse Letofsky-Papst

Institute of Electron Microscopy and Nanoanalysis (FELMI), Graz University of Technology, and Graz Centre for Electron Microscopy (ZFE), Steyrergasse 17, 8010 Graz, Austria, ilse.papst@felmi-zfe.at, https://felmi-zfe.at

The Austrian Centre for Electron Microscopy and Nanoanalysis (FELMI-ZFE) is a joint entity consisting of the **Institute of Electron Microscopy and Nanoanalysis (FELMI)** at Graz University of Technology and the **Center for Electron Microscopy Graz (ZFE)**. It provides partners from science and industry with access to cutting-edge technology for material characterization, quality control and failure analysis.

Research Areas

Electron Microscopy and Nanoanalysis

The institute is equipped with advanced transmission electron microscopes (TEM) and scanning electron microscopes (SEM), enabling investigations down to atomic resolution. These instruments facilitate the detailed analysis of material structures, interfaces, and defects.

Functional Nanofabrication

FELMI-ZFE employs high-precision maskless direct-write techniques such as focused electron beam-induced processing (FEBIP) and focused ion beam (FIB) processing to create functional nanostructures with exceptional spatial resolution.

Correlative Microscopy Techniques

By integrating multiple microscopy methods, the institute enables comprehensive analyses of complex material systems. This approach is particularly valuable for studying polymers, hybrid materials, and other heterogeneous structures.

In situ Experiments

The institute specializes in real-time and *in situ* characterization techniques, including heating experiments and aging studies, to examine material behavior under various environmental conditions.

Specific Applications

Materials Science: Examination of steels, light metals, composites, and coatings, with a focus on fatigue phenomena, failure mechanisms, crystal structures, defects, grain boundaries, and interfaces.
Nanotechnology: Investigation and fabrication of nanoscale structures, including thin films and nanoparticles, for advanced applications.

Energy materials: Analysis of energy storage and conversion systems, such as batteries, fuel cells, and photovoltaic components. It includes aging studies and degradation analysis to enhance performance and longevity.

Semiconductors: Failure analysis and structural characterization of semiconductor materials and microprocessors. Quality control and optimization of electronic components for technological advancement.

Life Sciences: High-resolution imaging of cell structures and biomaterials, as well as tissue sections at the nanoscale for biomedical research.

Geosciences: Mineralogical and petrological analysis of rocks and minerals to understand geological processes.

Polymers: Structural characterization of polymers, hybrid materials, and bio-based plastics to support material innovation and sustainable development.

Education and Training

The FELMI-ZFE regularly offers courses and hands-on workshops, providing participants with in-depth insights into fundamental principles and advanced methodologies.

The following courses are currently offered:

SEM Course: An intensive 3-day workshop that provides participants with practical skills in using modern scanning electron microscopes and X-ray microanalysis.

European EELS & EFTEM School: A 4-day course focused on transmission electron microscopy, enabling participants to gain expertise in techniques such as Energy Filtered Transmission Electron Microscopy (EFTEM) and Electron Energy Loss Spectroscopy (EELS).

Ultramicrotomy Course: A specialized 2-day hands-on workshop providing training in ultramicrotomy techniques for preparing high-quality thin sections for electron microscopy analysis.

With its state-of-the-art infrastructure and expertise, FELMI-ZFE serves as a leading hub for electron microscopy and nanoanalysis, supporting both academic research and industrial applications. The FELMI-ZFE continues to advance the understanding and development of materials according to its commitment to innovation and progress.