MATERIALS CENTER LEOBEN
FORSCHUNG GMBH

Electron Microscopy Laboratory

EXPERTISE & RELIABILITY

Electron Microscopy Laboratory

Our expertise is your benefit

The Materials Center Leoben offers a sound mix of theoretical and practical expertise and state-of-the-art facilities, making it a flexible and experienced partner for demanding research, development and application tasks in the areas of materials engineering, process engineering, quality assurance and component design.

The electron microscopy laboratory specialises in:

- SEM characterisation of surfaces, fracture surfaces and metallographic specimens
- Materials analysis including 3D microstructure tomography using SEM-FIB technology
- Target preparation of TEM thin films or atom probe specimens for subsequent high-resolution analysis
- Damage characterisation

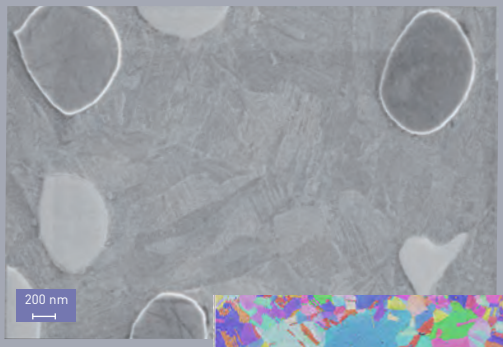
The range of services extends from fast standard analyses to sophisticated high-resolution examinations using the latest technologies available in the field of cross-beam scanning electron microscopy.

EXPERTISE AND HIGH-TECH EQUIPMENT

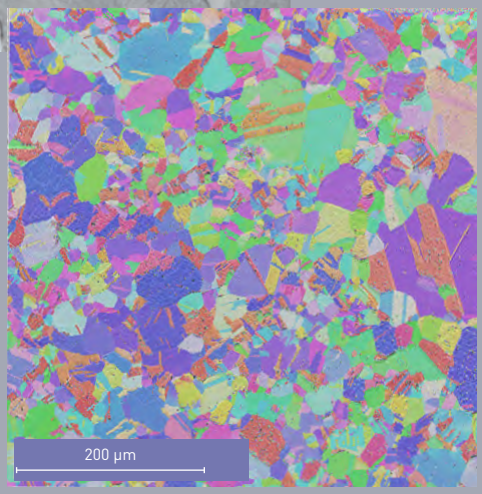
FOR YOUR SUCCESS

High-resolution SEM analysis

Standard and high-resolution SEM analysis of component surfaces, metallographic specimens (microstructure characterisation) and fracture surfaces (fractographic analysis).



Carbide precipitation in cold-work tool steel



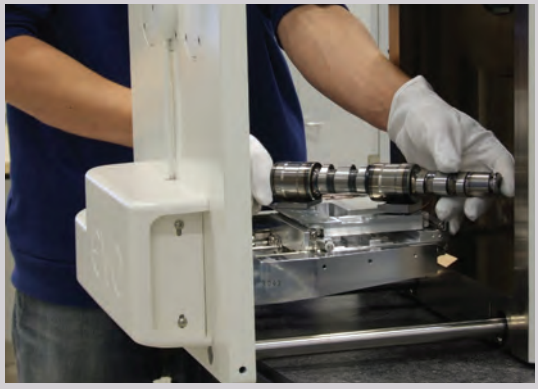
EBSD analysis of copper

Our fields of expertise

- Surface characterisation in terms of topography and local chemical composition
- Microstructure characterisation of metallographic specimens
- Characterisation and assessment of damaged surfaces (e.g. of corroded and worn parts)
- Fractographic analysis (especially as part of damage analysis)

Analysis of components and large specimens

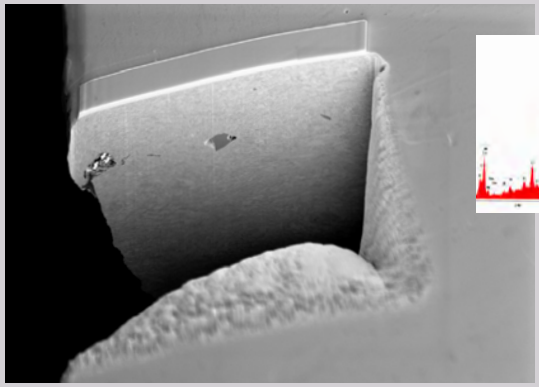
Examination and damage analysis of real components, tools or large specimens. This includes in particular analysis of materials with non-conductive phases or coatings without vapour deposition.

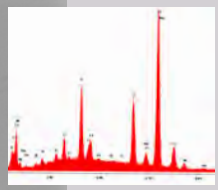


Examination of a crankshaft in the large chamber scanning electron microscope

Our fields of expertise

- SEM and damage analysis of large or hard-to-clean specimens
- SEM analysis of non-conductive components without additional vapour deposition (e.g. ceramic components or metal / plastic composites)
- Extended 3D damage analysis by FIB cutting



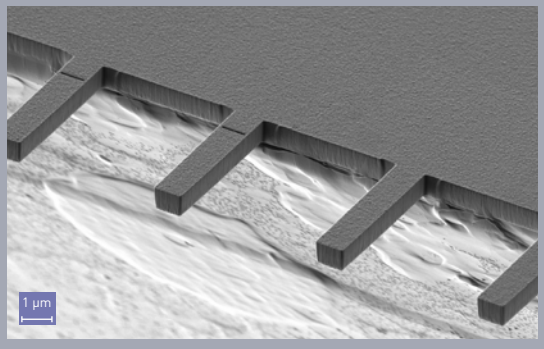


Chemical analysis (EDX) of inclusions

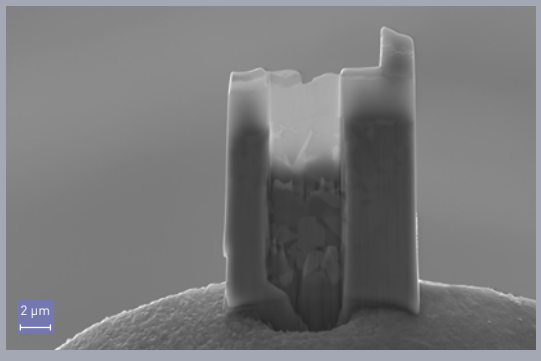
FIB cut reveals defects (inclusions)

Focussed ion beam micromachining

Micro- and nanomachining using focussed ion beam technology for the production of specimens for micro-mechanical and microstructural analysis.



Fabrication of a micromechanical bending specimen of a coating (2µm width)



TEM film preparation using FIB

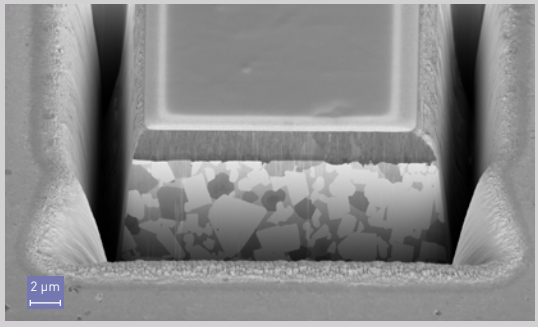
Our fields of expertise

- Target preparation of TEM thin films for subsequent electron microscopic analysis *
- Target preparation of atom probe specimens for subsequent atom probe analysis *
- Preparation of specimens for micromechanical testing of materials (e.g. thin films)*

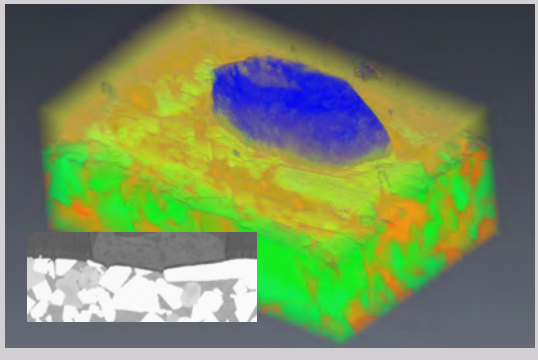
* Subsequent analyses (TEM, APFIM and micromechanical tests) are carried out in cooperation with research partners.

3D materials and damage analysis

Materials characterisation using sequential FIB slices and subsequent 3D reconstruction for description of the three-dimensional structure of materials or micro-components.



FIB cut into a coated surface

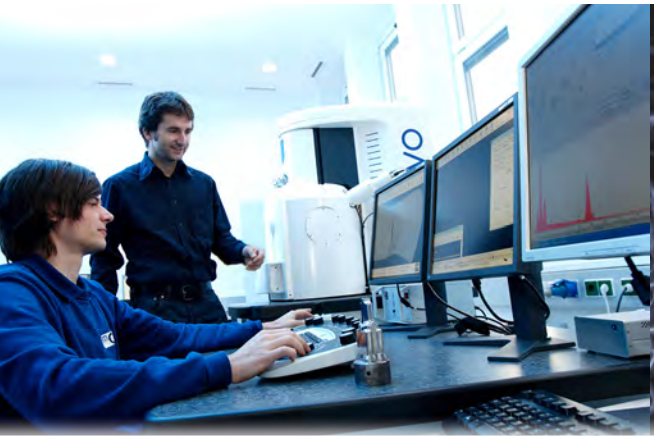
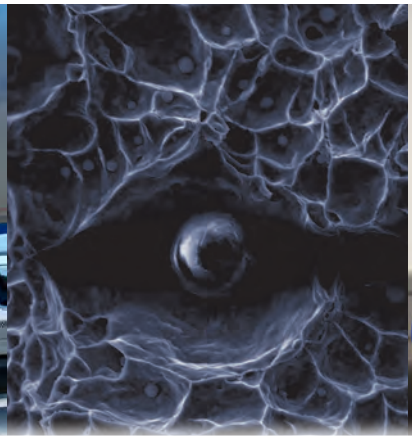


2- and 3-dimensional image of a coating defect

Our fields of expertise

- 3D microstructure tomography based on different electron and ion contrasts, EBSD orientation contrast and local chemical composition
- 3D tomography of coated surfaces (thin films) or microcomponents
- 3D damage tomography (damage mapping for analysis of damage occurring during production or in service)

RANGE OF SERVICES
AND EQUIPMENT


Our range of services

- **Materials characterisation** using scanning electron microscopy (SEM) (e.g. microstructure assessment, phase composition)
- 3D characterisation of **component surfaces and fracture surfaces**, including determination of local chemical composition and damage
- **3D microstructure tomography** based on grain orientation or chemical composition
- **Target preparation of thin films** for transmission electron microscopy (TEM) and analysis of TEM specimens in transmission mode (STEM), incl. chemical analysis (simple TEM analyses without diffraction)
- **Target preparation of atom probe specimens** from different bulk materials and thin films for subsequent analysis by our research partners
- **Production of micro specimens** for mechanical in-situ tests with different geometries (e.g. cuboid, cylinder or micro tensile specimens and bending specimens) (in-situ tests in cooperation with research partners)
- Inducement of small **crack-like defects** (in the sub-µm to µm range) for investigating the behaviour of short cracks

Our equipment

- **Cross-beam scanning electron microscope (focussed ion beam)** from Zeiss (AURIGA® - CrossBeam® workstation):
  - High-resolution **field-emission scanning electron microscope** with various detectors (secondary electron, backscatter electron, STEM, secondary ion, in-lens and EBSD detectors)
  - **Focussed ion beam** (Cobra Orsay Physics)
  - **Gas injection system** for different substances (for deposition of graphite or platinum, for etching by means of iodine and water vapour) and charge compensation for analysis of non-conducting specimens
  - **Energy dispersive X-ray analysis system** (EDX)

- **Scanning electron microscope with large specimen chamber** from Zeiss (EVO MA 25®):
  - Scanning electron microscope with LaB_6 cathode and low-pressure mode (also suitable for analysis of non-conducting or contaminated, e.g. oil contaminated, specimens)
  - Large specimen chamber for the analysis of components and large specimens
    - specimen weight with full tilting capability up to 2.5 kg, specimen height up to ~ 100 mm
    - specimen weight without tilting up to ~ 5 to ~ 10 kg (max. height up to ~ 210 mm)
  - Secondary and 5 quadrant backscatter electron detector
  - Energy dispersive X-ray analysis system (EDX)
  - 3D surface topography software from Alicona (MeX)

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