University of Basel

Swiss Nanoscience Institute

Swiss Nanoscience Institute
Center of Excellence supported by the University of Basel and the Canton of Aargau

Nano Imaging Lab

Services for Imaging and Analysis of Nanostructures

SEM of Calcit

The Nano Imaging Lab

Best service, excellent advice and scientific input for all aspects of imaging

The Nano Imaging Lab at the Swiss Nanoscience Institute (SNI) of the University of Basel offers a comprehensive service for the imaging and analysis of micro and nano structures. The interdisciplinary team of scientists and technicians carry out a wide range of microscopic analyzes for internal and external customers. Besides imaging, they also provide expertise, advice and sample preparation.

No matter what kind of sample the customer provides, the Nano Imaging Lab (NI Lab) is highly experienced to investigate all kinds of structures. Their diverse equipment allows them both to precisely map and analyze surfaces as well as to display internal structures down to atomic resolution.

Researchers who require these specialized methods on a regular basis are trained in order to work independently on the various devices. The NI Lab also runs several courses each year for biology and nanoscience students.

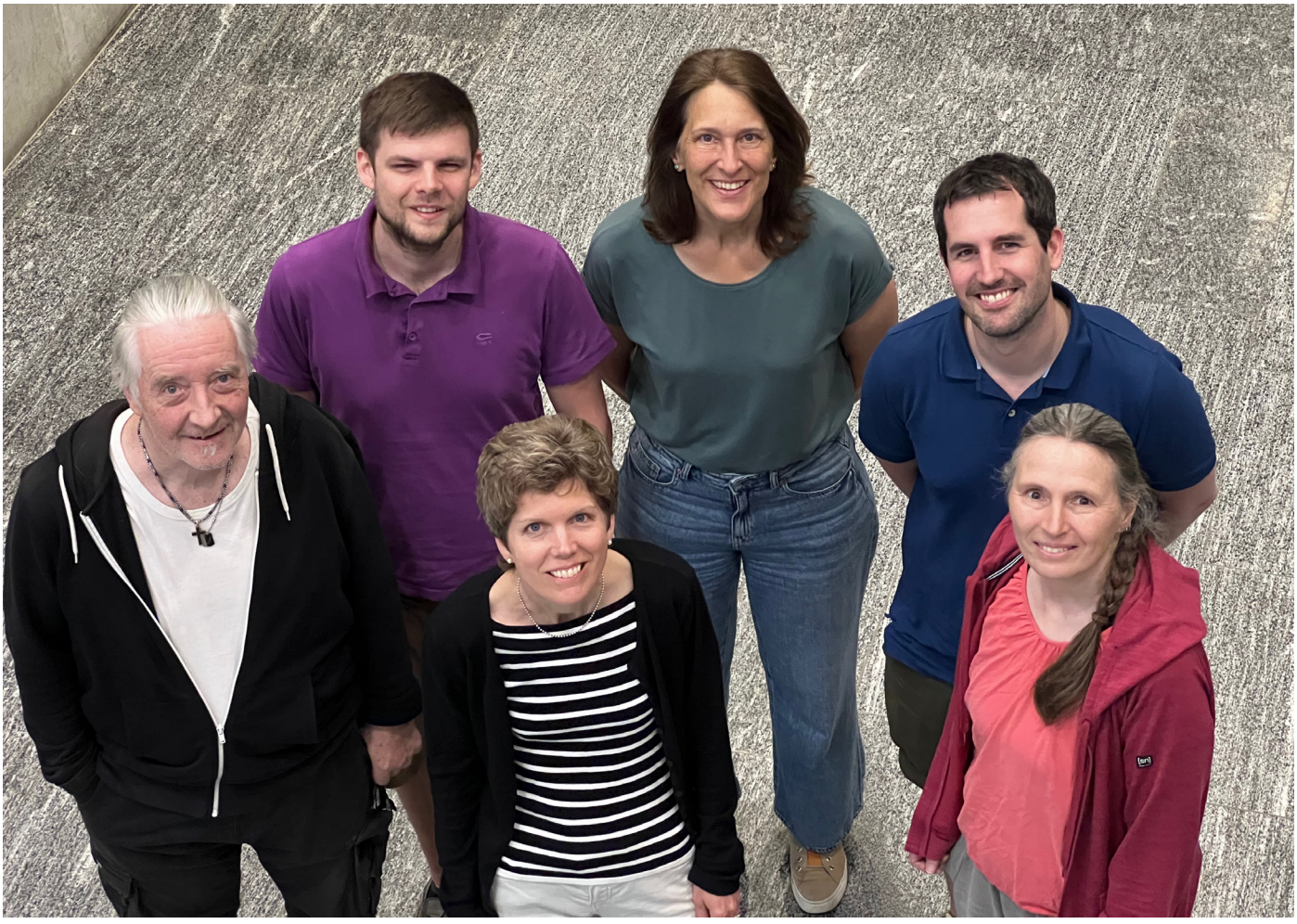
Whether you are working in physics, material science, geology, biology, pharmaceutics, biomedical engineering, dental medicine or any other field, the Nano Imaging Lab looks forward to participating in your projects and collaborating with you.

Please visit our website:

www.nanoimaging.unibas.ch

Or place a request:

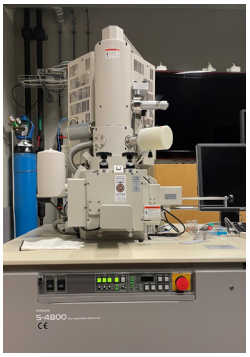
www.nanoimaging1.unibas.ch



From left to right: Daniel Mathys, Alexander Vogel, Monica Schönenberger, Susanne Erpel, Marcus Wyss, Evi Bieler

Technologies in the Nano Imaging Lab

Investigating the topology of a sample



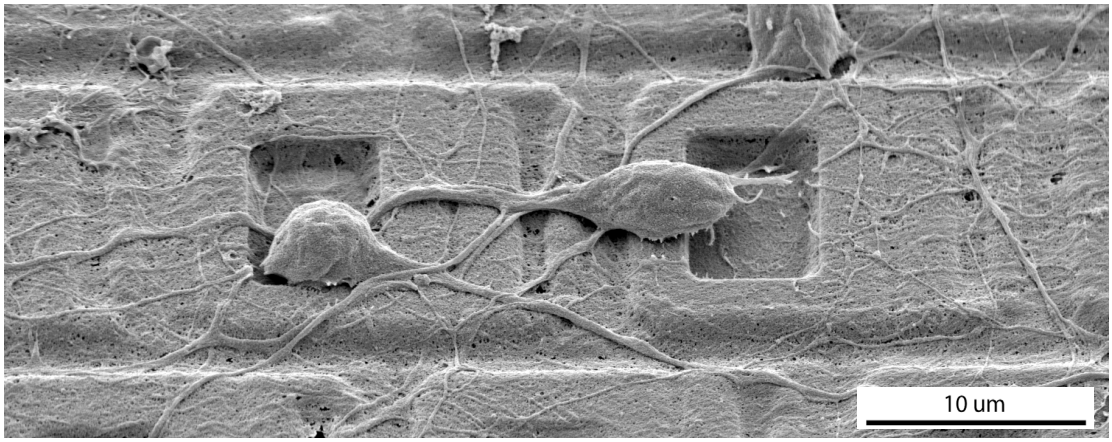
Hitachi S-4800

High Resolution Cold Field Emission Scanning Electron Microscope

Further information:
https://nanoscience.unibas.ch/...rem-hitachi-s-4800/

The Scanning Electron Microscope (SEM) is used to examine sample surfaces with secondary electrons (SE) in order to create a topographical image. Back-scattered electrons (BSE) provide information about qualitative material composition.

In the Cryo-SEM, shock-freezing can be applied to display aqueous samples without drying artifacts. The cryo stage permits contamination free transfer of frozen samples to the chamber and imaging of samples at temperatures down to -150 °C.



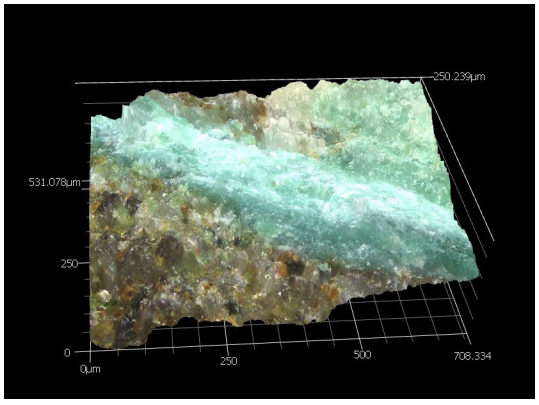
SEM micrograph of neuronal cultures grown on a CMOS chip.

Keyence VK-X1100

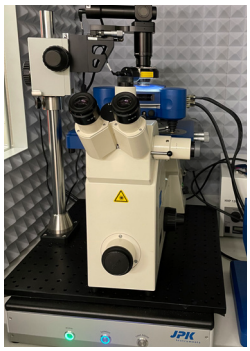
3D Laserscanning Microscope (reflexion type)

Further information:
https://nanoscience.unibas.ch/...lsm-keyence-vk-x1100

The 3D Laser Scanning Microscope (LSM) uses a violet laser (408 nm) and has a pinhole in front of the laser which ensures that no light other than the light reflected from the sample focus point reaches the photoreceptor. Three-dimensional high-resolution focus images are created by combining confocal laser optics with a high-speed XY scanner. Additional white light source detects objects in true colors.



Copper occurrence in a rock sample measured by LSM (height scale 250 µm).



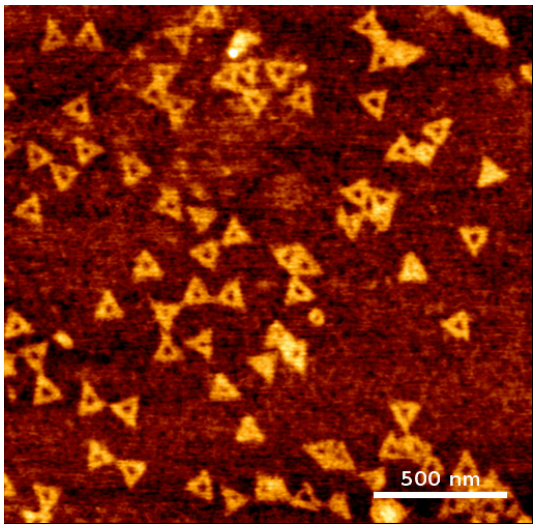
Bruker NanoWizard 4

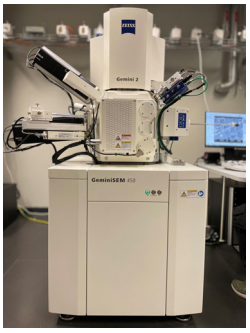
Atomic Force Microscope

Further information:
https://nanoscience.unibas.ch/...jpk-nanowizard-4

Atomic Force Microscopy (AFM) captures images of surfaces with nanoscale resolution in liquids and under ambient conditions. A sharp tip scans the surface of a sample and determines topography and surface properties such as adhesion, elasticity, magnetic or electrostatic force gradients or surface conductivity.

Right: AFM image of DNA origami triangles on mica substrate (height scale 3 nm).





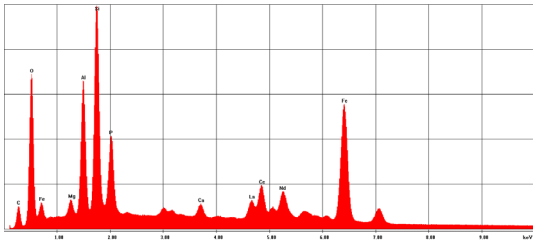
Zeiss GeminiSEM 450

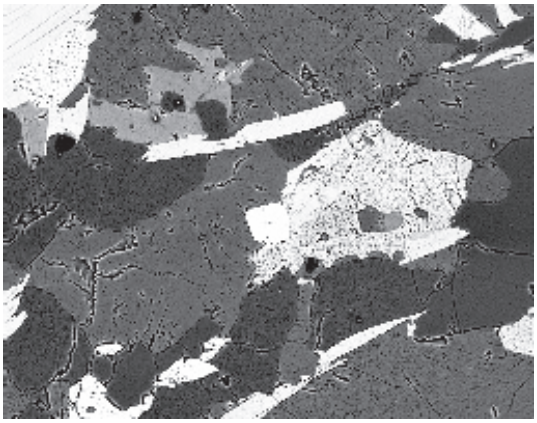
High Resolution Field Emission Scanning Microscope

Further information:
https://nanoscience.unibas.ch/...sem-zeiss-geminisem-450

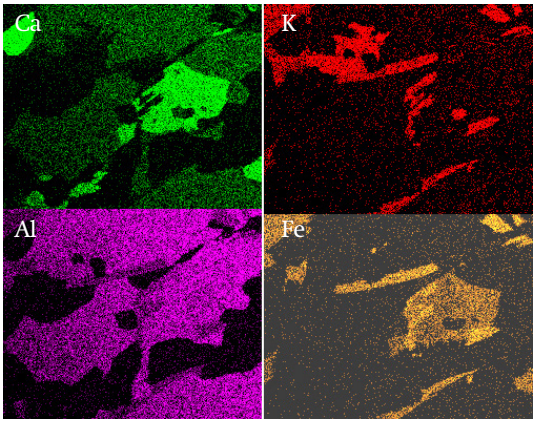
Identification and quantification of the chemical composition and crystalline structure

Energy-Dispersive X-Ray Spectroscopy (EDX) is used to identify and quantify elements and compounds. According to a SEM or STEM sample image, a region of interest is selected and analyzed. Results are displayed in a single spectrum (right) or as an elemental distribution diagram.





BSE image of a garnet sample.

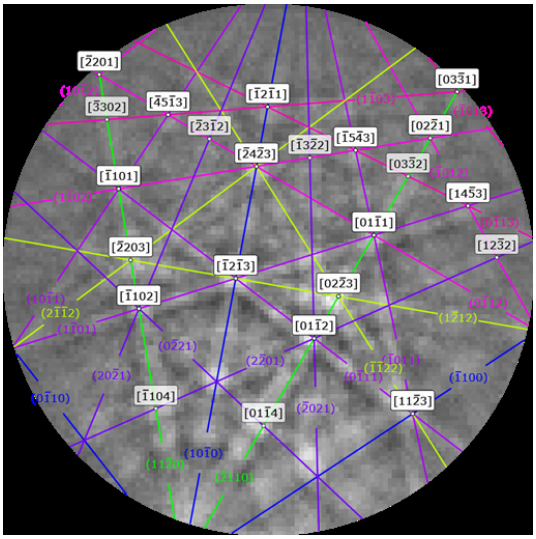


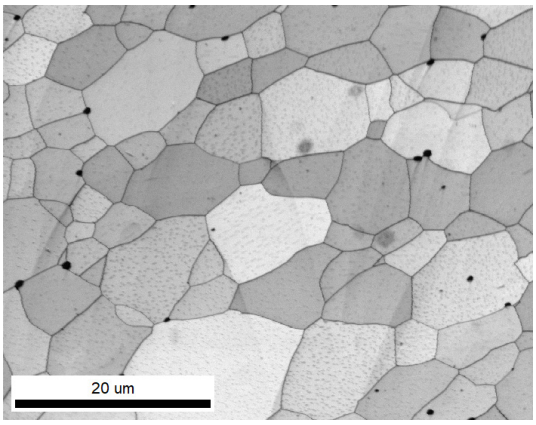
Elemental mapping of garnet by EDX.

EBSD (Electron Backscatter Diffraction) is a scanning electron microscope based technique that allows a crystalline microstructure of the sample to be analysed, visualised and quantified.

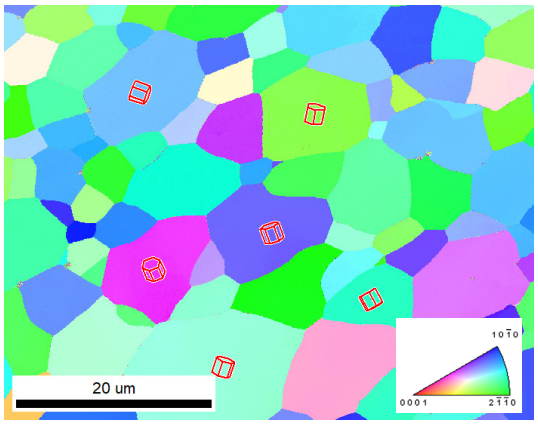
The data acquired by EBSD analysis determine the crystal structure and its crystal grain orientations, grain sizes and their distribution in the material. It characterizes grain boundaries, the texture and identifies different phases.

Right: Kikuchi pattern giving the geometry of the lattice planes in the crystal.

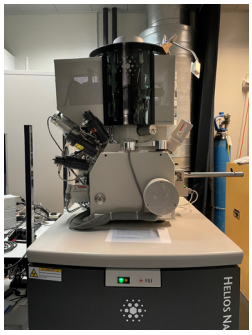




SEM picture overlaid by the crystal orientation map of a polycrystalline Zircon platelet.



Crystal grains with different unit cell orientation colored in red.



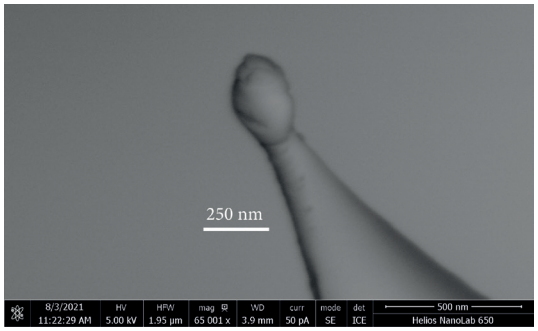
FEI Helios NanoLab 650

High Resolution Field Emission Scanning Microscope (Dual Beam)

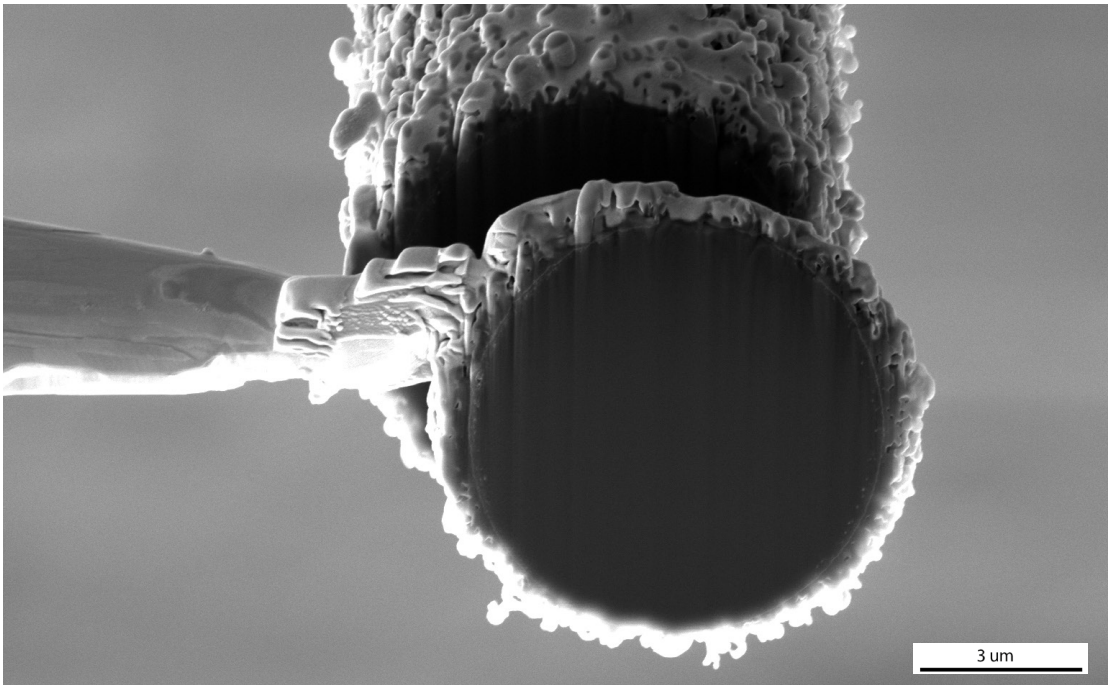
Further information:
https://nanoscience.unibas.ch/...rem-fei-helios-nano-lab-650

Manipulation and fabrication of nano-scaled samples

Focused Ion Beam (FIB) and Focused Electron Beam Induced Deposition (FEBID) technologies can be used for imaging, etching and depositing material (Pt, W, Co, C, Au, SCE) onto surfaces. With a Peltier heating and cooling system it is possible to adjust the temperature during the material deposition in situ in a temperature range from -60 °C to -120 °C.
The ion beam is able to remove and cut material, allowing the internal structures of an object to be analyzed, while both the ion and/or the electron beam dissociates the precursor gas adsorbed on the surface leading to the growth of a deposit.

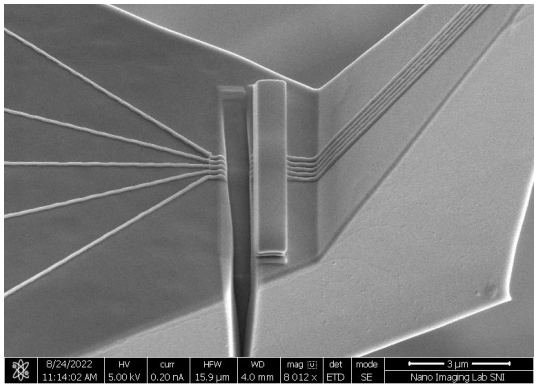


Cobalt nanosphere grown on a cantilever tip by FEBID.

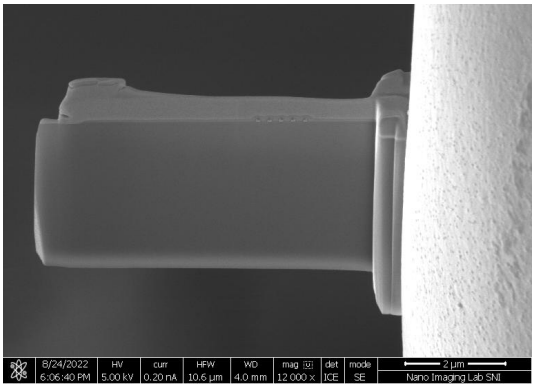


Procedure of sample transfer: A carbon fiber was Pt welded to the tip of a tungsten needle before the FIB detached the carbon disk.

FIB is also used for manipulation and fabrication of nanopatterns or to prepare ultra-thin samples (lamella) for TEM and STEM.



Cutting a lamella out of a cantilever with Pt deposition over gold wires via FEBID and FIBID.



Cut-out lamella showing the cross section of the gold contact wires attached to a Cu TEM grid.

Characterization of the atomic structure

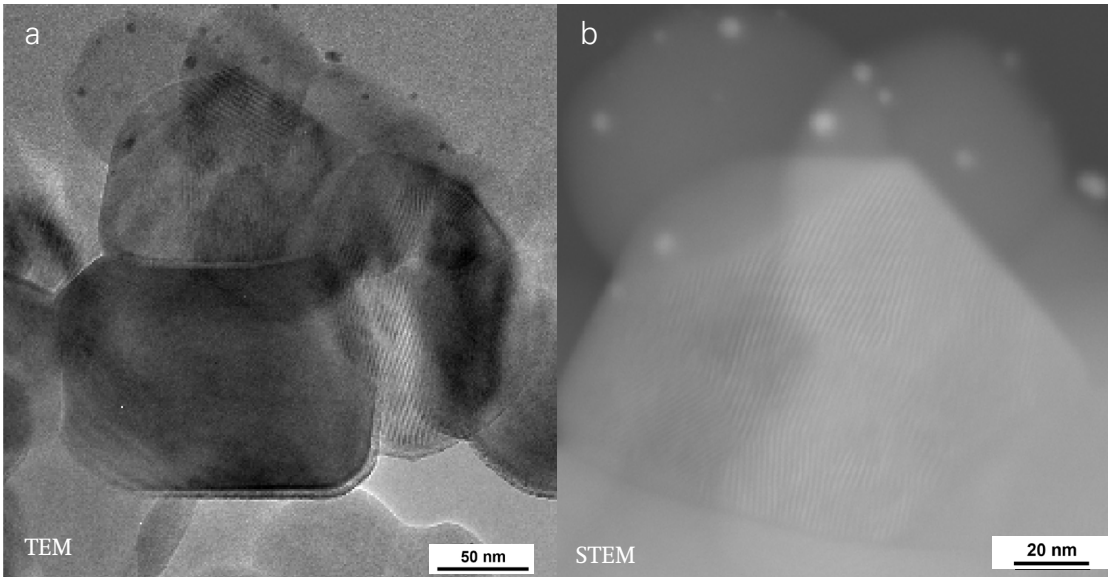
JEOL JEM-F200 cFEG

High Resolution Transmission Electron Microscope with a cold Field Emission Gun

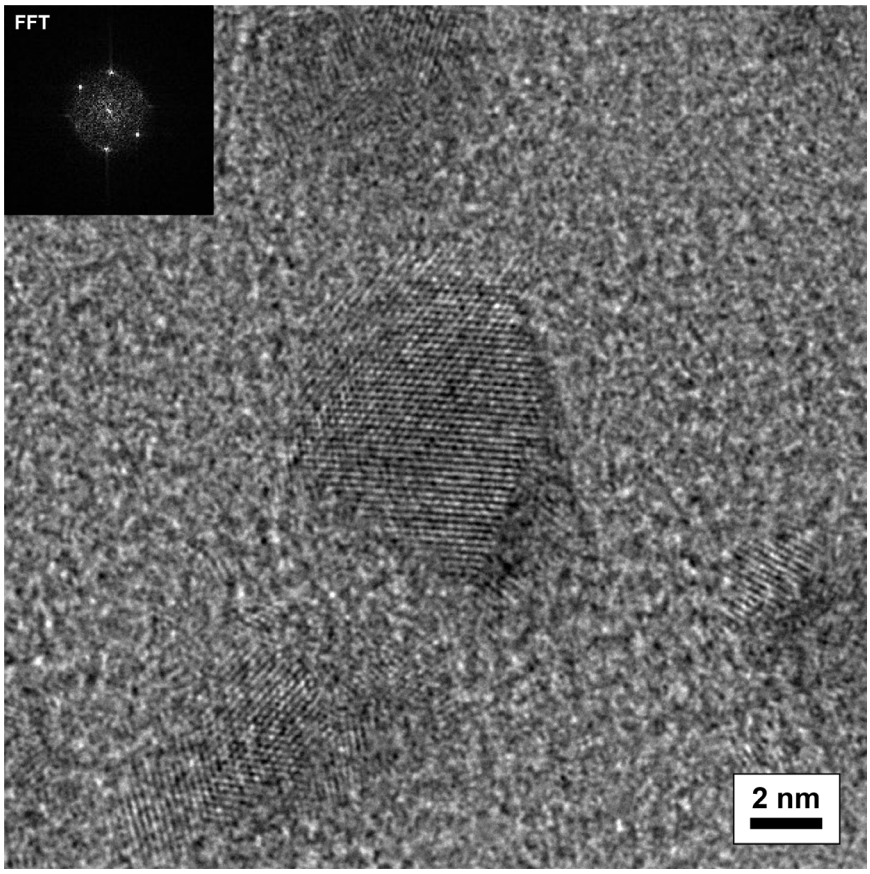
Further information:
https://nanoscience.unibas.ch/...tem-jeol-jem-f200-cfeg/

In Transmission Electron Microscopy (TEM) only thin and electron-transparent samples can be analyzed. This provides insights into the interior of an object. The expertise of the NI lab is to prepare such ultra-thin samples (lamellae) using Focused Ion Beam (FIB) so that these structures can be imaged with TEM or STEM.

Scanning Transmission Electron Microscopy (STEM) allows enhanced contrast imaging and enables efficient EDX spectra and elemental mapping at a better resolution compared to SEM.



TEM image (a) and HAADF-STEM image (b) of gold nanoparticles on top of TiO_2 particles on a dye-sensitized solar cell (DSSC).



High resolution TEM (HRTEM) image of an Europium nanoparticle (left). The inlet shows the fast Fourier Transform acquired of the crystallinity of the particle.

Lab Equipment

FIB/SEM	FEI Helios Nanolab 650 FEI Versa 3D
SEM	Zeiss GeminiSEM 450 Hitachi S4800
SEM/Cryo-SEM	Philips XL30 ESEM
STEM/TEM	Jeol JEM-F200 cFEG Philips CM100
AFM	Bruker Dimension 3100 Bruker/JPK NanoWizard4 Nanosurf FlexAxiom
LSM	Keyence VK-X1100
Light microscopy	Stereo microscopes

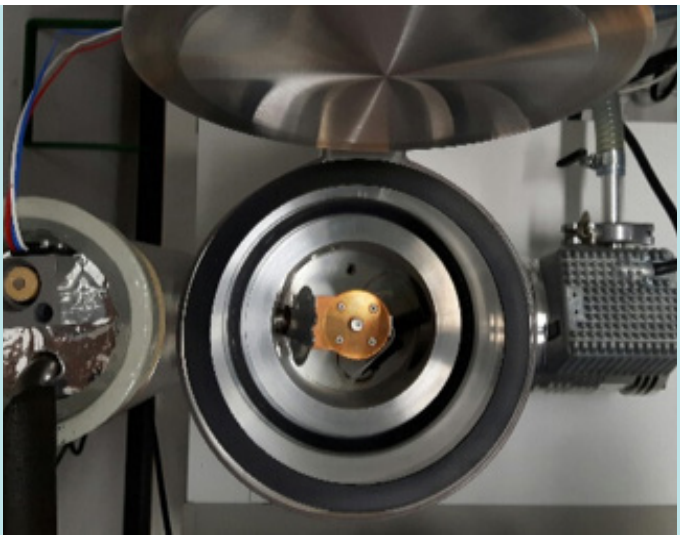
Costs

Download our price list here:

https://nanoscience.unibas.ch/en/services/nano-imaging-lab/preise/kosten/

Preparation Methods

- Critical point drying (CPD)
- Ultra rapid freezing and high vacuum drying
- Negative staining for TEM
- Mechanical cutting and polishing
- Plasma cleaning / Glow discharge
- Advanced nanomaterial deposition (Pt, W, Co, C, Au, SCE)
- TEM lamella preparation

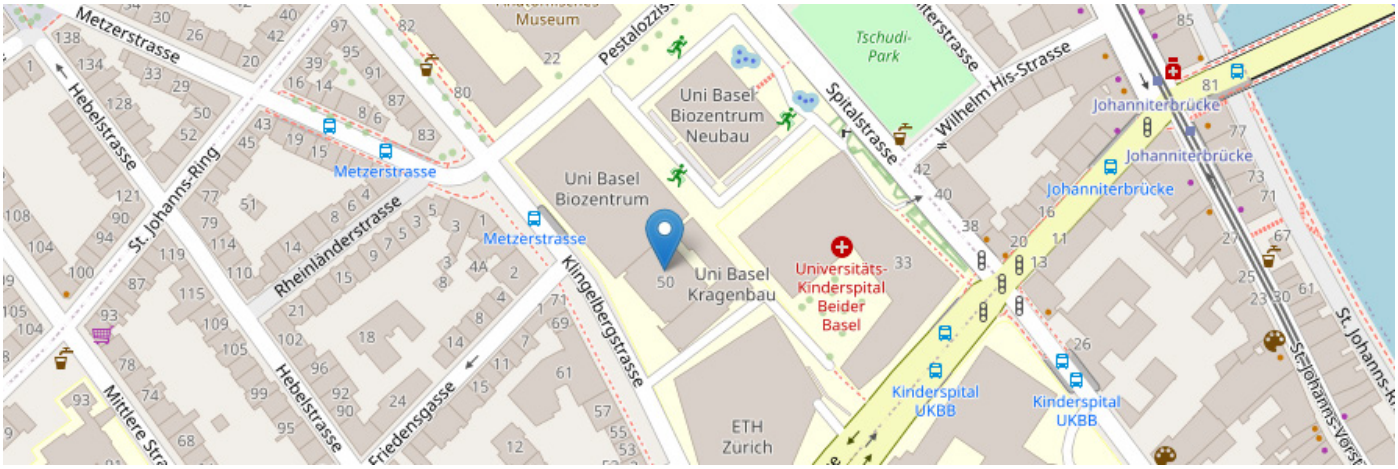


How to find us

Our labs and offices are located in the Pharmazentrum of the University of Basel.

Find directions here:

https://nanoscience.unibas.ch/en/services/nano-imaging-lab/contact/



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