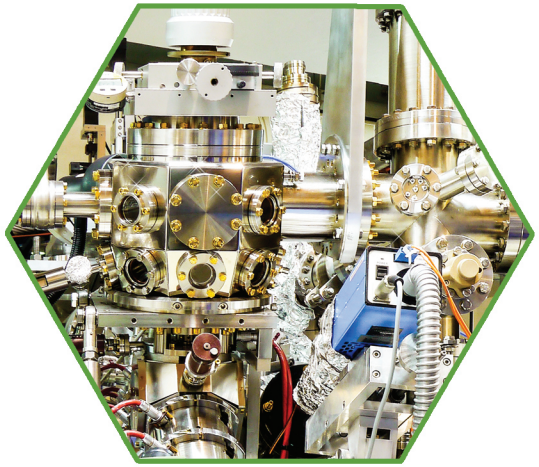
BRIEF INFORMATION

BL3.2Ub is undulator based VUV and soft x-ray beamline which is dedicated to photoemission electron microscopy (PEEM). PEEM is electron microscopy that utilized photoemitted electrons, as result of photoelectric effect, to image sample's surface. The photo-emitted electrons themselves carry information about local geometric and electron energy level of where they are originated therefore atomic structure and chemical state at particular surface area shown on the image can be realized.



The end station can also work as low energy electron microscope (LEEM). LEEM image is created by reflected/ backscattered low energy electrons at the surface using conventional electron source. It can obtain image in real time video frame rate which is ideal for monitoring in situ dynamic processes, such as growth and self-organization of nano-structures and thin films.

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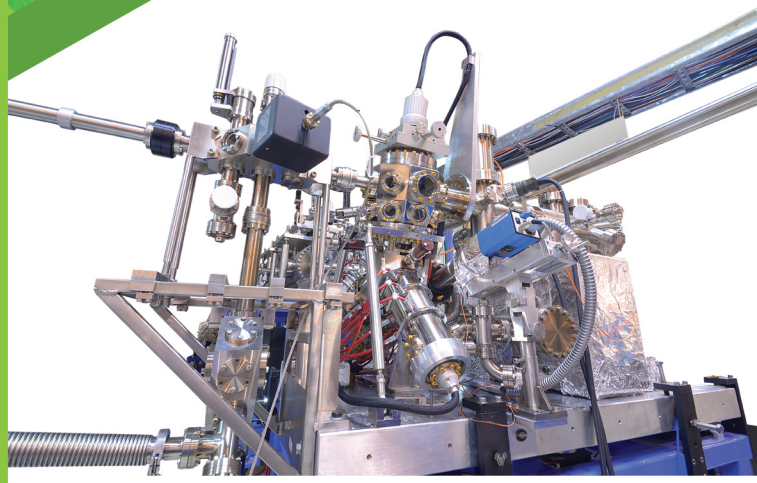


BL3.2:Ub

Photoemission Electron Microscopy (PEEM)

Synchrotron Light Research Institute (Public Organization)

Technical specifications

RADIATION SOURCE

- Planar Halbach-type undulator U60, 41 periods
- 0.5467 Tesla at 26.5mm gap

MONOCHROMATOR

- Varied Line Spacing Plane Grating Monochromator

PHOTON ENERGY

- Optimized range: 40-160, 220-520 & 440-1040 eV
- Working range: 39.5-210, 200-600 & 400-1080 eV

PHOTON BEAM SIZE END STATION

- Horizontal x Vertical: 0.8 mm x 0.1 mm

IMAGING MODE

- Real space - direct surface imaging (FOV 2-100 μm)
- Reciprocal space - electron diffraction imaging
- Energy dispersion - line intensity of energy distribution

OPERATING CONDITION

- ultra-high vacuum (UHV) environment
- wide sample temperature range (from room temperature up to 2300K for short flashes)

SAMPLE HOLDER

- It can accommodated sample for diameter of 5 - 13 mm and thickness of 3 mm.
- Sample surface must be smoothly flat, electro-conductive and vacuum friendly

END STATION

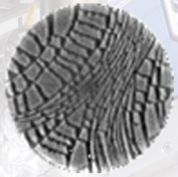
Spectroscopic Photoemission & Low Energy Electron Microscope (SPELEEM) from Elmitec GmbH, is equipped with mercury short-arc lamp, electron cathode and image energy analyzer. It can perform spatially resolved X-ray absorption and photoemission electron spectroscopy with the lateral resolution better than 30 nm and at energy resolution better than 300 meV while lateral resolution of LEEM is better than 15 nm.

APPLICATION

PEEM

- secondary electron imaging
- energy filtered imaging

Microprobe PES



MEM

LEEM

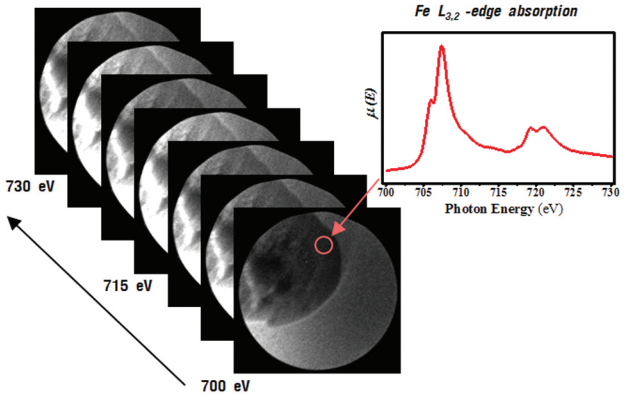
- bright field imaging
- dark field imaging

μ-LEED

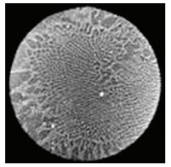
HIGHLIGHTS

Soft X-ray absorption spectromicroscopy

The intensity of photo-emitted electron is related to photon absorption coefficient. By turning photon energy across core level excitation, the energy structure of absorption edge can be obtained due to a variation image intensity generated by all photoelectrons or only secondary electrons.



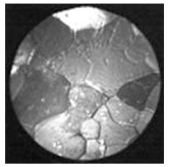
PEEM images by secondary electrons captured at photon energy across binding energy of Fe $L_{3,2}$-edge of the corroded CrN coated stainless steel



MEM image of high-alloyed chromium cast irons containing molybdenum

Mirror Electron Microscopy (MEM)

The low energy electrons interact to surface but do not reach sample. The variation of image intensity is caused by work function difference and surface topography.



LEEM image of in-stitu heating steel at 710°C

Diffraction Contrast of Bright Field Imaging LEEM

bright field imaging is done using backscattered electrons that undergo no momentum transfer parallel to the surface. The contrast comes from local variation of the structure factor on the sample surface.