MAPEX Bremen
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04
03-2017

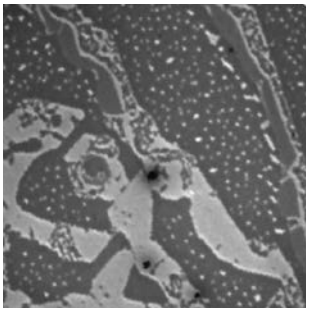
INSTRUMENT DATABASE
In situ structural and chemical imaging of surface processes

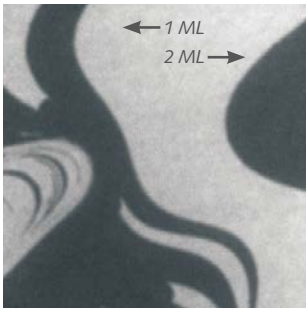
Universität Bremen

LEEM - LOW ENERGY ELECTRON MICROSCOPY

Adsorption, materials deposition, etching, and corrosion are processes that invariably result in a distinct modification of the structural, electronic, and chemical properties of materials. Low-energy electron microscopy (LEEM) is a surface-sensitive full-field diffractive imaging technique that provides real-time access to the mesoscale surface morphology with nanometer resolution and local atomic structure. Operating in a wide range of conditions from ultra-high vacuum (10^{-10} mbar) to gas ambients (10^{-4} mbar) and temperatures from liquid nitrogen to above the melting point of the coinage metals, LEEM is ideally suited to follow sample modification in heteroepitaxial growth, thermal annealing, oxidation, and chemical reactions at video rates.

The left image shows a silicon carbide (0001) surface partially covered by free-standing single-layer (bright) and bilayer (dark) graphene sheets, which can unambiguously be identified with pixel resolution owing to their energy-dependent electron reflectivity. The same physical effect, generally known as quantum size contrast, serves to elucidate the growth mechanism and local thickness of epitaxial silver films on a Ni(111) single crystal (right image).





left image: single (bright) and bilayer (dark) graphene flakes on a SiC(0001) substrate (field of view: 3 µm).

right image: crystalline single (bright, 1 monoatomic layer (ML)) and bilayer (dark, 2 ML) silver films on Ni(111) grown in situ by molecular beam epitaxy (field of view: 9 µm).

|| LEEM - LOW ENERGY ELECTRON MICROSCOPY

Low-energy electron microscope

01 || General Information

Keywords: surface microscopy, surface diffraction, surface dynamics.

Categories:

- Diffraction,
- Electron Microscopy,
- Surface / Interface Characterization.

Main Application: in-situ structural characterization of near-surface transformation processes in real-time.

Measured Quantities: surface morphology, surface structure.

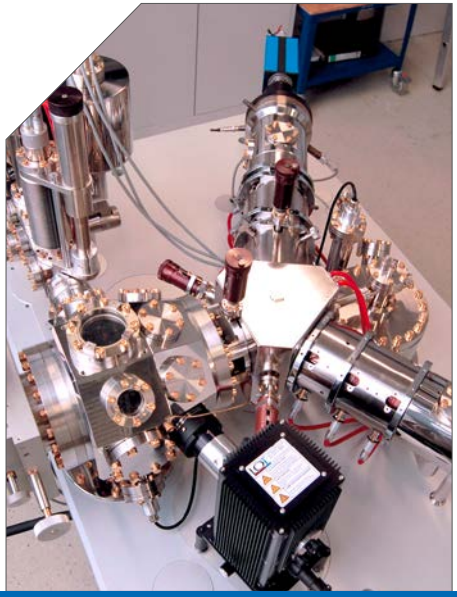
Features: in-situ sample preparation by molecular beam epitaxy.

Year of Fabrication: 2010.

Manufacturer: Elmitec.

02 || Specifications

Low-energy electron microscopy is a full-field diffractive imaging technique that allows imaging the morphology and surface structure of a crystalline sample at a lateral resolution down to about 10 nm for fields of view in the range of 3 to 50 microns at video rates (~10 Hz). Vertical resolution is limited to imaging of atomic surface steps. Preferred sample characteristics: flat, mono- or polycrystalline specimens up to 9x9 mm^2, thickness up to 2 mm; temperature range during operation: 300 - 1300 K; gas dosing from ultra-high vacuum up to 10^{-4} mbar during operation.



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