Scanning Auger Microprobe

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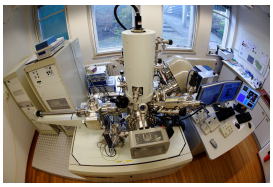

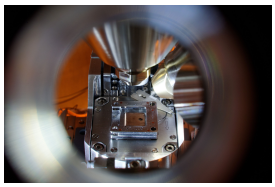

Brand

Jeol

Type

JAMP-9500F

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Organisation

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Description

This unique apparatus provides compositional (Auger electron spectroscopy) and distributional information (Scanning Probe Microscopy) of elements on the top few monolayers of surfaces with a resolution of 10 nm.
Auger electron spectroscopy (AES) is a surface analytical technique for determining the chemical composition of the surface layers of a sample. AES utilizes the Auger effect, a process where an atom that has been ionized with the emission of a core level electron undergoes a transition in which a second electron, the Auger electron, is emitted. Auger electrons are emitted at discrete energies that allow the atom of origin to be identified. High-spatial resolution is achieved because the specimen is excited by an electron beam that can be focused into a fine probe. In this way AES provides chemical information with high spatial resolution. AES is a straightforward characterization technique for probing chemical and compositional surface environments.
Scanning Probe Microscopy forms images of surfaces using a probe (atomically sharp tip) that scans the surface of the material. An image of the surface is obtained by mechanically moving the probe in a raster-like scan over the sample surface, and recording the probe-surface interaction as a function of position. Because the tip is atomically sharp the SPM provides topographical (3D) information with high spatial resolution.
Strength of the combined techniques
The integral combination of SPM and AES is the key to gain complementary information of the same sample area. Where SPM offers topographic information, AES can complement this with chemical information. Together they can study the spatial distribution, and can answer questions that neither SPM or AES alone would be able to answer. The combination is excellently suitable for studying the composition and structure of organic monolayers (e.g. inhomogeneous areas; distribution of elements), patterned monolayers, nanoparticles and nanostructures, and organic modification of distinct area's (e.g. organic electronic devices).

Technical Details

The AES is a Field Emission Auger Microprobe (JAMP-9500F, JEOL Tokyo) combined with an on-stage (in situ) Curlew™ SPM by (Specs, Berlin).

- AES: Secondary electron imaging 5 nm resolution, 10 nm probe diameter for Auger analysis
- AES: Auger Spectra, Auger imaging, Secondary electron imaging, depth profiling (ion gun)
- AES: Top Coating, layer thickness (2 to 10 nm)
- SPM: modes AFM & STM by Akiyama probes
- SPM: XY Scan Range (Sample) 10 m x 10 m, Z scan Range (Tip) 2 m.

Applications

• Thin film composition analysis
• Particle analysis
• Surface analysis
• Small-area depth profiling
• Defect analysis
Application areas include:
• Organic monolayers on surfaces
• Antifouling surfaces
• Micro-membranes
• Surface modification of AFM cantilever
• Nanoparticles for drug-delivery
• Toxicity of nanoparticles
• Analysis of pores of filtration membranes
• Metallurgy
• Surface chemistry
• Semi-conductors
Sample requirements
Samples are typically solids with low vapor pressures or thin films on solid substrates. Samples must be conductive or at least not completely insulating (Auger works best with conductors). Also thick insulating films could pose a problem. Samples must be compatible with an ultra high vacuum environment (10-8 Pa). Samples handling is according to UHV procedures. Typical sample size is 1x1 cm. Standard sample thickness is the thickness of a silicon wafer. Not suitable for biological samples due to UHV. Samples can be prepared and mounted in the Auger lab. Non-standard samples only after consultation with the technology expert.

Complementary Techniques

X-ray Photoelectron Spectroscopy (XPS) is available at the Laboratory of Organic Chemistry at Wageningen UR, where the Scanning Auger Microprobe equipment is located. XPS offers surface analysis with more detailed chemical state information, but at a lower spatial resolution (scale of 50+ micron; Auger is 50+ nm, i.e. thousand times smaller). On the same spatial scale as Auger are SEM and TEM, which can be used for biological samples, both actually provide a slightly better spatial resolution, but Auger provides more chemical insight.