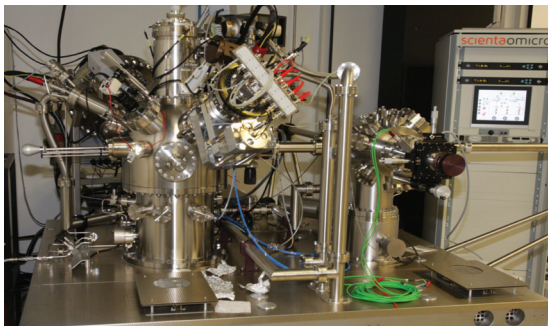
Surface analysis UHV system

NanoSAM Lab

DESCRIPTION

The Nano SAM Lab is a dedicated surface analysis UHV system for high resolution structural and chemical analysis by Scanning Auger Microscopy (SAM), Scanning Electron Microscopy (SEM) and Secondary Electron Microscopy with Polarization Analysis (SEMPA) for the characterization of the magnetic domain structure. The instrument is designed for use together with UHV Gemini high resolution electron column. It includes Matrix software and electronics for static Auger spectroscopy (AES) and SAM. In combination with UHV Gemini, Matrix provides an unsurpassed drift correction technology based on autocorrelation of subsequent SEM images. This opens up the possibility to perform long term AES measurements on very small features with low intensity, or elemental resolved SAM maps of nanostructures with a low concentration of elements of interest and/or low sensitivity factors. The NanoSAM Lab is equipped with high precision goniometer - mounted four axis UHV stage for the combination of high resolution SEM, SAM and SEMPA, which allows heating up to 750 K. Moreover, the NanoSAM Lab embodies preparation chamber which comprises a manipulator with the possibility of heating the sample to 1500 °C by resistive heating and 900 °C by radiative heating. The preparation chamber contains 8 flanges for user extensions.



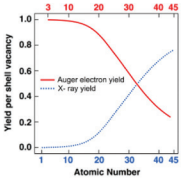
SPECIFICATION

SEM	
Electron Column	UHV Gemini (FEG)
Emitter	Schottky cathode
Acceleration Voltage	100 V – 20 kV
Probe Current	min. 50 nA @ 15 keV
	min. 28 nA @ 3 keV
Detectors	Inlens SE detector
Resolution	< 3 nm @ 15 keV
	< 13 nm @ 1 keV
Specimen Stage Movements	XYZ: 10×10×10 mm
	Tilt: -60° to +60°
Stage Heating	Up to 750 K
Maximum Sample Size	12×15×4 mm³
Basic pressure	< 3 e-10 mbar
Image drift compensation	
4 electrical contacts up to 6 Ghz	
Preparation chamber	

SAM	
SEM–SAM Coincidence at	~ 22 mm
SEM–SAM Angle at	+30°
Lateral Resolution (@ 1nA)	< 6 nm @ 10 keV
	< 10 nm @ 5 keV
Analyzer Resolution	> 420 KCPS no background
Image Drift	< 10 nm/10 hrs
SEMPA	
SEM–SEMPA Angle at	-60°
Resolution	< 50 nm
Image Drift	< 10 nm/10 hrs
Detectors	Rotation Detector
Ion Source/ Charge Neutralization	
Neutralization	10 eV - 5 keV ions
Ion Sputtering	@1 - 5 keV > 2 mA/cm²
	min. 100 nA @ 15 eV

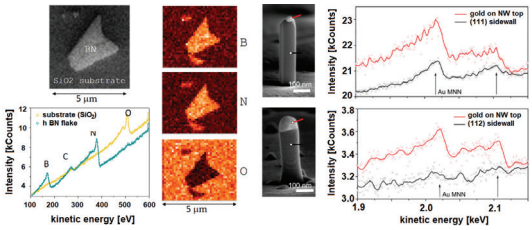
AES

AES provides quantitative elemental and chemical state information from surfaces of solid materials usually in the area of material science. Focused electron beam scans across the sample surface which leads to the production of various signals including the emission of ‚Auger' electrons. An electron energy analyzer measures the kinetic energies of the emitted Auger electrons, which are characteristic for elements present within the top 1-5 nm of the sample and intensity of an Auger peak. Hence, the identity and quality of a detected element can be determined. When used in combination with sputtering ion source, compositional depth profiling can be performed.



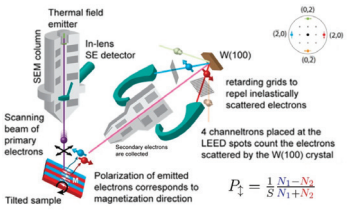
Chemical Composition Determination

b) AES of hexagonal Boron Nitride *a) Au detection on germanium nanowires*



SEMPA

SEMPA is a technique for direct characterization of the magnetic domain structure of a sample. Spin polarization of the secondary electrons (emitted by the primary beam) corresponds to the magentization direction in the material and can be measured in order to create a magentization map of the sample. Spin detection is based on the SPLEED (Spin Polarized Low Energy Electron Diffraction) principle, i.e. diffraction from a single crystal surface of W(100) forming a few well defined diffraction spots - (LEED) spots.



The LEED spots exhibits intensity variations and asymmetries that depend on the energy and degree of spin polarization of the scattered electrons.

Magnetic domains of Iron Whisker

(a) The domain images show the magnetization distribution obtained in the two perpendicular polarization components. (b) Topography image obtained simultaneously by counting the electrons in all 4 main LEED spots. (With permission of Lukas Flajsman)

MORE INFO

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