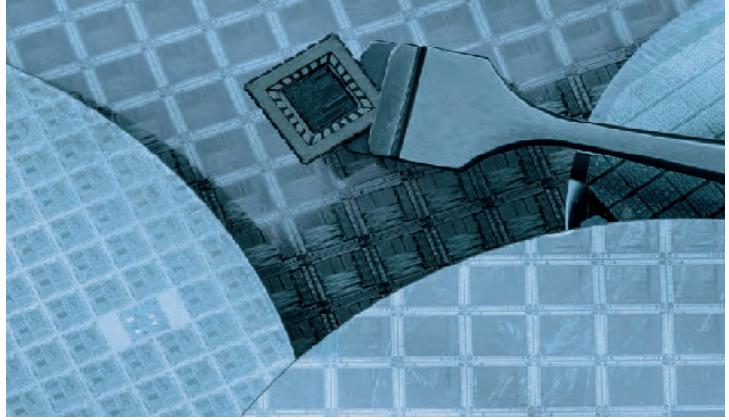
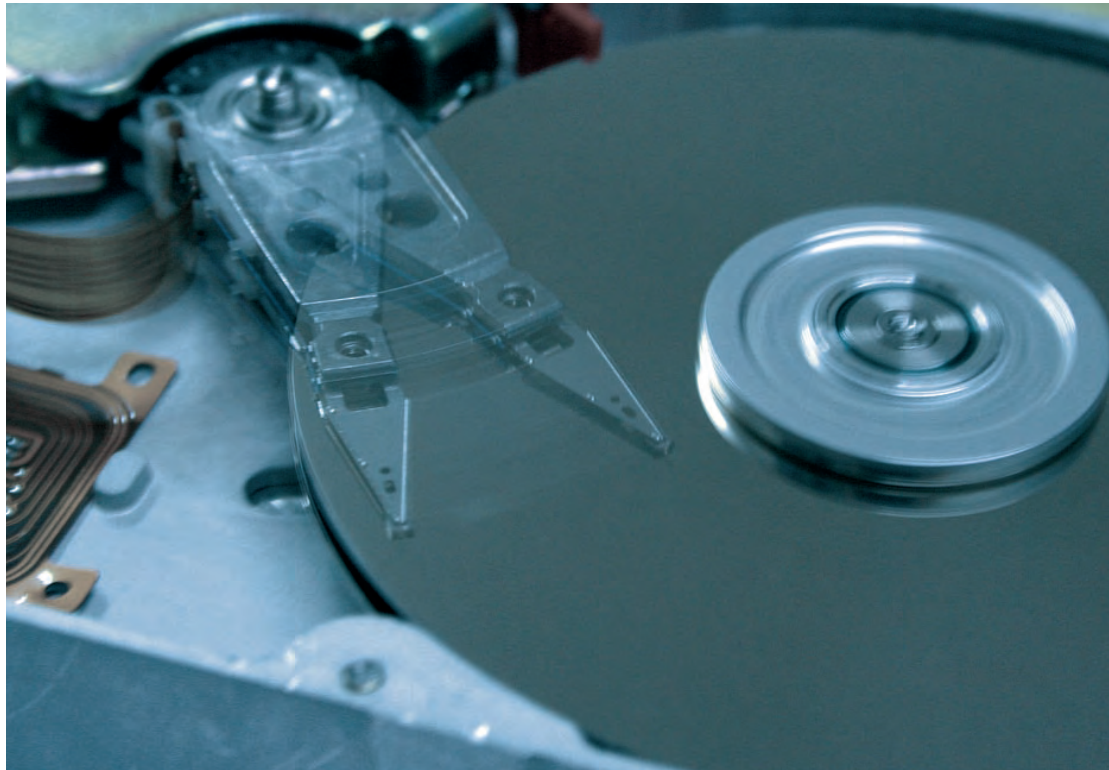
PHYSICAL ELECTRONICS
A DIVISION OF ULVAC-PHI

PHI 710

Scanning Auger Nanoprobe





PHI 710

Scanning Auger Nanoprobe

The PHI 710 Scanning Auger Nanoprobe is a unique, high performance Auger Electron Spectroscopy (AES) instrument that provides elemental and chemical state information from sample surfaces and nano-scale features, thin films, and interfaces. Designed as a high performance Auger Nanoprobe, not an SEM with Auger capabilities, the PHI 710 provides the superior Auger imaging performance, spatial resolution, sensitivity, and the spectral energy resolution needed to address your most demanding AES applications.

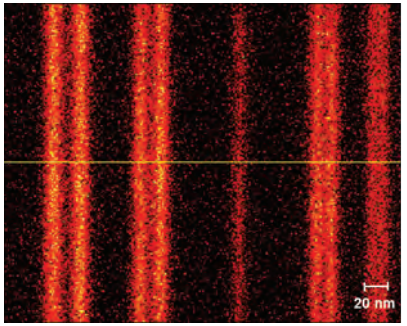
Key Features

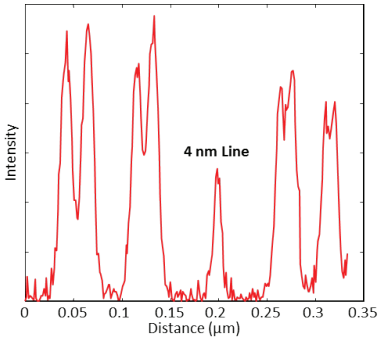
- High spatial resolution Auger and secondary electron (SE) imaging
- Superior Auger imaging of real world (rough) surfaces
- Cylindrical Mirror Analyzer (CMA) with high energy resolution capability
- Robust insulator analysis capability
- Highest performance Auger sputter depth profiling
- Modern, easy-to-use software platform

HIGH SPATIAL RESOLUTION

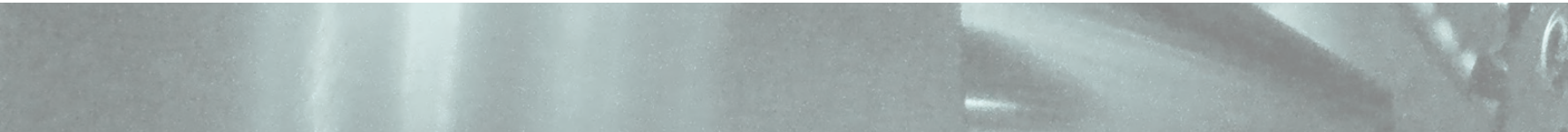
High Stability Nanoscale Analysis Platform

High performance electron optics, precision sample handling, and advanced vibration and thermal isolation provide a superior environment for nano-scale Auger imaging and analysis at working magnifications of 500,000 X and higher. A robust imaging registration capability ensures long term image stability when it is needed.



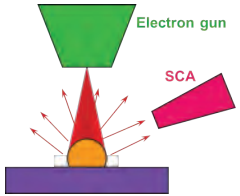


Figures A and B are data from a BAM L-200 lateral resolution reference sample. The sample presents the cross-section of alternating layers of GaAlAs and GaAs of known thickness. Figure A is an Al Auger map and figure B is an Al line scan that was extracted from the map data. The map was acquired for 24 hours to demonstrate long term stability and the effectiveness of the image registration software. The shape of the single 4 nm line demonstrates the high stability of the 710 and the effectiveness of its image registration software.

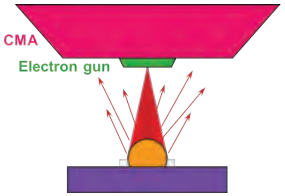


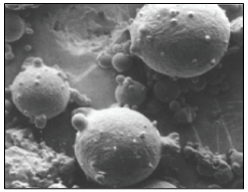
COAXIAL GEOMETRY

Non-Coaxial Geometry

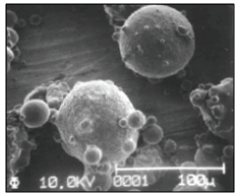


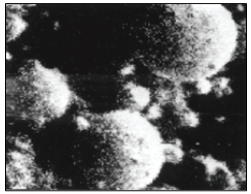
PHI's Coaxial Geometry



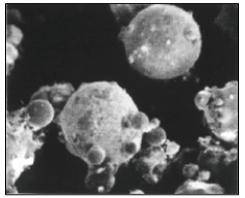


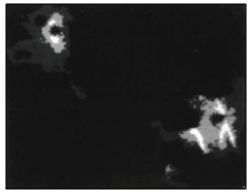
Secondary Electron Images



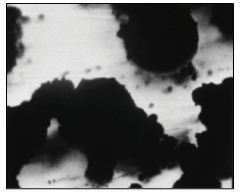


Nickel Auger Maps





Indium Auger Maps

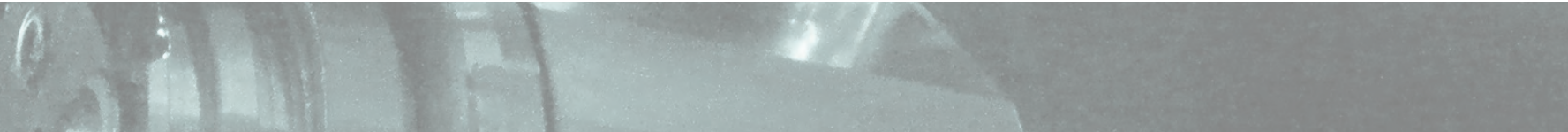


Superior Image Quality

PHI's coaxial electron gun and analyzer geometry provides the sensitivity and unobstructed vision needed to fully characterize the microstructures that exist on most real world samples.

Instruments with non-coaxial geometry suffer from geometric effects that dramatically reduce instrumental sensitivity and create shadows that limit the usefulness of compositional images.

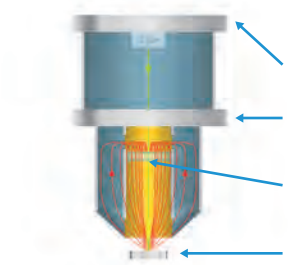
With the 710's coaxial geometry, Auger data is obtained from all sides of particulates and between particles with equally high sensitivity providing Auger maps with meaningful compositional information.

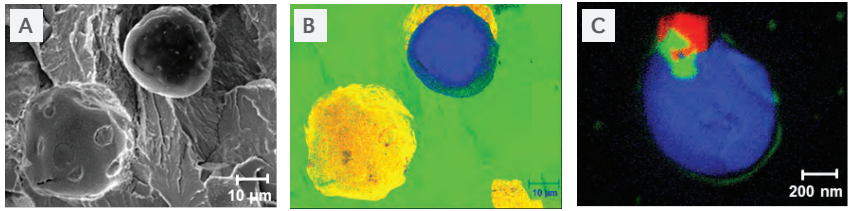


AUGER MAPPING

A Complete Compositional Picture

The coaxial analyzer and electron gun geometry provided by the PHI 710 produces a complete compositional picture of the area selected for analysis. The analyzer will provide data from every location the electron gun probes. Black areas in maps are usually not caused by sample roughness and analyzer shadowing, but instead indicate the presence of another element.



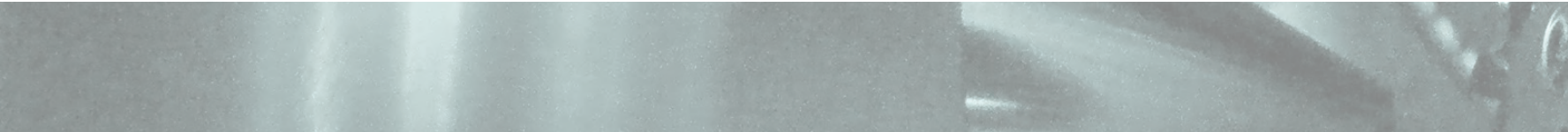


SE Image

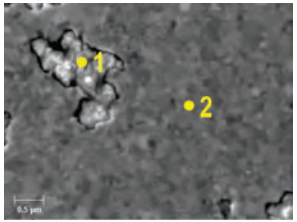
Fe, ***C***, *and* ***Sn***
Auger Maps

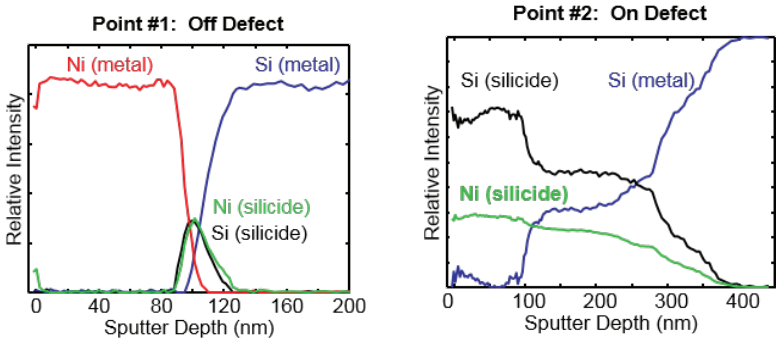
Mg, ***Ca***, *and* ***Ti***
Auger Maps

The secondary electron image in figure A shows the microstructure of a ductile iron fracture surface including graphite nodules and craters where graphite nodules have fallen out as a result of the fracture. The AES maps in figure B show the ability to map across the graphite nodule and the crater where Sn has segregated to the nodule / iron interface. AES maps in figure C show the complex composition of a small precipitate observed in figure B. Only PHI Auger instruments with coaxial electron gun and analyzer geometry provide such a complete compositional picture of a rough sample surface.



NANOSCALE THIN FILM ANALYSIS

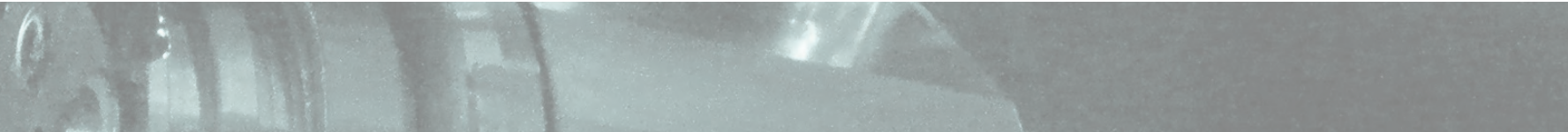




The sample shown in the SE image above contains a defect that appeared in a thin nickel film deposited on silicon substrate after it was annealed to form a nickel silicide at the interface. A 500 V multi-point argon sputter depth profile showed the expected formation of Ni silicide at the interface at point 1. However at point 2 a complex multiphase silicide is observed at the defect. The chemical state information was obtained using linear least squares fitting to process the high energy resolution spectra that were collected.

Superior Thin Film Analysis

The PHI 710's floating column ion gun provides a broad range of depth profiling capabilities. At higher ion beam energies (2-5 keV) structures several microns thick can be routinely depth profiled. For thin and ultra thin films (< 5 nm) the floating ion column can be used to efficiently sputter with ion beam energies of 100-500 eV. The use of lower accelerating voltages reduces sputter mixing that could broaden the observed interfaces in an ultra thin film structure.



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Standard Features

- Cylindrical mirror analyzer (CMA)
- Coaxial 25 kV field emission electron gun
- Scintillation secondary electron detector
- High energy resolution module
- 5 axis sample stage
- 5 kV floating column Ar^+ ion gun
- SmartSoft-Auger instrument control software
- MultiPak data reduction software
- Acoustic Enclosure
- Ion pumped main chamber

Optional Accessories

- Intro camera
- *In situ* sample parking
- *In situ* sample fracture apparatus
- Sample Transfer vessel
- EDS Detector
- EBSD Detector
- BSE Detector