



永聯分析
Ever Union Analysis Limited

Introduction of Ever Union

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Chief Technology Officer

Ever Union Analysis Limited

永聯分析有限公司



Reliable companion in surface analysis and material characterization

可靠的表面分析和材料測試伙伴

About us

Ever Union (EU) is a provider of surface analysis and materials characterization services located in Hong Kong. EU's expertise in surface analysis, composition and contamination measurement, trace elemental analysis and microscopy can assist you and your company to achieve your goals in R&D, failure analysis and quality control.

Quality Policy

EU is committed to offer professional consultation on surface analysis and material characterization to industries and research institutes for coping with the technology advancement.

EU endeavors to achieve the policy through provision of:

- State-of-the-art analytical equipment to match the frontier technology;
- Qualified professionals to understanding your need;
- Tailor-made test proposal to fulfill your budgetary plan;
- Timely delivery of test result to shorten development time and production downtime.

Surface Analysis and Material Characterization Services

●Research and Development:

Quick inspection and examination of the prototype by various analytical techniques could lead to fully understanding the material functionality and properties. Example: determination of the variation of Ti and N ratio across the TiN coating; chemical change of polymer surface before and after modification; confirmation of the construction of magnetic storage media.

●Failure analysis:

Make use of proper analytical techniques could lead to fully understanding the failure of product. Example: analysis on the surface contaminant could trace the origin; detection of discoloration, surface morphology, crack, pit or void could trace the abnormality of process parameters.

●Quality control:

Development of adequate analytical technique to govern the manufacturing process parameters in order to avoid producing non-conformance product. Example, periodic inspection of plating thickness could confirm whether the deposition process within the product specifications; checking fineness of the precious metal coating could could trace the discrepancy of process parameters.

Equipment List

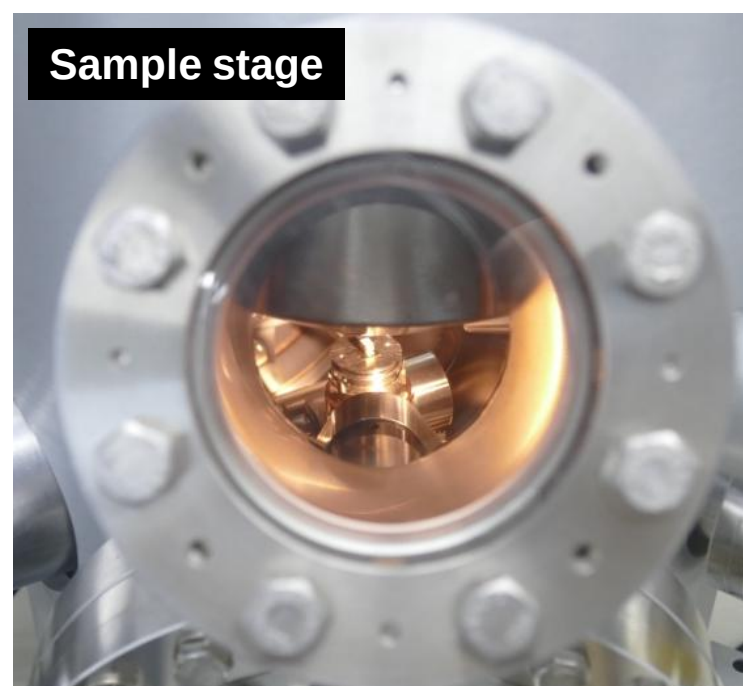
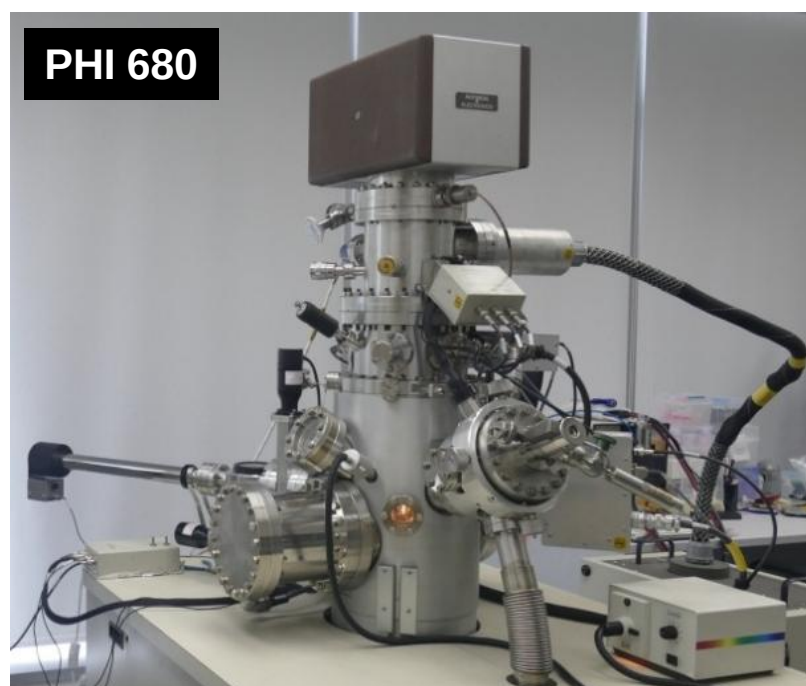
Technique	Equipment Model
Auger Electron Spectroscopy (AES/SAM)	PHI 680 Scanning Auger Nanoprobe
X-ray Photoelectron Spectroscopy (XPS/ESCA)	PHI Quantera Scanning X-ray Microprobe
Scanning Electron Microscopy (SEM)	PHI 680 Scanning Auger Nanoprobe
Optical Microscopy (OM)	Nikon MM-400 measuring microscope
	SK-HZM digital microscope
Precision cutting	MTI SYJ-200 precision cutting saw
Micro-sectioning	MTI EQ-Unipol-820 dual platens grinder/polisher

Analytical and Preparation Techniques

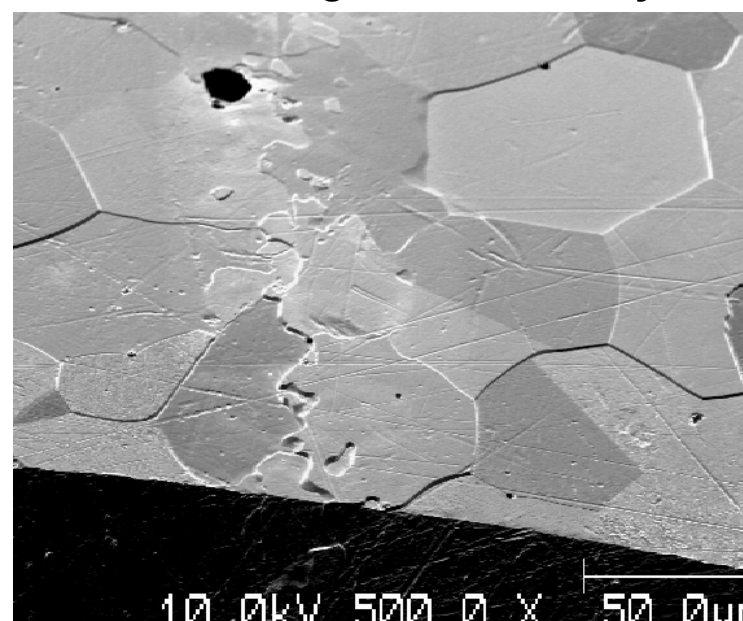
Technique: Auger Electron Spectroscopy (AES), Scanning Auger Microscopy (SAM)

Equipment: PHI 680 Scanning Auger Nanoprobe

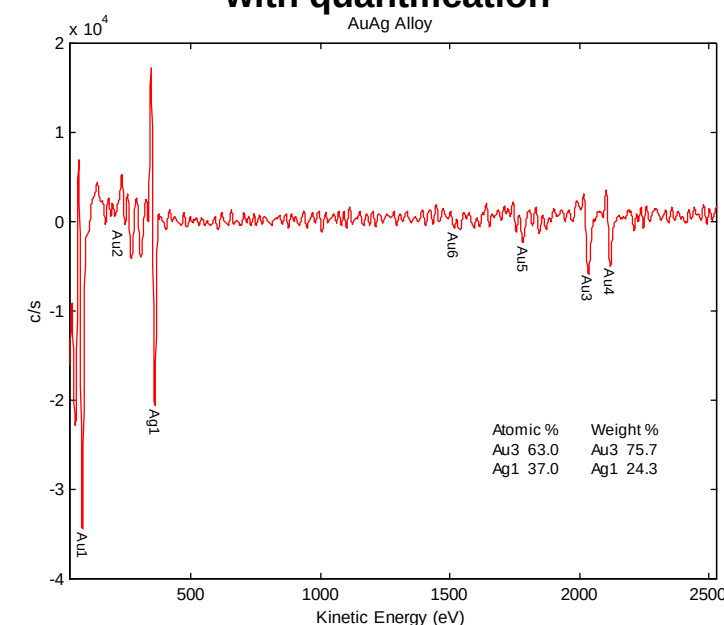
Feature: A combination of surface sensitive Auger Electron Spectrometer (AES) and high resolution Field Emission Scanning Electron Microscope (FESEM)



SEM image of AuCu Alloy



Auger spectrum of 18k AuAg alloy with quantification



Technique: Auger Electron Spectroscopy (AES), Scanning Auger Microscopy (SAM)

Capabilities

- Nanoscale compositional analysis and imaging (with probe size down to 10nm)
- Large area surface analysis using scan mode
- Elemental Depth profiling with ion sputter gun
- Thin film thickness measurements with calibrated ion sputtering rate
- Elemental mapping and line scanning
- Dimensional measurement with calibrated scale

Specifications

Target Signal: Auger electrons from 5-10nm of the sample topmost surface

Elements covered: All except H & He

Detection Limits: 0.1-1at% depends on element

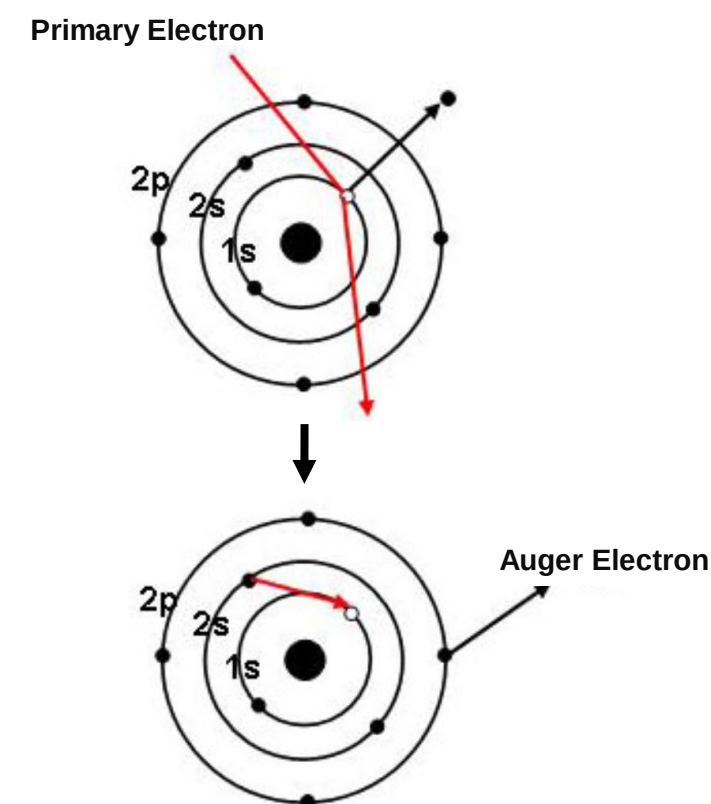
Lateral Resolution: 10-40nm

Image modes: Secondary Electron (SEM), Auger Electron (Elemental mapping)

Theory behind

Auger Electron Spectroscopy (AES) is a quantitative analytical technique that utilizes a finely focused high energy electron beam (up to 20keV) as an excitation source to eject Auger electrons from the surfaces of solid materials. The in-situ electron energy analyzer is used to measure the kinetic energy (KE) and number of electrons that escape from the surface. From the kinetic energy and intensity of an Auger peak, the elemental identity and quantity of a detected element can be determined. The average analysis depth of Auger electrons approximately 5 nm which make AES is extremely surface sensitive. The electron beam size is as small as 10 nm which make this technique have very high lateral spatial resolution, high definition elemental line scanning and mapping can be obtained with the scanning function. With equipping ion sputtering gun, elemental distribution against sputter depth (i.e. depth profile) at the surface of a material can be monitored.

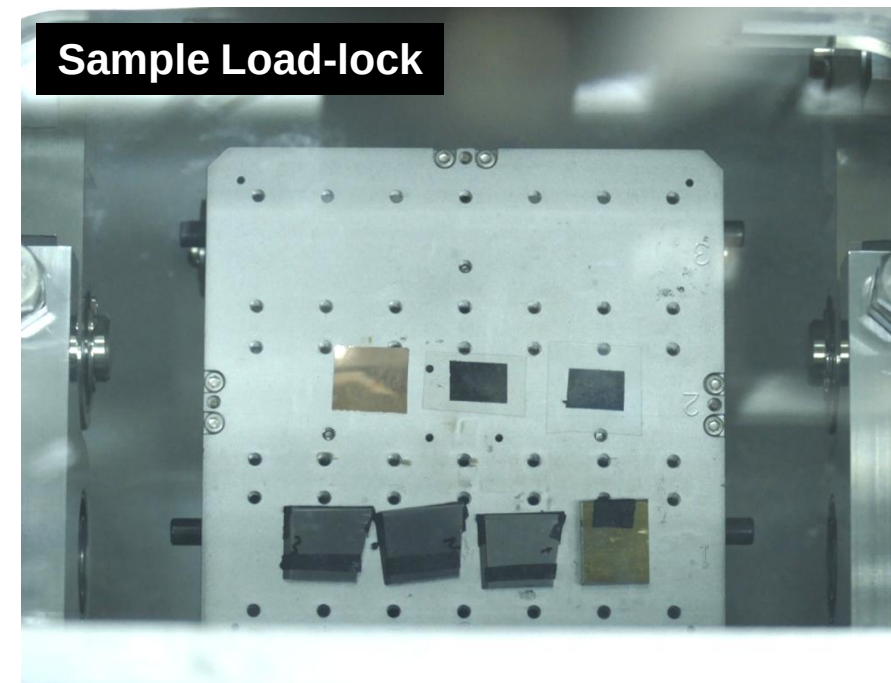
Auger Electron Emission



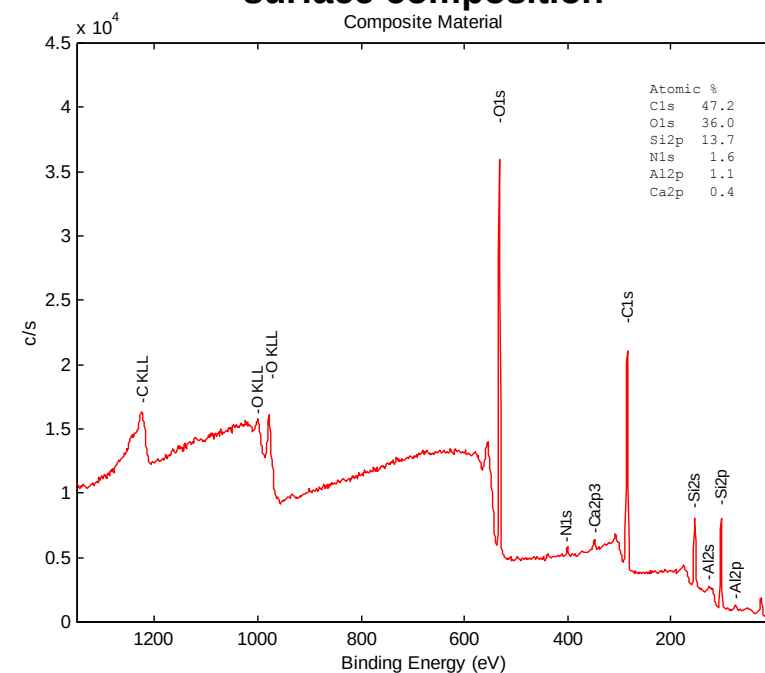
Technique: X-Ray Photoelectron Spectroscopy (XPS / ESCA)

Equipment: PHI Quantera Scanning X-ray Microprobe

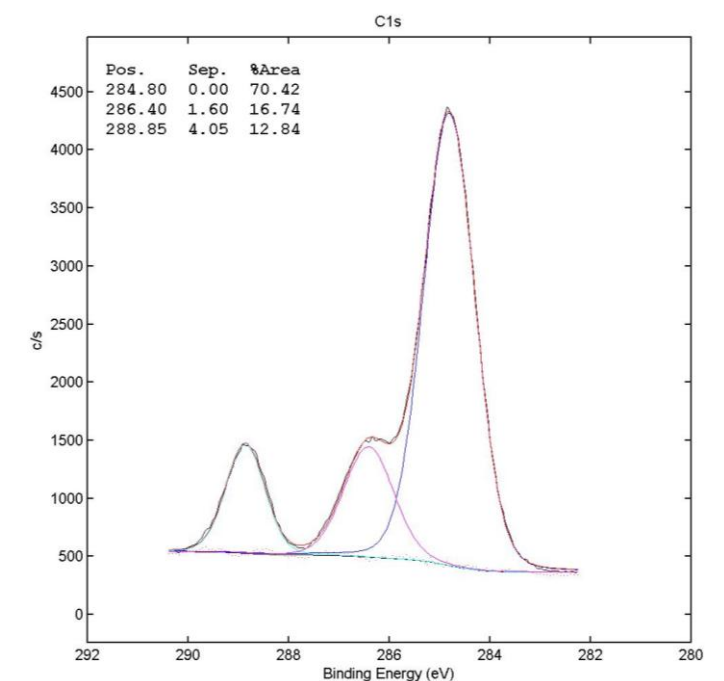
Feature: A X-ray photoelectron spectrometer with finely focused scanning X-ray probe which could provide not only single point analysis but also imaging and elemental mapping.



Photon electron spectrum to show surface composition



Chemical shifts to differentiate types of Carbon



Technique: X-Ray Photoelectron Spectroscopy (XPS / ESCA)

Capabilities

- Surface analysis of organic and inorganic materials, stains, corrosion or discoloration
- Determination of chemical state of the detected elements [e.g, Cu(0), Cu(I) & Cu(II)]
- Elemental and chemical state mapping
- Depth profiling for thin film composition
- Thin film thickness measurements with calibrated ion sputtering

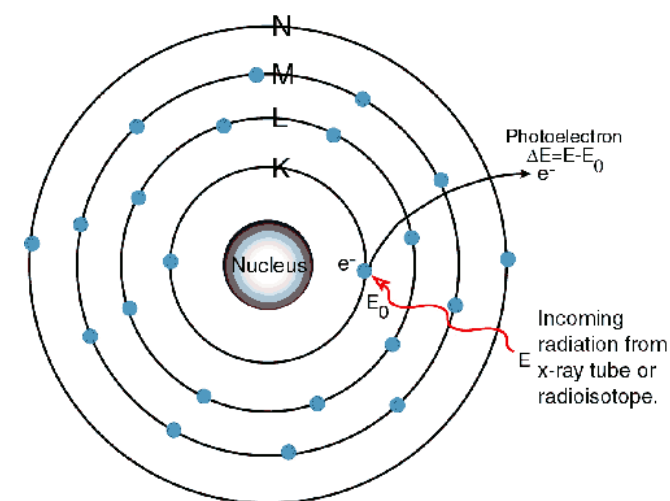
Specifications

- **Target Signal:** Photoelectrons from 5-10nm of the sample topmost surface
- **Elements covered:** All except H & He
- **Chemical state information:** Yes
- **Detection Limits:** 0.1-1at% depends on element
- **Image modes:** Scanning X-ray Induced secondary electron (SXI), Photoelectron (Elemental and Chemical state mapping)
- **Probe size:** 9 - 200 μm

Theory behind

X-ray Photoelectron Spectroscopy (XPS) or Electron Spectroscopy for Chemical Analysis (ESCA) is a quantitative spectroscopic technique that measures the elemental composition and chemical states of the elements that exist in a material. XPS spectra are obtained by irradiating a material with a beam of monochromatic Aluminum X-ray (Al $K\alpha$) causing photoelectrons to be emitted from the sample surface. The in-situ electron energy analyzer is used to measure the kinetic energy (KE) and number of electrons that escape from the top 5 nm of the material. From the binding energy (deduced from KE) and intensity of a photoelectron peak, the valuable information about the elemental identity, chemical state and relative amount of the detected elements can then be determined. XPS detects all elements with atomic number (Z) greater than 3, this implies that XPS cannot detect hydrogen (Z=1) and helium (Z=2). With equipping ion sputtering gun, elemental distribution against sputter depth (i.e. depth profile) at the surface of a material can be monitored; the change in chemical state of particular element can also be tracked.

Photoelectron Emission

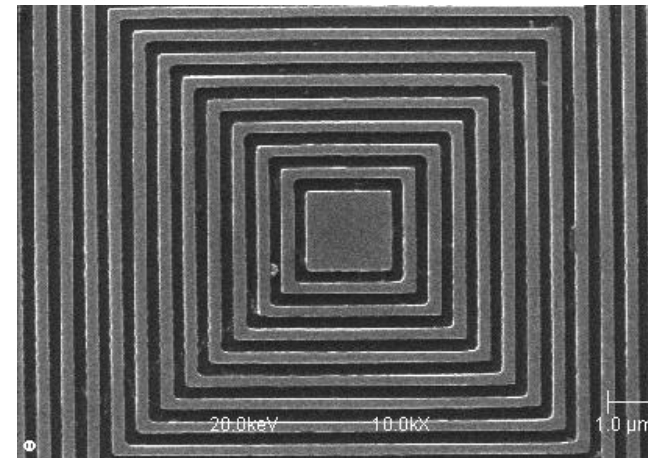


Technique: Scanning Electron Microscopy (SEM)

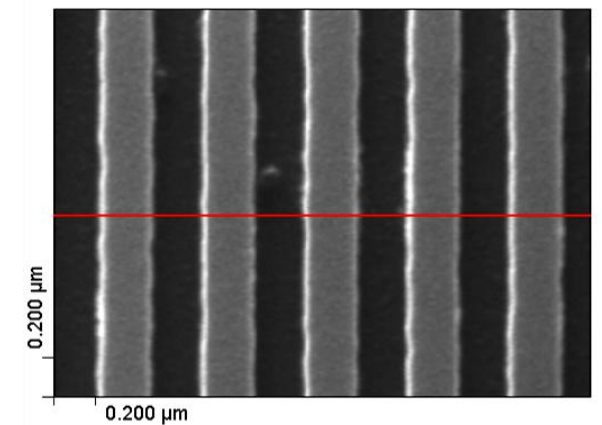
Equipment: PHI 680 Scanning Auger Nanoprobe



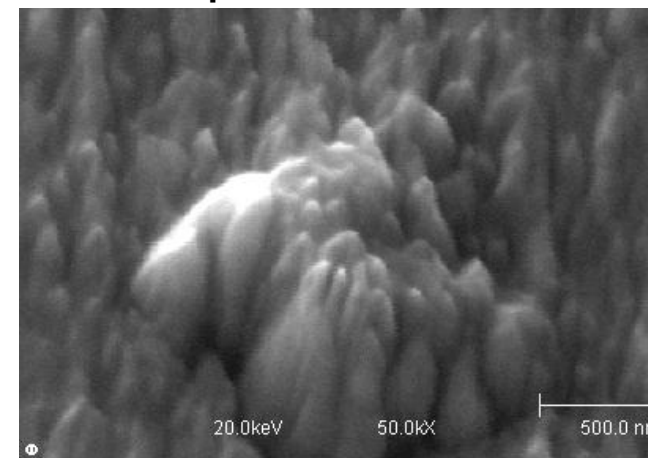
0.5 μ m calibration spacing at 10kx



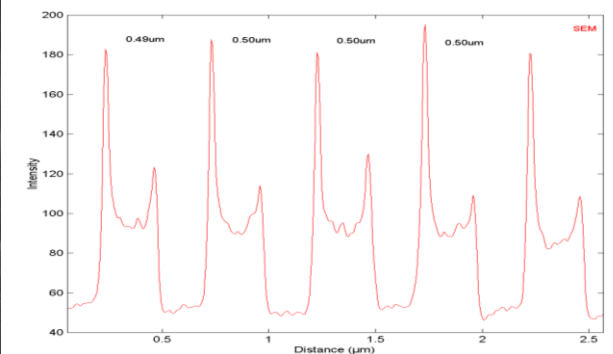
0.5 μ m calibration spacing at 50kx
SEM



Sample surface at 50kx



Line profile showing repeating pattern with 0.5 μ m pitch



Capabilities

- High magnification image with spatial resolution down to 10nm
- Dimensional measurement down to submicron level with calibrated scale

Specifications

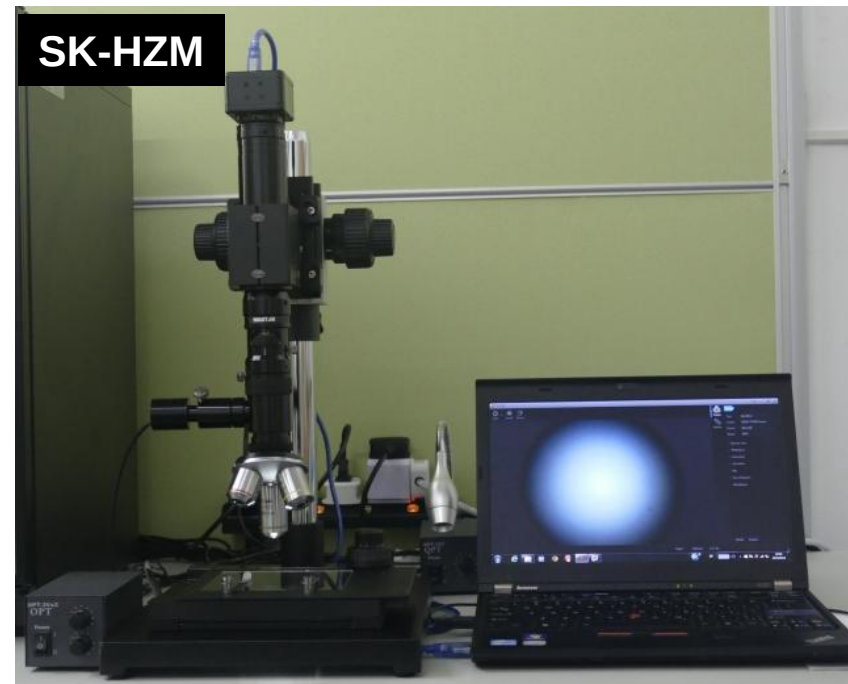
- Target Signal:** Secondary & backscattered electrons
- Lateral Resolution:** 10nm at 20kV

Theory behind

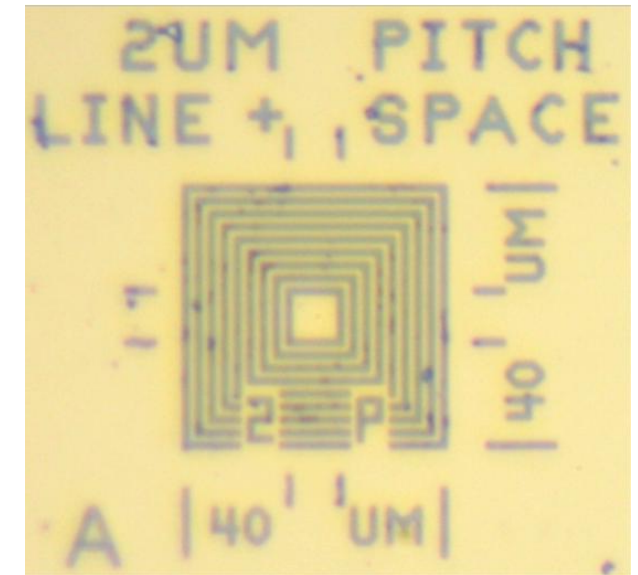
Scanning Electron Microscopy (SEM) is one of the most widely used analytical tools today. It provides high-resolution and long-depth-of-field images of the sample surface that optical microscopy cannot provide. The Secondary Electron (SE) and Backscattering Electron (BSE) images are formed by scanning the sample with a high energy electron beam (up to 20kV). The primary electrons interact with the sample and generate low energy secondary electrons and back-scattered electrons, these electrons are collected by corresponding electron detectors and the surface topography of the sample can be constructed.

Technique: Optical Microscopy (OM)

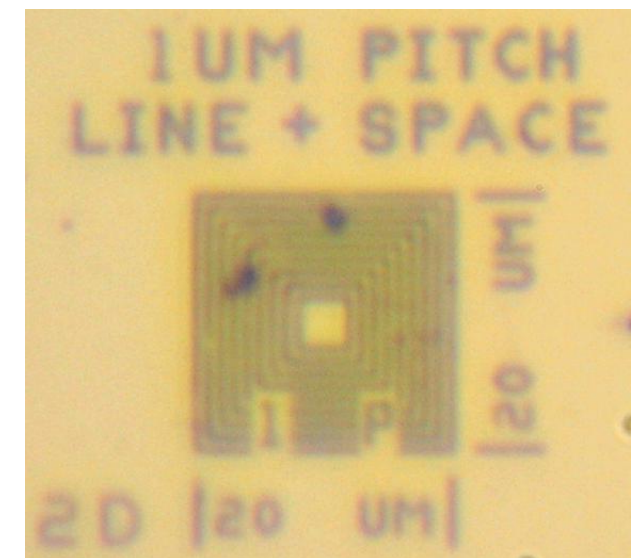
Equipment: Nikon MM-400 measuring microscope & SK-HZM digital microscope



Optical image of 2 μ m spacing



Optical image of 1 μ m spacing



Capabilities

- High magnification color image with spatial resolution down to 1 μ m
- Dimensional measurement down to micron level with calibrated scale

Specifications

- **Target Signal:** Visible light
- **Lateral Resolution:** down to 1 μ m
- **Sensor resolution:** 5 Megapixel

Description

Optical Microscopy is a widely used technique for inspection of surface feature and morphology under visible light with wide range of magnifications; with combination of micro-sectioning, the internal feature of the specimen could also be revealed and inspected. With proper scale calibration, optical microscope can be used for dimension measurement such as plating thickness and particle size.

Technique: Precision cutting

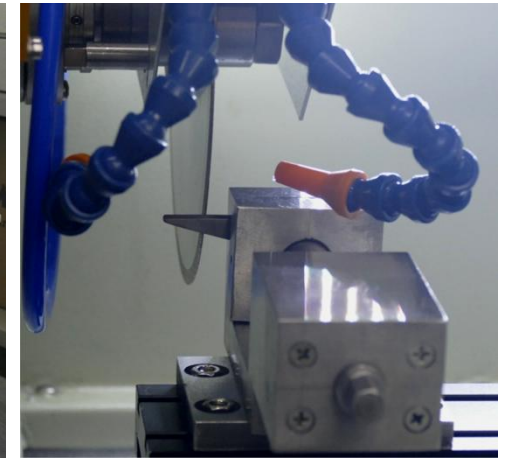
Equipment: MTI SYJ-200 precision cutting saw

Specifications

- **Target material:** All types of solid
- **Blade selection:** Diamond, Silicon Carbide or Aluminum Oxide
- **Feed speed:** 1 -20mm/min
- **Blade speed:** 300-3500 RPM
- **Precision:** 0.01mm

Description

Precision cutting is a useful sample preparation technique. When sectioning small, delicate, or extremely hard materials, a thin metal bonded diamond blade is used for cutting, the cut piece will have more precise cut, less material loss and less induced deformation than other types of cutting.



Technique: Micro-sectioning

Equipment: MTI EQ-Unipol-820 dual platens grinder/polisher

Specifications

- **Mounting medium:** Epoxy resin
- **Grinding tool:** Silicon Carbide abrasive papers
- **Polishing aid:** Diamond or Aluminum Oxide suspension
- **Wheel speed:** 50-600 RPM

Description

The micro-sectioning is multi-stage sample preparation process for revealing coating layer structure/uniformity, thickness in plating finishes, or ascertaining the internal failure in the bond pad/junction/joint at Printed Circuit Board and electronic packages. The isolated area of interest from the sample is firstly encapsulated into a mounting medium (e.g., epoxy resin) within a mould and is left to solidify. On solidification, the mounted specimen (or micro-section) is subjected to a number of grinding/polishing stages to generate a final polished specimen free of deformation and suitable for optical and/or electron microscopy analysis.



Sample requirements

AES/SAM

- Conductors (such as metal coating, metal contact on PCB, electronic connector, integrated circuit, wafer, etc.)
- Insulators are possible with ion neutralizer and proper charging reduction (such as thin ceramic coating on metal, organic coating and composite material, etc.)
- Samples must be vacuum compatible (i.e., any solid or residue in liquid after drying that will not sublime under vacuum)
- Sample cutting is required for fitting the dimensional requirements

XPS/ESCA

- Applicable for both of conductors (such as metal coating, metal contact on PCB, electronic connector, integrated circuit, etc.) and insulators (such as polymers, mineral, ceramics, glass, paper, etc.)
- Samples must be vacuum compatible (i.e., any solid or residue in liquid after drying that will not sublime under vacuum)
- Sample cutting is required for fitting the dimensional requirements

SEM

- Conductors such as metal, semiconductor
- Insulators are possible with application of conductive coating on the surface
- Samples must be vacuum compatible (i.e., any solid or residue in liquid after drying that will not sublime under vacuum)
- Sample cutting is required for fitting the dimensional requirements

OM

- Applicable for all solid surface, semi-solid and suspension in liquid
- Sample cutting is required for fitting the dimensional requirement

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