Instrument Name: X-ray photoelectron **spectroscopy** (**XPS**)
Make: Kratos/Shimadzu Amicus,
Model: ESCA 3400
Specifications:

- Developed from proven technology and incorporates the latest in digital control electronics producing an easy to use, flexible system suitable for all levels of expertise.
- Used for a wide variety of applications ranging from routine laboratory use to quality control and assurance in production environments
- Highly user friendly and data processing software enables both simple and complex studies to be carried out in a totally automated fashion
- The ability to set up and store previously defined data acquisition and processing parameters ensures that reproducible procedures are maintained, an important criterion in quality control environments.
- Sample introduction chamber: 10 sample introduction chamber (optional)
- X-ray Source: Dual Mg/Al anodes
- Electron energy analyser: Low pass/high pass filter, selectable pass energy, 25, 75, and 150eV, single channeltron detector.

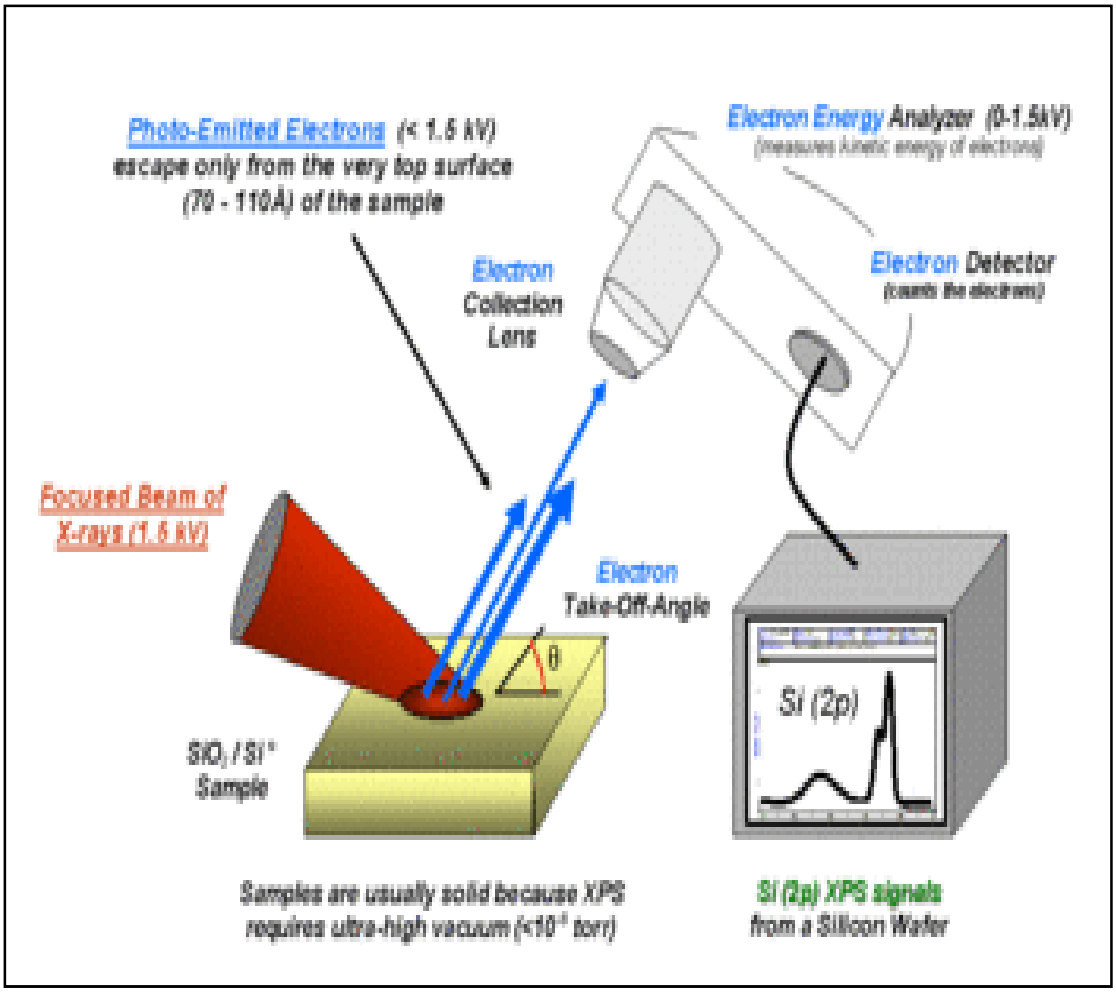
Description

X-ray photoelectron spectroscopy (XPS) is a quantitative spectroscopic technique that measures elemental composition, empirical formula, chemical state and electronic state of the elements that exist within a material. XPS spectra are obtained by irradiating a material with a beam of X-rays while simultaneously measuring the kinetic energy and number of electrons that escape from the top 1 to 12 nm of the material being analyzed. XPS requires ultra-high vacuum (UHV) conditions

XPS is a surface chemical analysis technique that can be used to analyze the surface chemistry of a material in its' "as received" state, or after some treatment, for example: fracturing, cutting or scraping in air or UHV to expose the bulk chemistry, ion beam etching to clean off some of the surface contamination, exposure to heat to study the changes due to heating, exposure to reactive gases or solutions, exposure to ion beam implant, exposure to ultraviolet light

Principle

Irradiating a sample with x-rays of sufficient energy results in electrons in specific bound states to be excited. In a typical XPS experiment, sufficient energy is input to break the photoelectron away from the nuclear attraction force of an element. Two key features are derived from XPS data.



Main features

X-ray Photoelectron Spectroscopy (XPS) also known as Electron Spectroscopy for Chemical Analysis (ESCA) is the most widely used surface analysis technique because it can be applied to a broad range of materials and provides valuable quantitative and chemical state information from the surface of the material being studied. The average depth of analysis for an XPS measurement is approximately 5 nm. PHI XPS instruments provide the ability to obtain spectra with a lateral spatial resolution as small as 7.5 µm. Spatial distribution information can be obtained by scanning the micro focused x-ray beam across the sample surface. Depth distribution information can be obtained by combining XPS measurements with ion milling (sputtering) to characterize thin film structures. The information XPS provides about surface layers or thin film structures is important for many industrial and research applications where surface or thin film composition plays a critical role in performance including: nanomaterials, photovoltaics, catalysis, corrosion, adhesion, electronic devices and packaging, magnetic media, display technology, surface treatments, and thin film coatings used for numerous applications.

XPS is typically accomplished by exciting a samples surface with mono-energetic Al kα x-rays causing photoelectrons to be emitted from the sample surface. An electron energy analyzer is used to measure the energy of the emitted photoelectrons. From the binding energy and intensity of a photoelectron peak, the elemental identity, chemical state, and quantity of a detected element can be determined.

Physical Electronics XPS instruments function in a manner analogous to SEM/EDS instruments that use a finely focused electron beam to create SEM images for sample viewing and point spectra or images for compositional analysis. With the PHI XPS instruments, a finely focused x-ray beam is scanned to create secondary electron images for sample viewing and point spectra or images for compositional analysis. The size of the x-ray beam can be increased to support the efficient analysis of larger samples with homogeneous composition. In contrast to SEM/EDS which has a typical analysis depth of 1-3 μm, XPS is a surface analysis technique with a typical analysis depth of less than 5 nm and is therefore better suited for the compositional analysis of ultra-thin layers and thin microscale sample features.

Limitations:

An ESCA sample can be up to 60mm in diameter x 13 mm high in size. We can analyze insulators, thin films, powders and organics. The sample must be non-volatile and be compatible with ultra high vacuum in the range of 10^-7 to 10^-10 Torr.

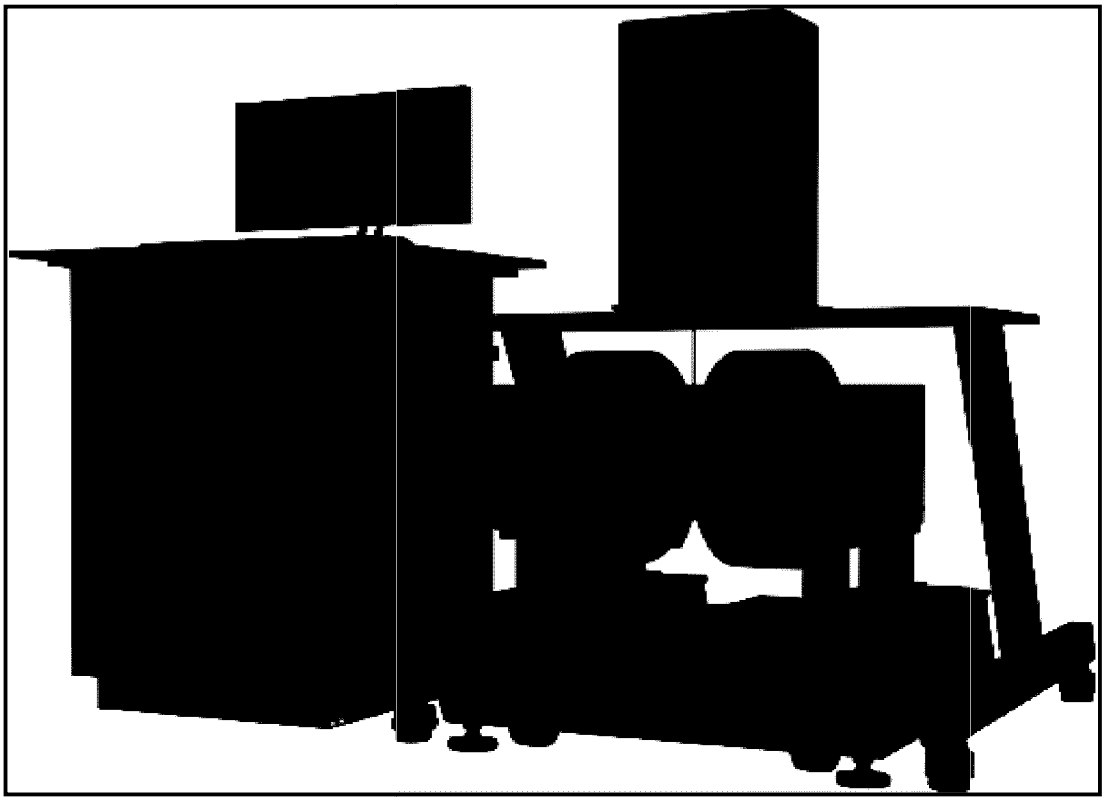
Applications:

- Surface analysis of organic and inorganic materials
- Determining composition and chemical state information from surfaces
- Depth profiling for thin film composition

Instrument Name: VIBRATING SAMPLE MAGNETOMETER (**VSM**)

Make: Lake Shore

Model: 8600 Series VSM



VSM Application:

- The vibrating-sample magnetometer can be used for magnetic measurements as a function of temperature and magnetic field of materials.
- The measurements can be done from LN_2 to 950K.
- Argon purging facility is available.