X-ray Photoelectron Spectrometer

Introduction

X-ray Photoelectron Spectroscopy or **Electron Spectroscopy for Chemical Analysis (ESCA)** is a powerful technique to determine the quantitative elemental composition of sample surfaces. XPS can be used to analyze inorganic compounds, metal alloys, semiconductors, polymers, glasses, ceramics, teeth, bones, medical implants, bio-materials, industrial samples, and many others.

Specifications

Analyzer	**180° double-focusing hemispherical analyzer with 128 channel detectors**
X-ray source	Al-Kα (1486.8 eV) micro-focused monochromator with variable spot size (50-400 µm)
Ion Gun	Ar+ Energy range 100-4000 eV
Charge Compensation	Dual-beam source
Sample Stage	60 x 60 mm2; 5 axis auto-z can accommodate samples of maximum size 60 x 60 mm2 with 15 mm thickness. However, ~5 mm2 area with < 1 mm thickness is preferred for solid samples.

Samples

- Solids, crystals, thin films, epitaxial layers, polymers, powders - tightly packed pellets of 6 mm to 10 mm diameter, glasses, ceramics, teeth, bones, medical implants, and biomaterials.
- **Powders / Nanomaterials pressed in Indium metal foil/ the ball is recommended.** If sample preparation is needed user may need to pay additionally for sample preparation.
- Samples should be clean and dry, the samples should not be outgassing in nature, and should not degrade under high vacuum
- Samples composed of Na, K, S, P, F, Zn, Pb, Bi, I, Se, As, Te, and Hg are not suitable for Depth profile analysis
- No liquid and moisture samples shall be done
- If any samples contain **Iodine** and **Sulphur**, XPS measurements cannot be done. However, Sulphur bonded strongly i.e. GaS, MoS_2, etc. are possible, if stable under vacuum.
- Solid sample size: (i) 5 mm (*l*) X 5 mm (*b*) X 2 mm (*h*)

  (ii) 5 mm (*dia*) X 2 mm (*h*)
- Powder sample weight: 20 mg

Types of analysis

- Survey Scan
- Narrow Scan
- Mapping
- Depth profiling
- Angle-resolved XPS

Applications of XPS

- Survey the atoms, percentage of the elements, chemical state, and electronic state of the elements within a material
- Resolve mixtures of chemical states (e.g. Si, SiO, and SiO_2)
- Profile the change in element atom% versus depth
- Map the uniformity of surface chemistry of a large area
- Surface contamination
- Chemical state changes or contamination due to processing or heating
- Check the purity of a chemical (e.g MoO_3)
- Corrosion study
- Chemical depth profile down to 2,000 nm

Details of XPS

Brand	**Thermo Scientific**
Model	**K-Alpha**
Sponsored Agency	RUSA 2.0 Physical Sciences - TRP (Ref. No. 63iii-1/BDU/RUSA2.0/TRP/PS Date:06.06.2022)

scan for more details.