XPS / ESCA

X-Ray Photoelectron Spectroscopy

Electron spectroscopy for chemical analysis

Technique

Photoelectrons result from the interaction of electromagnetic radiation with matter. Useful energy ranges for the exciting radiation go from UV (Ultraviolet Photoelectron Spectroscopy, **UPS**, leading to valence electrons excitation) to soft X-Rays (X-Ray Photoelectron Spectroscopy, **XPS**, leading to core level electrons excitation and hence to elemental selectivity). Excited photoelectrons are analyzed according to their kinetic energy, which is, at least for core electrons, a fingerprint of the emitting element. Elemental identification is therefore possible (apart from H and He) for core level photoemission. Elements' relative abundance can in addition be made semi-quantitative or quantitative.

Information on chemical bonds is derived either from core level shifts or from changes in the valence band electronic structure. Characteristic of the technique is its surface sensitivity (a few monolayers), which, combined with an etching process (usually through sputtering by accelerated noble ions) allows to measure elemental depth distributions.

The most important feature

is its ability to provide detailed chemical information on virtually each kind of solid sample, i.e. also on insulating or easily damaged samples.

Applications

In microelectronics XPS is usually used to characterize oxynitride or to improve utilization of new gate materials. On the other hand, XPS finds wide **applications** in several field of materials science (biomaterials, polymers, organic materials,....).

Intrument	**Scienta ESCA 200 (operating since 1995)**
X-Ray Source	Monochromatic AlKα radiation
Analyzer	Hemispherical Analyzer, which can be operated either in transmission or in spatial mode
Sample surface imaging	via optical microscope
Energy resolution	ΔE≈0.3eV on the Ag Fermi edge with a pass energy of 75eV
Sensibility	0.5-1at%
Spatial resolution	10µm. XPS line scans and maps can be acquired
In-depth information	an Ar gun (up to 5keV accelerating voltage) is provided for the etching process. To preserve chemical information wet etching is therefore possible
Charge compensation	a low kinetic energy electron gun is provided