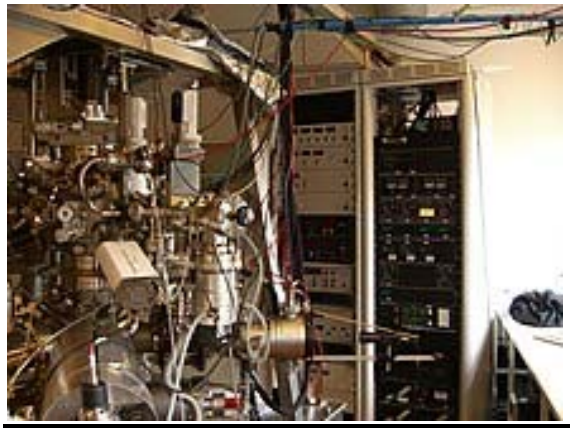
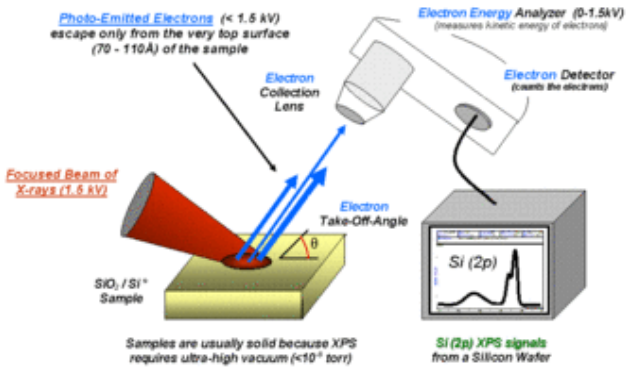
Objective: XPS can measure elemental composition as well as the chemical and electronic state of the atoms within a material. XPS is also routinely used to determine composition of material surfaces (elemental identification), the relative abundances of these components on surfaces (semi-quantitative analysis), and the chemical state of polyvalent ions by measuring the binding energies of elements, which is related to the nature and strength of their chemical bonds. XPS is used to characterize the surfaces of diverse materials such as inorganic compounds (minerals), semiconductors, organic compounds, and thin films and coatings on natural and engineered materials. XPS is used to support research on surface-mediated processes such as sorption, catalysis, redox, dissolution/precipitation, corrosion, and evaporation/deposition type reactions.

Operating principle: XPS spectra are obtained by irradiating a solid surface with a beam of X-rays and measuring the kinetic energy of electrons that are emitted from the top 1-10 nm of the material. X-rays (photons) are shot onto a sample, and when electrons in the sample absorb enough energy, they are ejected from the sample with a certain kinetic energy. The energy of those ejected electrons is analyzed by a detector and a plot of these energies and relative numbers of electrons is produced. Electrons of different energies follow different paths through the detector which allows the computer to differentiate the electrons and produce the spectra



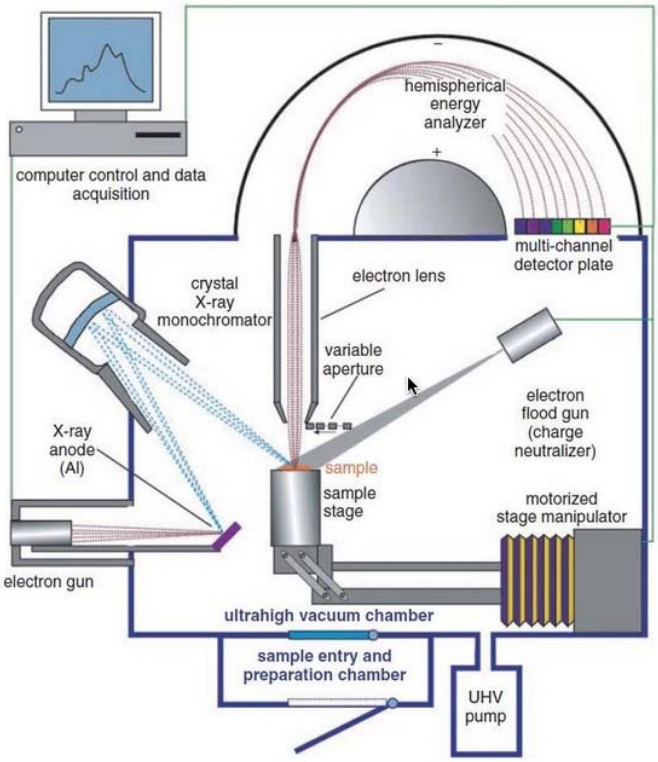
Example of an X-ray Photoelectron Spectrometer



Basic components of a monoschromatic XPS system

Diagram depicting the instrumentation of the X-ray photoelectron spectrometer.

Physical Instruments 5600 XPS instrument at the Imaging and Chemical Analysis Laboratory, Montana State University



Schematic diagram of the components of an XPS Instrument