
Product Information

FULL AUTOMATIC X-RAY PHOTOELECTRON SPECTROSCOPY XPS-7000

1. Introduction

X-ray photoelectron spectroscopy (XPS) has been extensively used as a surface analysis technique and its applications are surprisingly increasing particularly in studies of semiconductor devices, optical devices, catalysts, polymers and new ceramic materials. To meet the demands from these fields Rigaku XPS-7000 has been developed as a completely automatic surface analysis instrument providing high speed and high sensitivity measurements. The XPS-7000 is equipped with a sample introduction chamber and a preparation chamber and is designed to accomplish full automatic performance of both data acquisition and processing for several samples.

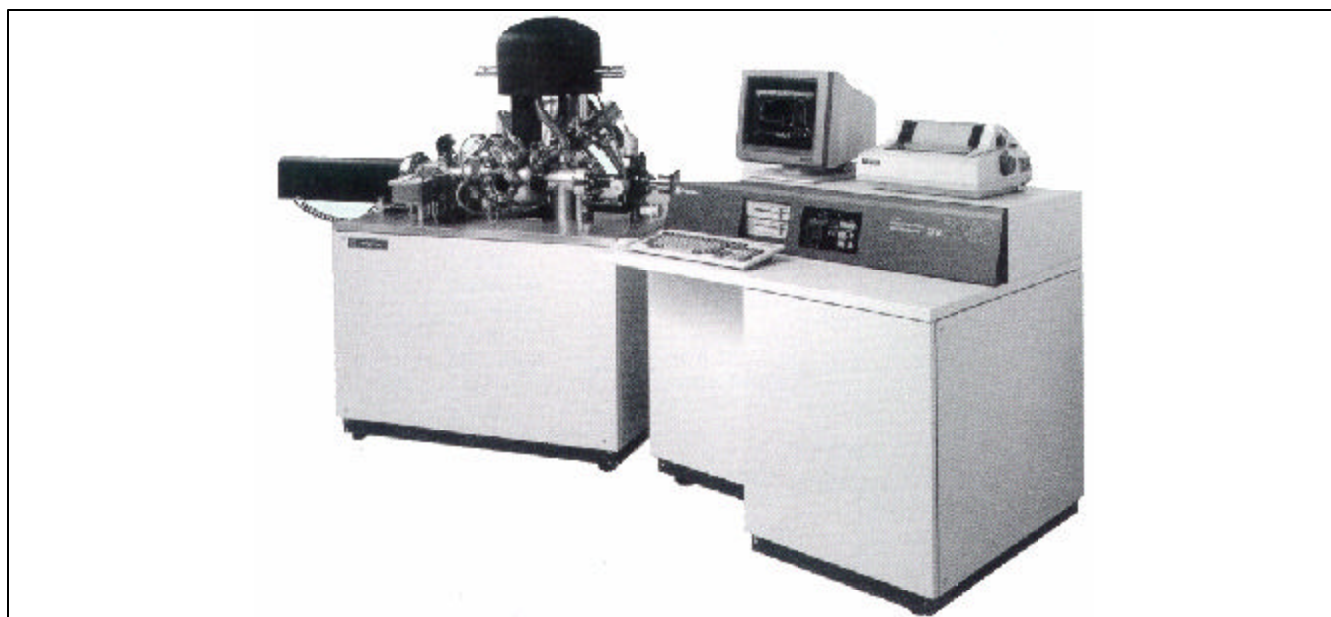
Also available is a crystal monochromator system consisting of a rotating-anode type high intensity X-ray generator, enabling high-resolution measurements with higher sensitivity compared to existing XPS instruments.

2. Configuration

The standard configuration of the XPS-7000 system is shown in Fig. 1. By using a dual anode

(Al/Mg) X-ray tube (0.6/0.3kW) either the Al-K α or Mg-K α radiations can be selected as the excitation energy. Samples of maximum 6 are installed to the introduction chamber and are automatically transported to the preparation chamber. Any one of these samples is also transferred automatically to the analysis chamber for the spectral measurements. Since the analysis chamber consists of many CF ports various surface treatments are possible using an evaporation gun, a Kaufman-type ion gun, an electron gun and so forth. These sample treatment guns work as well in the preparation chamber, too. Temperature of a sample may be computer-controlled in the range between -120° C and 600 °C by using a heating-and-cooling stage. The non-destructive depth analysis may also be performed by inclining the sample on the θ -manipulator.

Photoelectrons from the sample pass through an electrostatic cylindrical lens and a hemispherical analyzer then are detected by a channel electron multiplier.



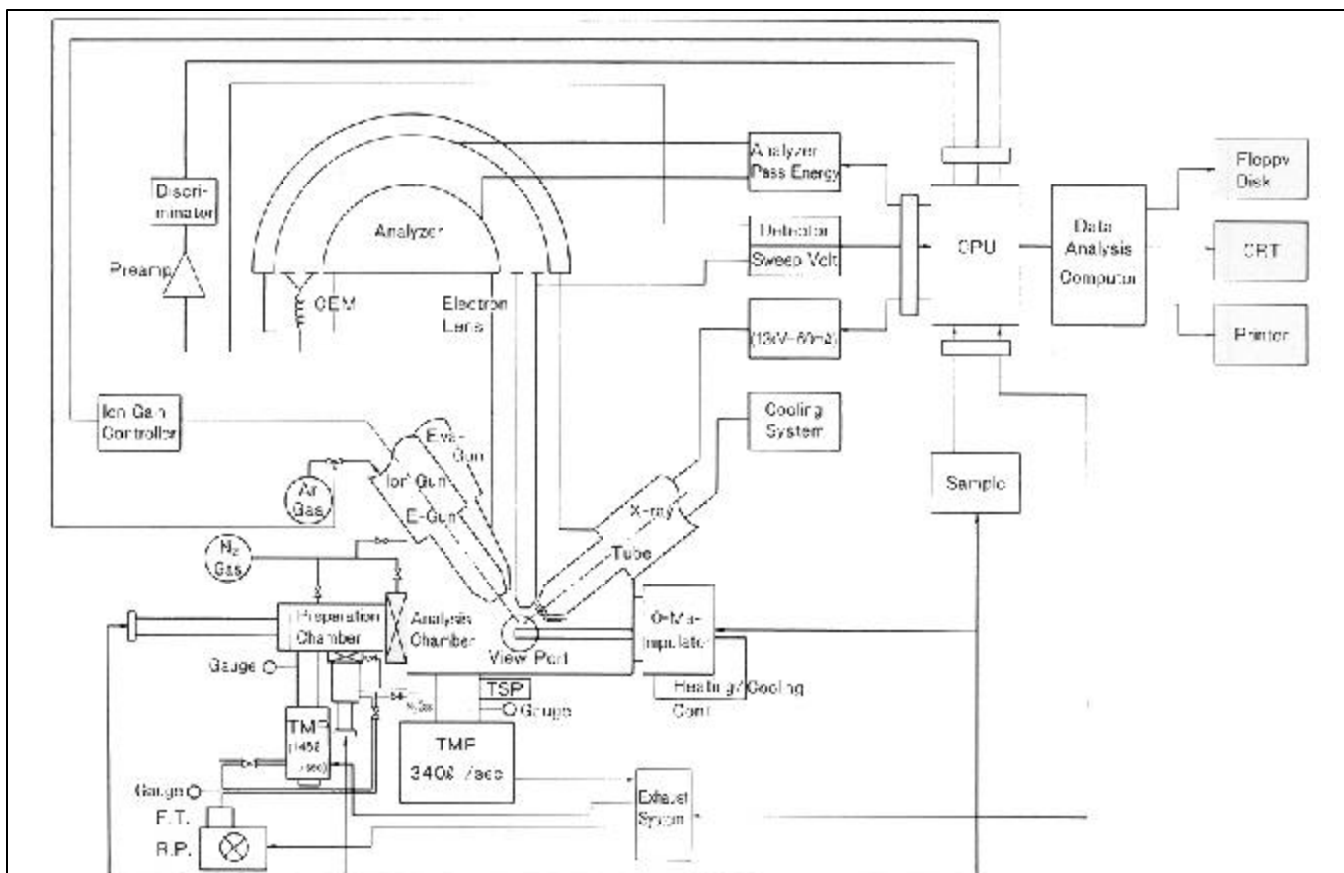


Fig. 1 Full Automatic X-ray Photoelectron Spectroscopy XPS-7000 Block Diagram (Standard)
 TMP: Turbo-Molecular Pump
 F.T. : Foreline Trap
 R.P. : Rotary Pump
 TSP : Titanium Sublimation Pump

All the sequence described above, from the sample transportation to the photoelectron measurement, are automatically controlled by the microcomputer units. Detailed information about the photoelectron spectra are obtained with the XPS-7000 data system providing a variety of data processing softwares such as automatic depth profiling, qualitative and quantitative calculation, smoothing, background subtraction, satellite peak subtraction and deconvolution.

3. Performance

A correlation between the sensitivity and the resolution (FWHM) obtained under the following condition is presented in Fig. 2 showing high sensitivities over the whole range investigated, e.g. 400 keps at 1.1 eV FWHM.

X-ray source: Mg-K α (1.2 kV-25 mA)
 measured area: ϕ 8 mm
 Spectrum: Ag 3d_{5/2} (368.2eV)

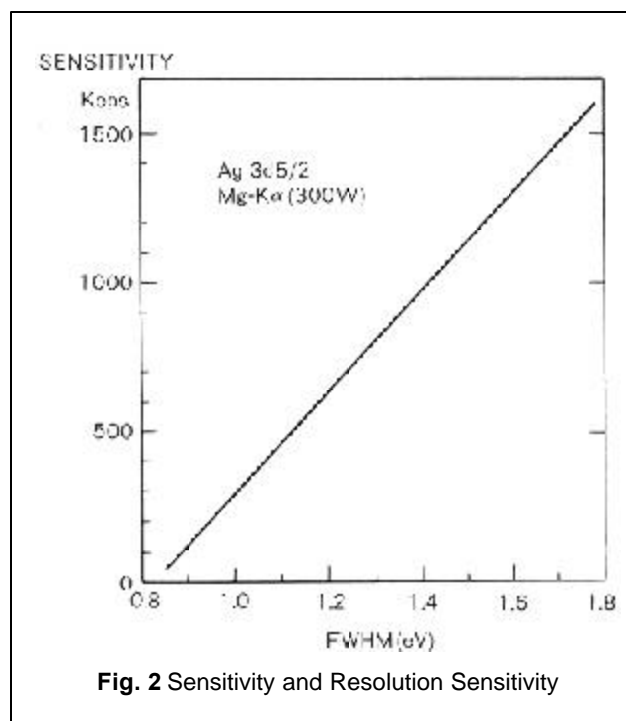


Fig. 2 Sensitivity and Resolution Sensitivity

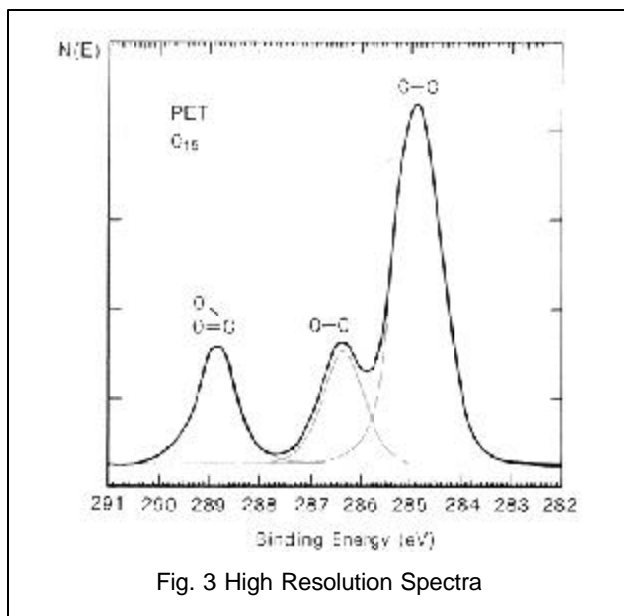


Fig. 3 High Resolution Spectra

Fig. 3 shows an example of high resolution spectra excited by the monochromatized Al-K α X-rays using a crystal monochromator system (optional unit). Carbon 1s spectra are well resolved into three binding energies arising from the different chemical bondings as denoted in the figure. The small area

analysis of about ϕ 0.1 mm may be achieved with this monochromator unit. By utilizing a XYZ θ -manipulator this opens up greatly the possibility of XPS analysis of surface segregation or small spot depth profiling.

4. Conclusions

The instrumental configuration and the performance of Rigaku XPS-7000 have been given briefly. One of the main characteristics of the system is the full automatic measurement including data processing as well as sample transportation. Small area analysis with high resolution is also possible with the crystal monochromator unit. Ultra-high vacuum condition of below 10^{-8} Pa can be achieved with a turbo-molecular pump (or ion pump) and with a titanium sublimation pump. The other major feature is the possibility of clean surface analysis with a Kaufman-type ion gun, since the sputtering damage of the sample surface may be largely reduced using low energy ion beams of below 100 eV. Rigaku XPS-7000 providing a number of these advantages may serve as a powerful tool for a wide range of surface analysis applications.