ESA 126i _504

The first portable high resolution photo-electron microscope & spectrometer for chemical analysis of all solid surfaces

vsmanalysis

Revolutionary way of bringing a powerful analytical tool to solve problems in urgent forensic, R&D or QA cases in production monitoring

Revolutionary combination of 3 techniques in one portable instrument

XP Spectrometry (XPS)

- XPS spectroscopy of highest quality
- Rapid snap shot spectroscopy

Angle resolved spectra (ARXPS)

- Simultaneous acquisition of angular and energy information
- No sample tilting necessary

XP Microscopy (XPM)

- Chemical state maps
- 0.2 um resolution
- Image acquisition in secs
- Remote instrument diagnostic

Sample handling

- 6" wafers
- Multiple samples possible
- 30 min batch exchange time
- Remote instrument control & sample handling

Instrument Portability

- Instrument transport under vacuum
- Ready for operation in minutes

VS MicroAnalysis VS Ltd , Unit 11, Lexden Lodge Industrial Estate , Jarvis Brook, Crowborough, East Sussex, TN62NQ,U.K.Tel. (+44) -1892-665633, email krizek@vacsys.co.uk, www.vacsys.co.uk

High Resolution XPS

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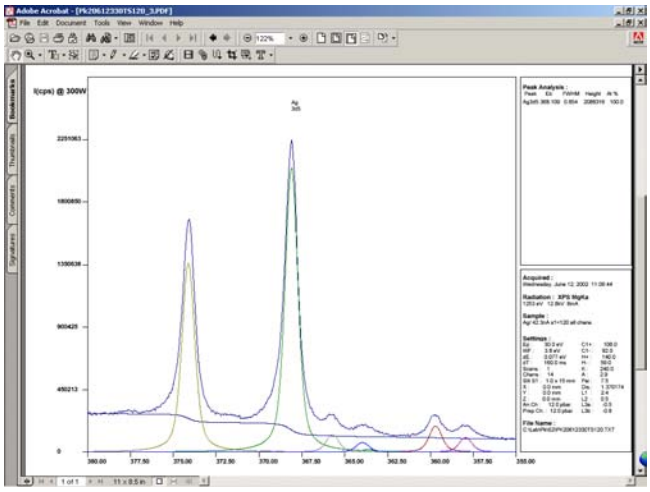
Removal of the instrument background and substantial reduction of the second order analyser aberrations made it possible to achieve the best energy resolution spectrometer for its size

Fine resolution on standards

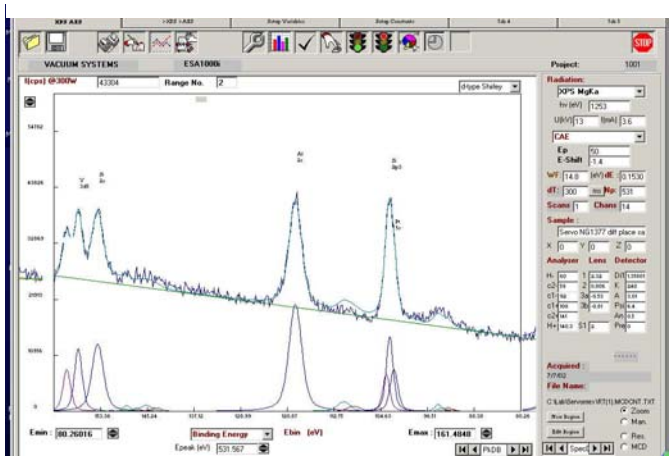
The optimum is high transmission, minimum background and line width at the peak bottom



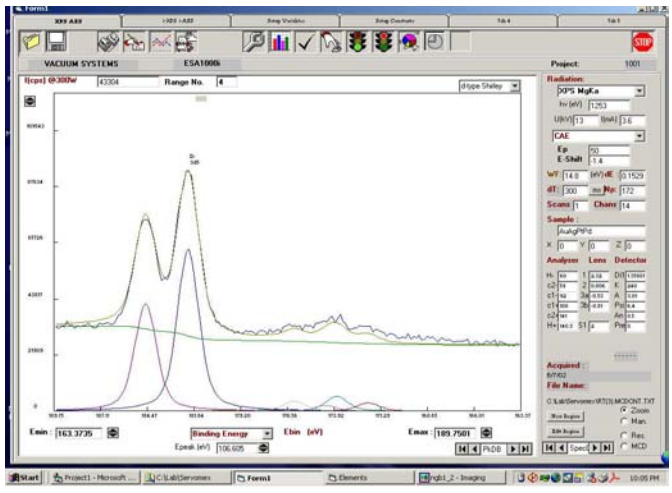
Fine energy resolution and high transmission XPS MgKa of Ag 3d at 300W on standard metallic sample. The background is calculated according to Shirley definition gives dE=0.85 eV at FWHM and dE=1.0 eV at the 10% base line (FWBL10) Some manufacturers define an unrealistic background as the line connecting points at +- 2 eV either side of the Ag3d5 peak in order to show "better" FWHM.. For our case this would give dE=0.795 eV.

Application to catalysis

The real test of an XPS spectrometer is in catalysis applications. These require high energy peak resolution to distinguish different chemical states and high spectrometer sensitivity as most of the samples under go charge compensation problems or change surface conditions with time.



XPS MgKa of Yttria Alumina Silica glass. It shows a structure of Y 3d from Y2O3.



A real power of this spectrometer to resolve neighboring peaks at FWBL10 is shown by a well resolved structure of Zr 3d of ZrO2 glass.

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High Resolution Imaging

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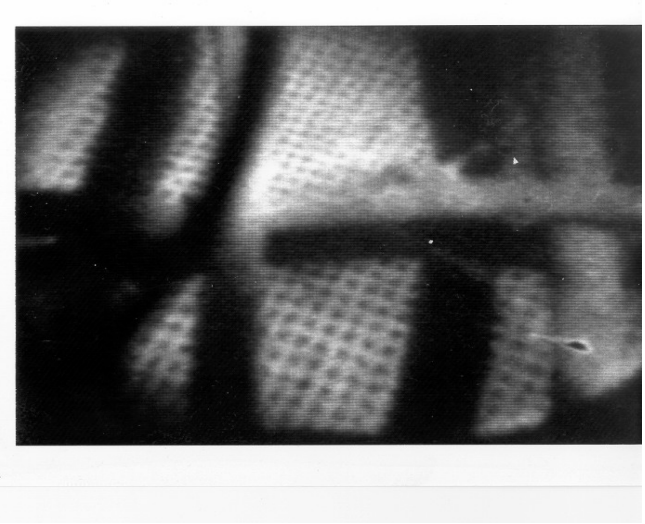
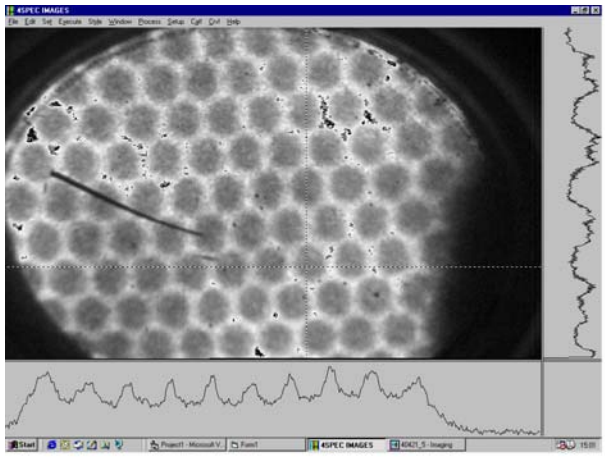
High resolution imaging is a combination of superior focusing properties of the analyzer , lens system and resolution of the imaging detector.

New lens features

- Guaranteed spatial resolution of 0.2 um in XPS mode
- Angular acceptance for ARXPS +_ 25 deg
- Lens System magnifications 60x – 600x continuously adjustable zoom facility
- Continuously adjustable IRIS mechanism for angular acceptance adjustments.



Electron image with an electron gun illuminating a set of two meshes: a stainless steel woven mesh on the top of a copper SEM test mesh with spacing 17 um and 5 um etched bars.



Spatial image with the spectrometer in the spectrum mode. An electron image of a micro-channel plate with 8um distance between the hole centers shows the resolutions below 1 um while focus aperture was opened to accept angle of +/- 6 degrees during the imaging process.

Imaging Detector System CCDXM

CCDXM is a two-dimensional detector ased on a CCD read-out and is used in all ESA imaging spectrometers for high resolution chemical mapping.

The read-out has the TV frame collection speed of 25 frames/sec
Minimum camera resolution is 758x480.

The system can accommodate cameras with resolutions of up to 4k x 4k x 16 bit.

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AXPS 2000
Combined Analysis in One Module

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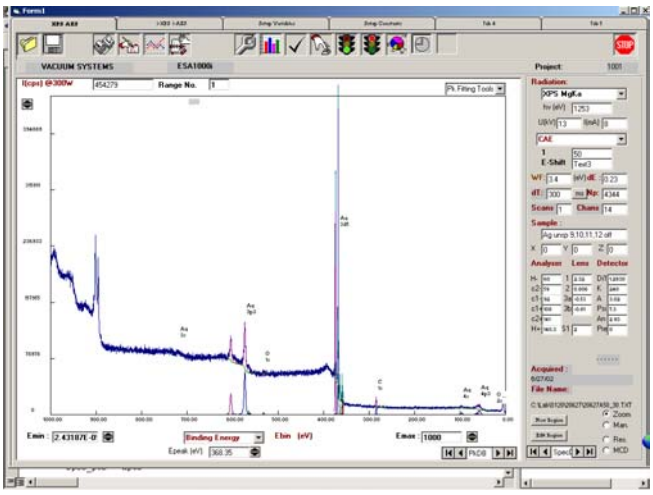
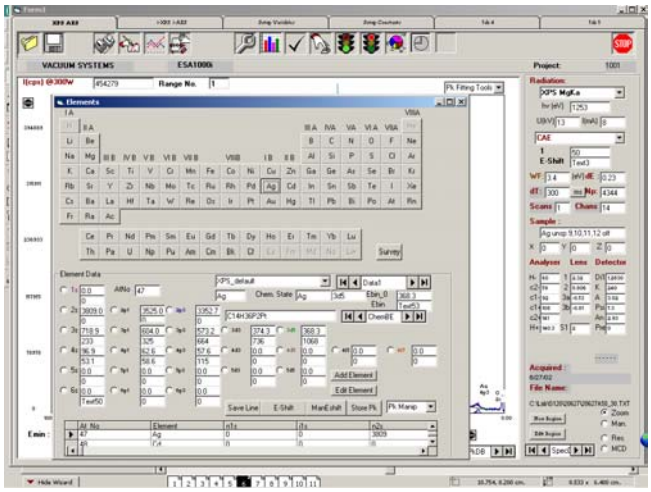
Our software has an intuitive customer interface , is flexible and easy to use. Its standardized data transfer is ready to accommodate future developments.

Data acquisition

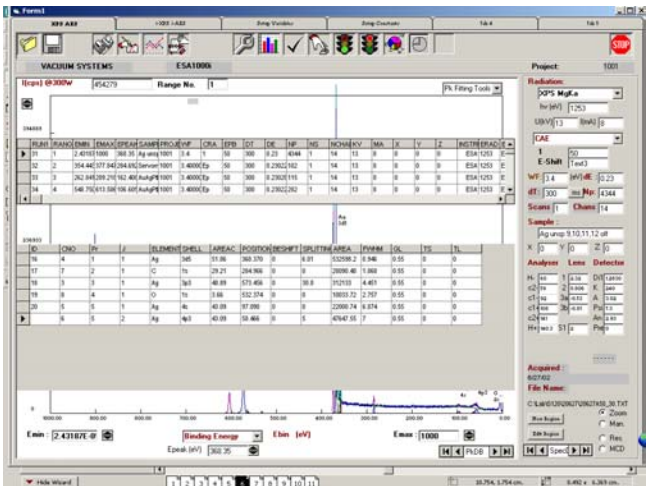
- Combined spectra and chemical map acquisition and processing
- XPS database with sensitivity factors for
- 50000 Elements and chemical states
- Automatic peak fitting & background modeling (Linear, Shirley, Tougaard)
- Data compatible with 3rd party software



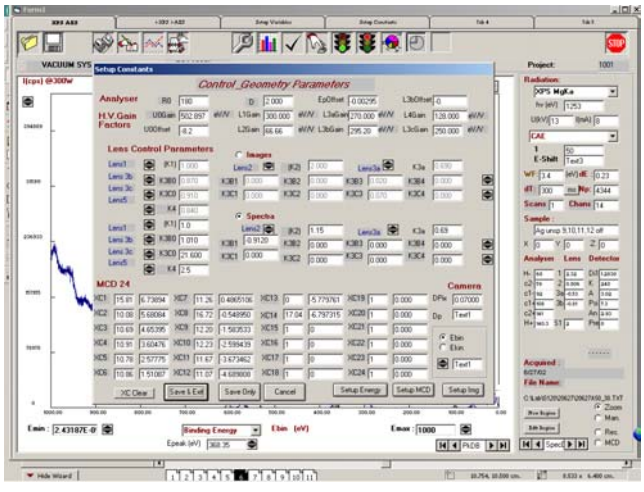
Spectrum acquisition sheet with command buttons: open, save, print, peak & chemical state analysis, instrument setup, bar chart, spectrum setup, start, stop, peak fit, spectrum & energy range parameters



Intuitively designed XPS database table with sensitivity factors for elements & chemical states.



To assist spectrum acquisition, two tables of energy range parameters and peak fitting parameters are available form the main sheet.



Software controlled instrument set up covering lens zooms , imaging modes, analyzer parameters, gain & offsets of HV modules etc.

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AXPS 2000
Combined Analysis in One Module

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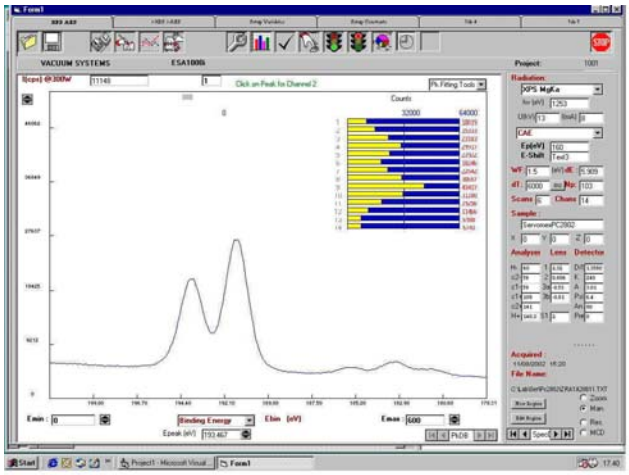
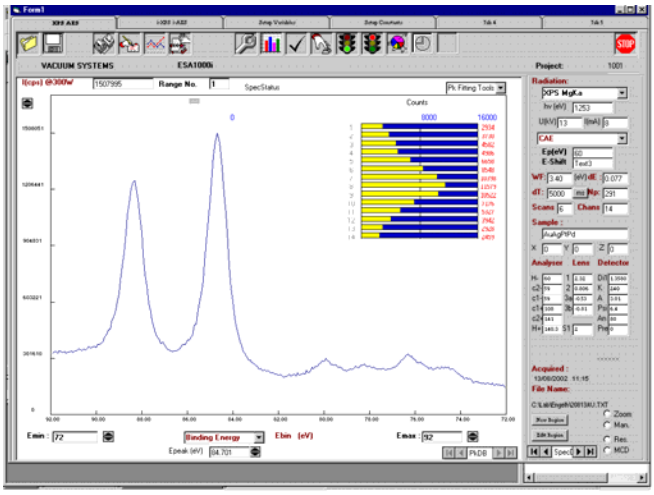
Comprehensive analysis by combining XPS spectra , XPS snap-shots and XPS imaging in one instrument .

UPS/XPS AES snap shots



XPS snap shots are available in the form of a bar chart and can be combined intuitively with the XPS spectrum. A simple click on the spectrum chart adjusts the spectrometer and displays the bar chart snap shot at that energy setting. This example shows a profile of the Zr 3d5 peak with 14 channels.



XPS snap-shot intensity profile of Au 4f7 peak

ARXPS application: non-destructive thickness measurement of surface layers

The input lens systems , the analyzer and the detector area are designed to image at solid angles (+- 25 degrees standard, 30 degrees optional) that enable angle resolved ARXPS without tilting the sample.

Image acquisition

One of the requirements of a modern XPS system is to combine chemical maps with XPS spectrum acquisition

Advanced image acquisition is integrated within the same package as spectrum software with easy access to both methods.

One click can set the analyzer to any of the required XPS line peak energy retrieved from the 32000 data long database of chemical substances and their XPS and AES lines.

The output data form is compatible with the third party software for easy data base access, report generation or image processing and manipulation.

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MCD 128 II
High resolution and high count rate detector system for electron and ion spectroscopy

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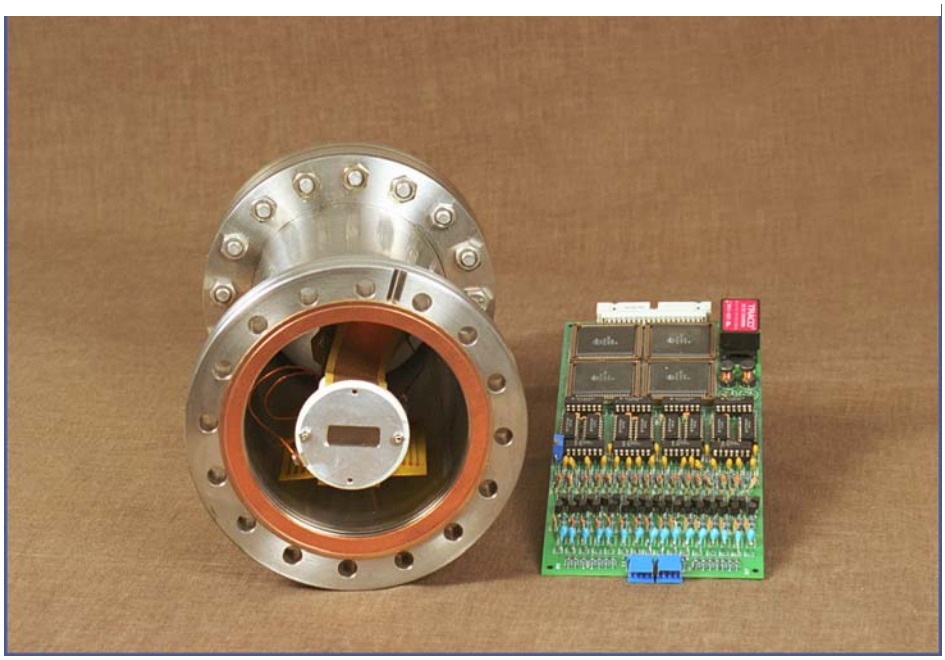
MCD 128 II brings a real improvement to particle spectrometer count rate and resolution.

Its innovative mechanical design makes it adaptable to any analyser geometry to bring the optimum performance.

Its imaginative patented data read-out concept based on the latest CPLD technology

- extends number of channels
- makes the detector compact,
- flexible and compatible to many data system standards for expansion in future



Detector System MCD 128 II

MCD 128 II is the result of several years of development collaboration between Space Research Daresbury Synchrotron Research facilities and VSL

A large number of channels available at this detector ensures that the energy resolution is never compromised by the width of the detector channels. This ensures a greater flexibility of operation as different techniques of analysis require frequent adjustment of analyzer input slit width now the only determinant of the energy resolution.

The output area does not mechanically change and is fully utilized by the whole detector for spectrum acquisition.

The present detector technology makes it possible to design channels of any shapes and sizes and expand number of channels further to utilize area behind the analyzer fully for data acquisition by different new techniques.

The latest **CPLD technology** ensures a greater detector flexibility so that a number different analyzer types can use this detector design. VS also markets it as a stand-alone component.

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MCD 128 II
High resolution and high count rate detector system for electron and ion spectroscopy

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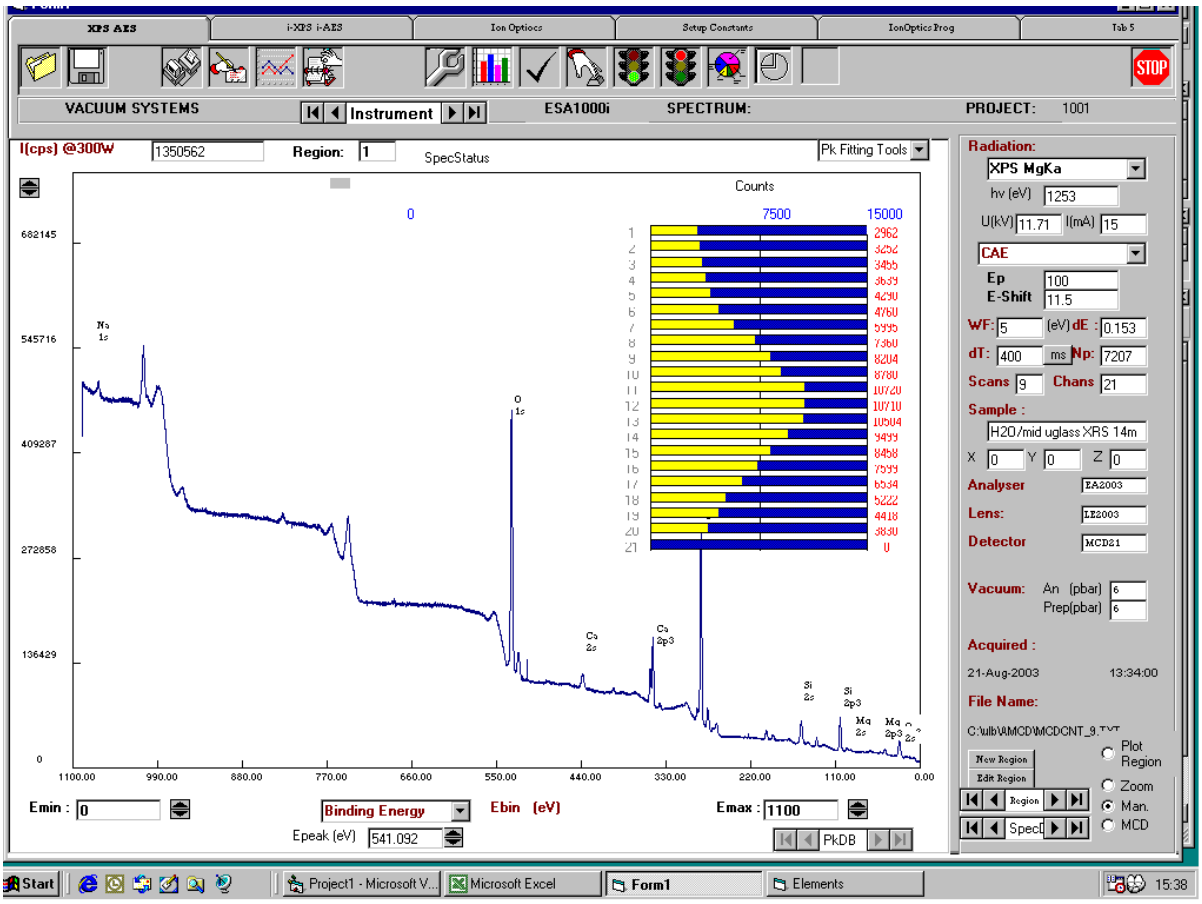
Detector System
MCD36

The position sensitive detector consists of 36 channels placed at the output of the analyzer for the spectrum acquisition.
The large number of channels available at this detector ensures that the energy resolution is never compromised by the width of the detector channels. This ensures a greater flexibility of operation as different techniques of analysis require frequent adjustment of analyzer input slit width now the only determinant of the energy resolution.
The output area does not mechanically change and is fully utilized by the whole detector for spectrum acquisition.



An XPS spectrum of water contaminants on glass . Spectrum acquisition sheet with real time snapshot of detector channel outputs as O1s peak is passing through the detector Number of MCD channels is 20, Instrument used is ESA1000i

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LM Series
Advanced High Voltage Technology

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A considerable effort has been invested into a new technology of the resonance mode power supplies that gives low ripple high response time and high accuracy and stability.

Computer Controlled Power Supply

Two sets of 5 computer controlled modules of bipolar power supplies .Modules built in the latest resonance-mode technology

3 gain ranges computer adjustable

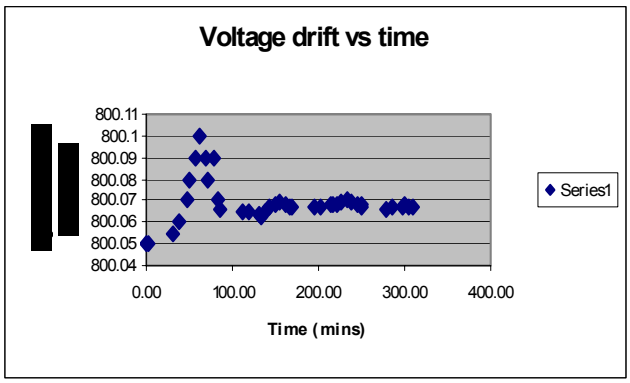
- UPS/ELS 0-150 eV
- XPS standard 0-1500eV
- XPS extended energy 0-2500eV.

All essential functions such as CRR,CAE value Emin ,Emax , step size, step time etc. are computer controlled

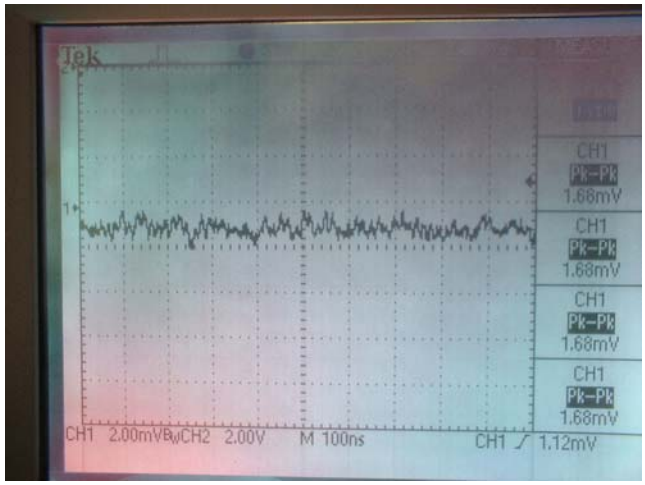
For all modules there is an accurate and continuous computer monitoring and control of gain, offset and calibration values to within +-1 LSB in 16 bits.

Accurate readouts for voltage and current outputs ensure remote diagnostics and servicing.

Units are modular and each module separately computer controlled via opto-coupled links.



A record of the spectrometer voltage drift over 5 hours of measurement period.



Storage scope record of the ripple at the output of the spectrometer energy module.

System Power supplies		Lens modules	Analyser modules
Accuracy/min. step	(bits)	16	16
Ripple UPS mode	(mV)	10	0.5
Ripple XPS mode	(mV)	20	5
Stability XPS mode	(mV/5hours)	100	10

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Specifications

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aESA 126i Analyser	
Analytical techniques	**XPS, AES, SAM, UPS, ISS**
Type	An aspherical analyser of proprietary design with variable slits
Mean radius (diameter)	126mm
CE Conformity	Meets Electromagnetic Compatibility Directive 89/336/EEC and Low
Detector	Multi channel detector with 20, 40 & 60 channels
Magnetic shielding & vacuum envelope	Vacuum envelope constructed from mu-metal to reduce outgassing in vacuum
Analyser operating modes	CAE (constant analyser energy) CRR (constant retard ratio)
Energy range	0-2500eV
Pass energy range	0-300eV
Retard ratio values	Continuous
Minimum step size under computer control	+- 1 LSB of the full scale
Analyser ultimate resolution	8 meV
Analyser machining tolerance	To 0.005 mm (0.0002")
Mounting flange size	C150 mm (6") o.diamater
Recommended working distance	30 mm. Longer distances easily accommodated by simple lens control potentiometer adjustment.
Slit mechanism operation	Single rotary drive
Spectrometer control unit ripple level	As specified
Spectrometer control unit output voltage drift	+/-LSD of 16 bit on FSD; over 5 hours after 1 hour warm up
Bake-out Temperature	250 C

Performance

XPS large area	dE(eV)	I(cps)
MgKa Ag3d5 300W		
	0.854	2000000
	0.87	2500000
	1.00	5000000
Selected Area XPS		
MgKa Ag3d5 300W	dE(eV)	I(cps)
Sample dia 150um	0.81	50000
	0.99	200000
Sample dia 1000um	0.81	300000
	0.99	1500000
Imaging XPS	Resolution	
MgKa Ag3d5 300W	dX (um)	Pixel cps
dE=1.4eV	10	16
dE=2.0eV	2	1
Ultimate resolution by dE=3.0eV	**< 0.2 um**	0.1
UPS He I	dE(eV)	I(cps)
Ag val. Band 300K	0.14	20000000
AES	dE/E	I(cps)
Cu 920eV 20nA/5kV	0.50%	2000000
Analyser Ultimate Energy Resolution	2 meV	For Ekin=100eV

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Product Range

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Products

VS MicroAnalysis particular strength is to provide maximum performance and analyzer technical advance for minimum costs to the customer.

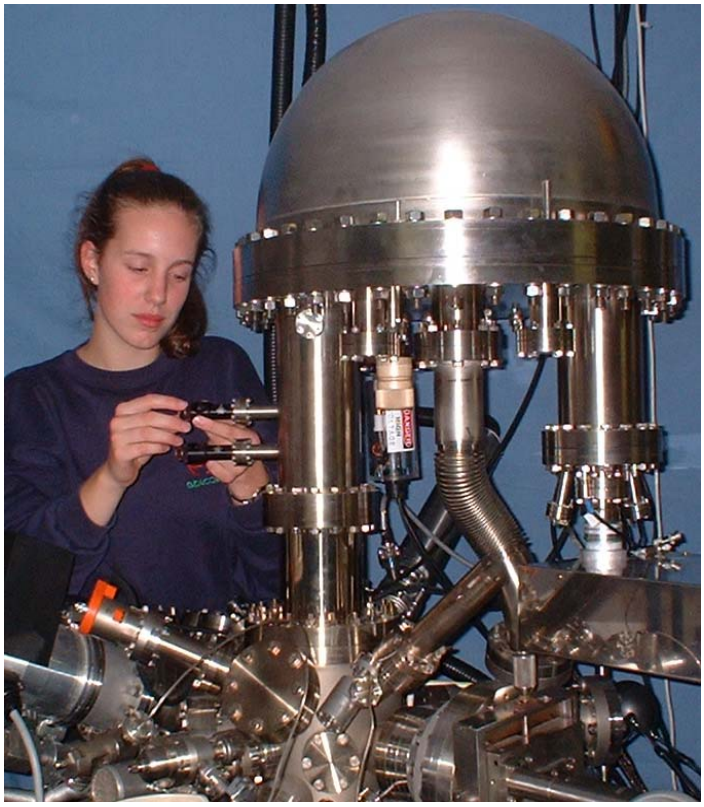
VS concentrates on components for surface analysis maximizing performance in their key features such as electron or ion focusing quality.

A special care has been taken on the multi-technique capability of the instruments in which all techniques of surface analysis including photoemission spectroscopy as well as imaging electron and ion microscopy have the same analysis conditions for quantitative analysis.

Apart from the big research grade analysers VS introduced a portable low cost but high performance surface analysis station for a routine laboratory work. This would be useful to a field engineer , who needs to analyze samples in a harsh environment of the real

Ordering Information

ESA 126	Electron spectrometer with 40 channel output detector
A-ESA 126	Electron spectrometer with 40 channel output detector angle resolution lens
ESA 126i_04	Electron spectrometer with 60 channel output detector angle resolution lens, Imaging facility
MCD 60	60-channel detector
CCD XM	Imaging detector system with soft ware



This picture shows a top of the range research instrument for surface analysis manufactired by VS MicroAnalysis.

It is a combination of XPS AES ISS and UPS spectrometer, imaging electron microscope to 1um resolution and an angle resolved XPS Its 190mm energy analyser and its 60 channel MCD gives unprecedented energy resolution for XPS. Focus contrast for microscopy, the analysis field of view or analyzer input conditions can be simply and accurately set for routine measurements by a student.

VSL run laboratory sample services for industry and schools.

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