Emma

XRD

Multi-Materials Analyser
X-ray Powder Diffractometer

XRD

GBC

ISO 9001
Quality Accreditation

GBC has always placed a strong emphasis on quality in all aspects of our operation, from design and manufacture to the provision of service and support to our customers, and we are fully committed to continuous evaluation and improvement in all areas.

The GBC Quality Management System has been accredited to the ISO 9001 quality standard by Lloyd's Register Quality Assurance Limited. This certification is your assurance that the procedures and processes used to produce the goods and services which GBC provides comply with the relevant International Standard, and demonstrates commitment to meeting the needs and expectations of our customers.

Since 1978 GBC has been at the forefront of scientific technological development, manufacturing and marketing a wide range of award winning, quality scientific instruments.

GBC's Product lines

Visionary Technology

GBC Scientific Equipment will advance people's knowledge and their capacity to enhance the quality of life for all humankind.

GBC

Enhanced X-ray Powder Diffractometer

The Enhanced Multi-Materials Analyser with Maxi-Capabilities

Available in Theta-2Theta geometry or in Theta-Theta geometry.

Keeps a constant irradiated area with motor-driven auto slits, available as an option.

Communicates directly via Ethernet TCP/IP over a managed network or direct connection to PC. Emma supports either fixed IP address or DHCP.

Supports a wide variety of sample sizes.

The multi-disciplinary capabilities and affordability of Emma makes it the perfect choice for many industries.

Available as floor standing model with base cabinet and also as benchtop model.

For Materials Research – its range of optics, stages and detectors, with their interchangeability makes it a better instrument for material research. The wealth of software available through the "Open Software" policy make it an obsolescence proof investment.

For Mining and Geology – its portability and integration with the latest ICDD® databases and compatibilty with quantitative analysis with the renowned SIROQUANT® package, make it a productive tool.

For Process Control – its simplicity of operation and stability means reproducible data. Its autoloader and sensitivity for minor phases extends its analytical range. For example, it can be used in Cement Clinker analysis, Pharmaceutical Research and Industrial Minerals.

For Metallurgy – its slim-profile Eulerian Cradle means Chi-offset Residual Stress measurements can be made at extreme back reflection angles. This feature together with the flexibility of Pole Figure data collection in many different formats and the "Open Software" availability of advanced Texture Analysis capability means it is an ideal research tool.

For Thin Film Analysis – its choice of optics, precision-adjustable sample holder and detector configuration, means it can be used for Glancing Incidence scans.

Emma is also suitable for:

Pigments and Dyestuffs – identification
Forensics – Crime scene evidence
Archaeology – analysis and correlation of artifacts
Conservation – authentication of works of art
Environment – Contaminant dispersal and mitigation work
Soil Science – Clay Mineralogy
Semiconductors – Alloys, Thin Films, packaging
Nano-materials – particulate size, alloying

Geometries

Components for Best Results

The Emma in basic configuration offers a complete package, and will perform superbly for routine powder scanning. For more advanced or specialised applications, there is a wide range of options and accessories.

Slit Optics (Standard)

The basic divergence optic is the slit optic. It includes divergence slits for 1°, 2° and 3° divergence, and the primary beam Soller slit. The very narrow receiving slits can be fitted for special applications.

Polycapillary Optics

The optional monolithic optic "X-ray Lens" from XOS®. This monolithic optic is ideal for off-axis specimen alignment applications such as Texture and Residual Stress. The 6 mm dia. beam is supplied as standard. The large (10 mm dia. beam) as shown is available as an option.

Planar X-ray Waveguide Resonator

A unique optic for large d-spacings and less ordered materials. It produces a thin beam from a narrow gap between optically flat plates, resulting in excellent efficiency for less ordered materials.

Choice of Optics

All optics are pre-aligned and interchangeable on the Dovetail slide without realignment.

Interchangeability

Choice of Detectors and Optics

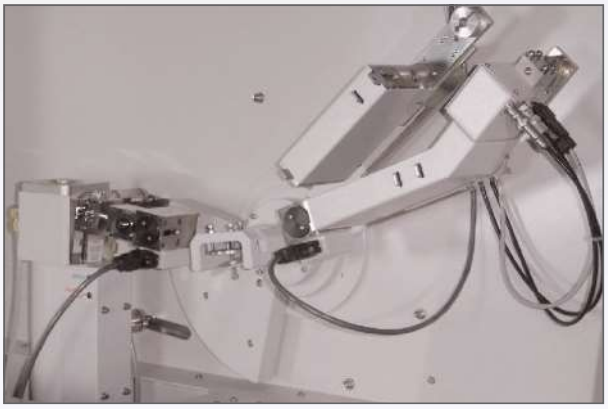
Xe Proportional Detector Graphite Monochromator

Available in Cu or Co monochromators. (The Cu monochromator is standard with the basic Emma package. Both monochromators utilise a special Xe proportional detector tube and low-noise preamp (linear to >90000 cps). A receiving slit, secondary Soller slit and scatter slit all work together to improve the resolution and shape of the measured peaks.

Parallel Beam or Thin Film Detector

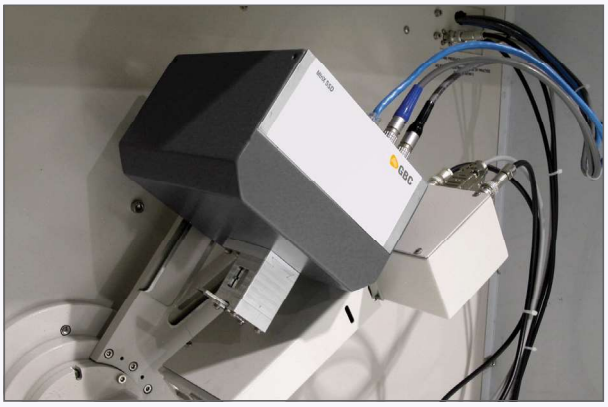
This includes a long Soller slit collimator of 0.4° acceptance angle, and an Xe proportional detector with a large window detector tube.

This is essential for parallel beam use, as the Bragg angle is defined by the Soller collimator. It is used with the Polycapillary Optic.



Dual or Bifurcated Arm

Uniquely allows both focussing and parallel beam detectors and optics to be permanently mounted. Changeover between them is simply done in software.



MtriX Multi-strip Solid State Detector

High speed multi-strip solid state detector for rapid scans with high intensity and resolution.

The detector has 96 channels with a pitch of 120 µm subtending 0.06° at 200 mm radius.

With a maximum count rate of 5 x 10^6 per strip it supports scan speeds up to 120°/minute over an energy range from 4.5 to 17 keV with an energy resolution better than 10%.

Flexibility

Choice of Stages

Standard Stage

The standard stage takes the standard 2 inch diameter sample holders, which are spring loaded against height setting pegs precisely adjusted to the goniometer axis.

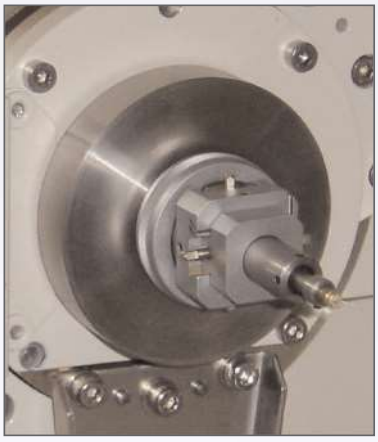
Long Sample Stage

This stage can also be used for bulk sample applications and can take ingots up to 52 mm diameter and 100 mm long.

Spinning Stage

A variation on the standard stage; it holds the sample holders up against small ball-bearing rollers which are precisely adjusted to height.

Spinning reduces preferred orientation effects, and is stepper motor driven.

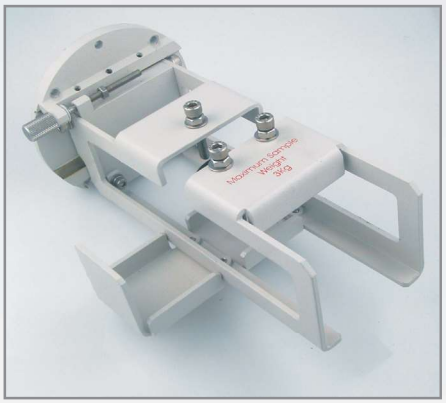


Capillary Spinning Stage

Used with parallel beam detector and optic. Allows data collection in Debye-Scherrer geometry in sealed capillaries or to minimise preferred orientation.

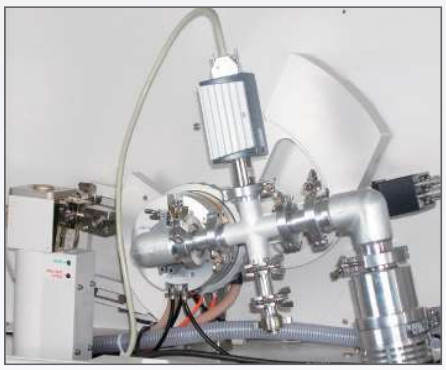
Versatility

Choice of Stages



Large Sample Stage

This stage is for bulk samples and can take large samples up to 150 mm diameter x 20 mm thick. Translation and rotation allows access to the whole surface.

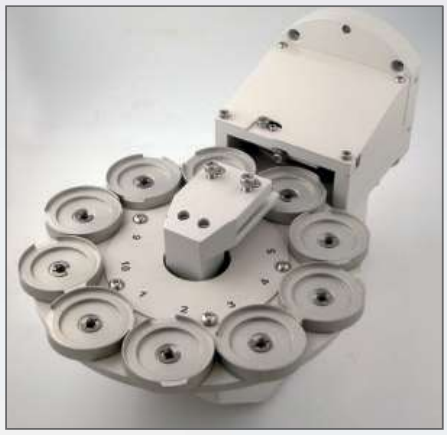


PAAR HTK-16 High Temperature Stage

Allows setting of temperatures up to 1600°C in Vacuum with precise and rapid temperature setting. Software allows setting up of an automated temperature ramping and repeat scan sequence.

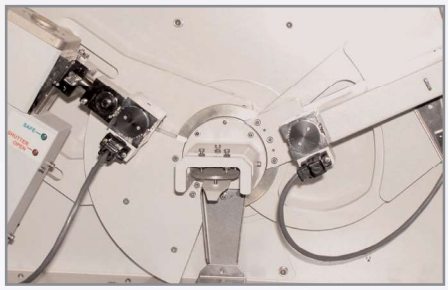
PAAR TTK-450 Low Temperature Stage

Also available is the PAAR TTK-450 Low Temperature stage, with air jet cooling, which allows temperature setting from -10°C to +450°C without cryogenics.



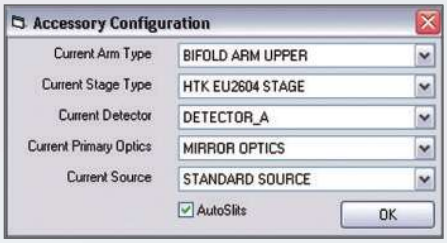
Auto Loader

The 10 sample Auto Loader includes the option to spin in the analysis position. Random access to any position makes it convenient for permanent mounting and/or use for single samples.



Auto Slits

Stepping motor driven auto slits mount in the divergence and matching scatter slit positions to give constant irradiated area on the sample. They open and close with Theta angle.



Accessory Picker

Allows rapid interchange between hardware accessories by calling up their individual calibrations.

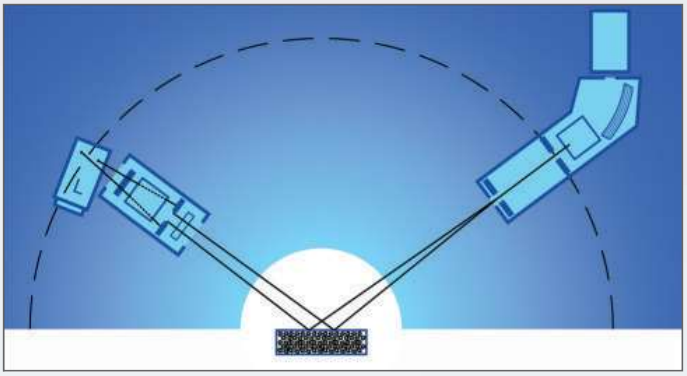
Eulerian Cradle

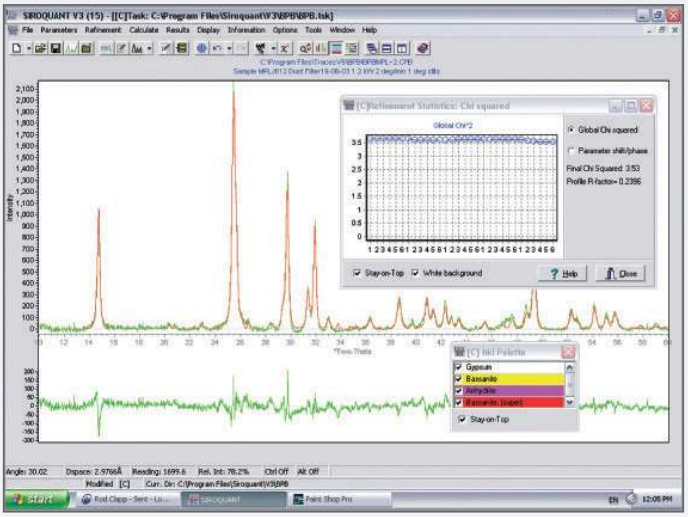
Essential for Pole Figure data collection and preferable for Residual Stress work. It has a slim cross section, so has minimum obscuration of the detector and maximum available angle.

Practicality

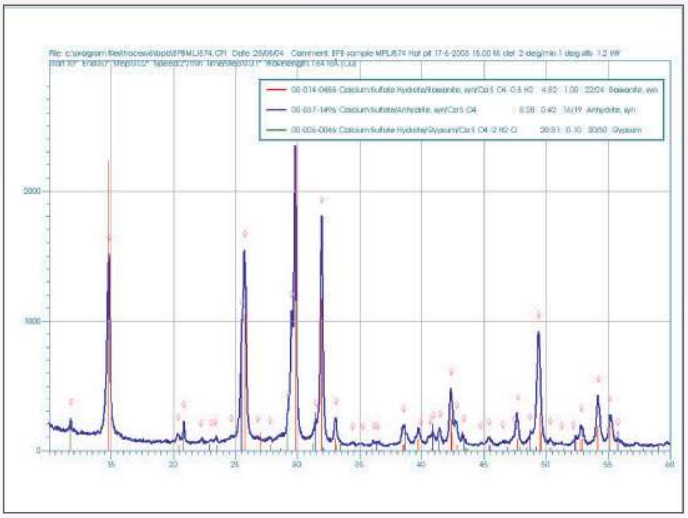
Qualitative and Quantitative Analysis Application

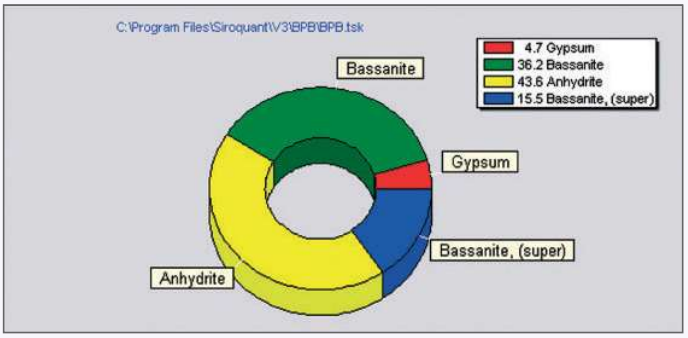
Qualitative and Quantitative analysis with the Bragg-Brentano focussing geometry, using a Xe detector with graphite monochromator, or a MtriX multi-strip solid state detector.





Search match for Qualitative ID of phases, using the DSearch option in Traces software, and either a PDF-2 or a PDF-4+ database from ICDD®.

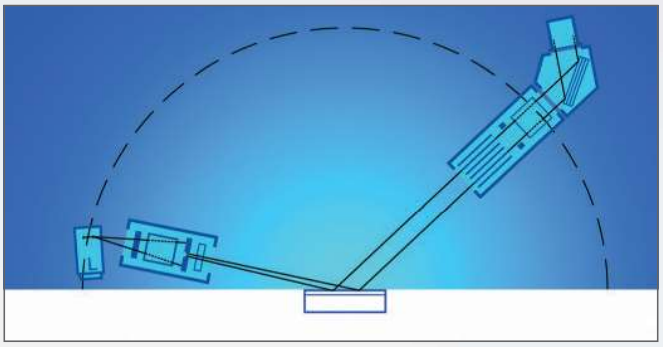




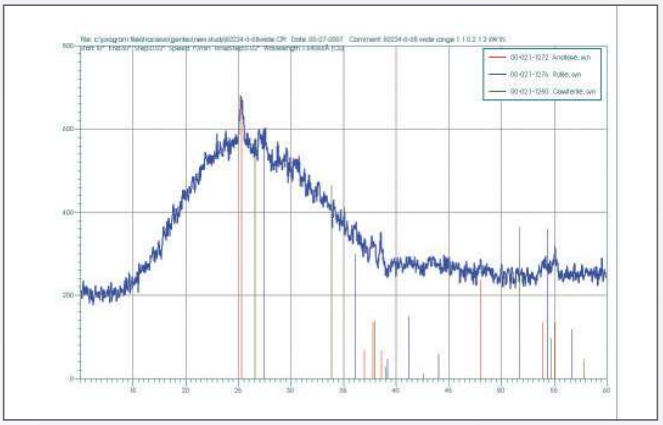
Quantitative Analysis using the Rietveld pattern synthesis quantitative software SIROQUANT®. This application is the analysis of Anhydrite production for Plaster Board manufacture, tracking the kiln dehydration of Gypsum, through Bassanite to Anyhdrite.

Sensitivity

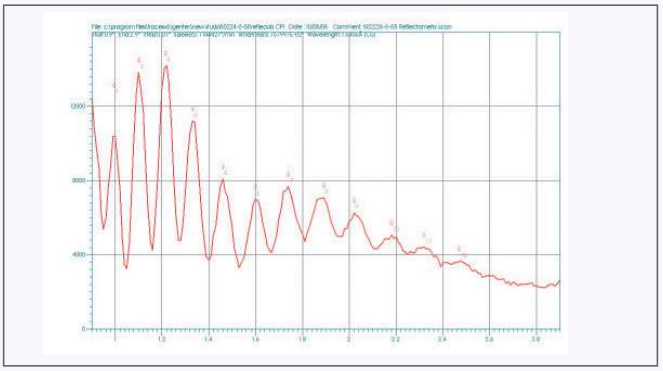
Thin Film Application



Fine slit optic with parallel beam detector



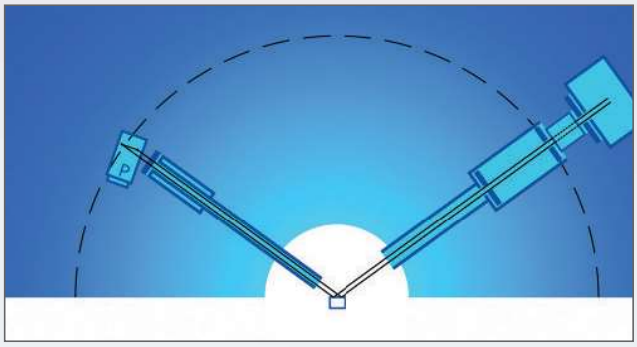
This example shows reflectivity fringes to determine film thickness and a wide range Bragg-Brentano scan to identify the phases in the thin films. These films were tri-layers on glass, with approximately 50 nm of SnO_2 on the glass, then approximately 200 nm of TiO_2, then approximately 5 nm of SiO_2 on top.



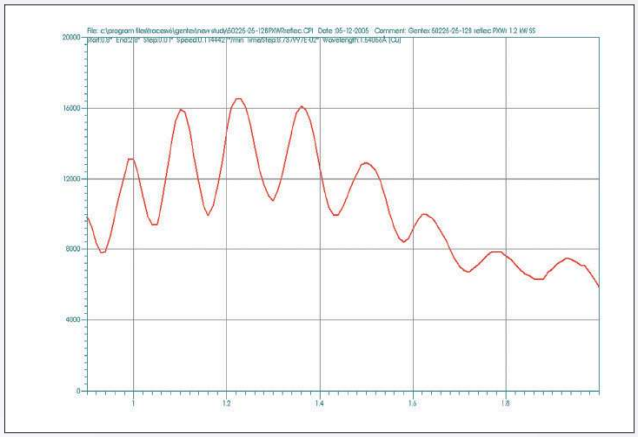
The reflectivity fringes show sets of superimposed periodicities corresponding to the multiple films.

Nano Structures

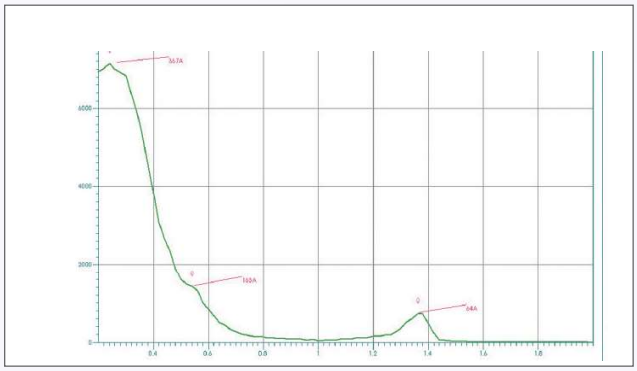
Analysis of Thin Disordered Films



The PXWR or Planar X-ray Waveguide Resonator is a unique primary beam optic which produces a very thin (100 nm high) nearly parallel beam with enhanced transmission intensity for very low angles (d-spacings up to 300Å) in less ordered structures.



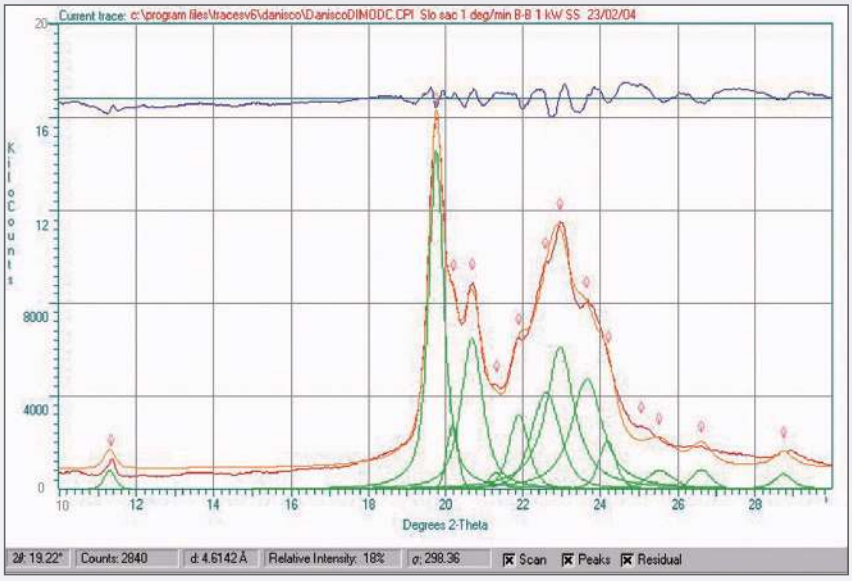
An example of reflectometry fringes obtained with the PXWR.



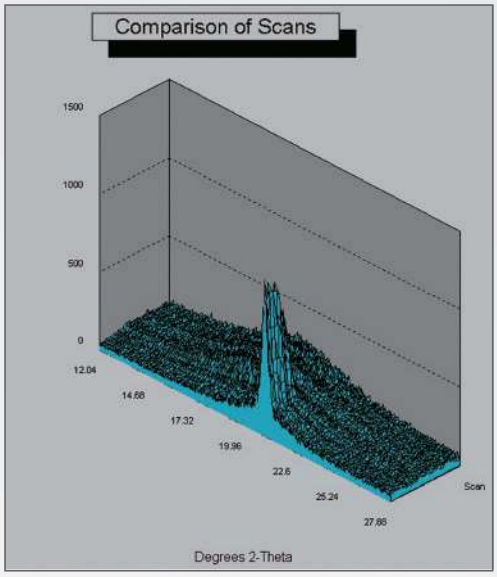
Scan starting from 0.2° 2θ on mesoporous SiO_2 showing periodicities up to 367 Angstroms.

Multi-Materials Analyser

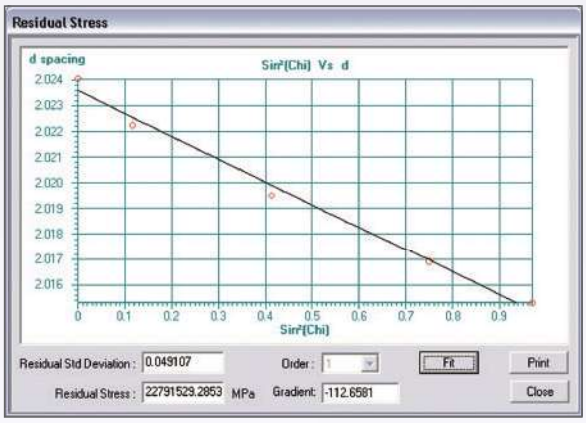
Software Applications

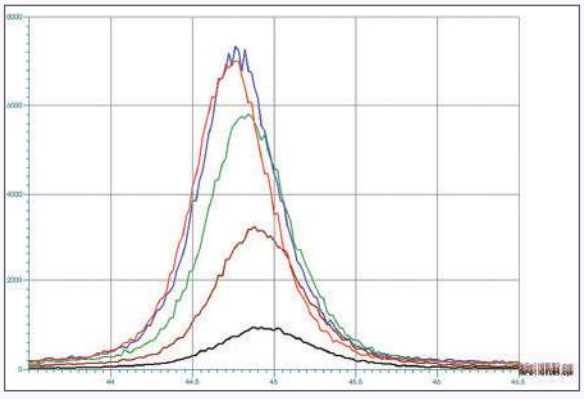


Peak Fitting and Deconvolution

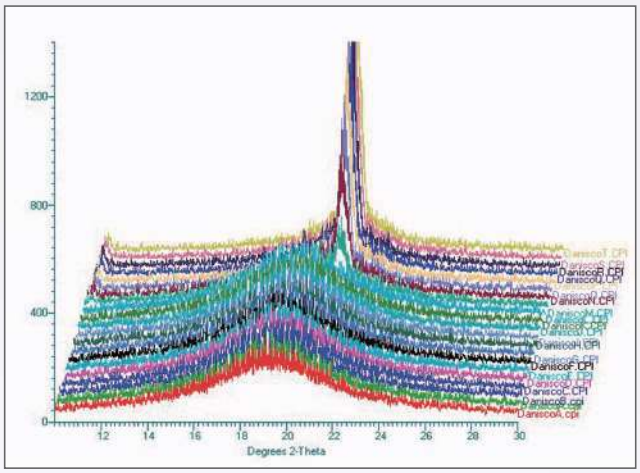


3D Visualization

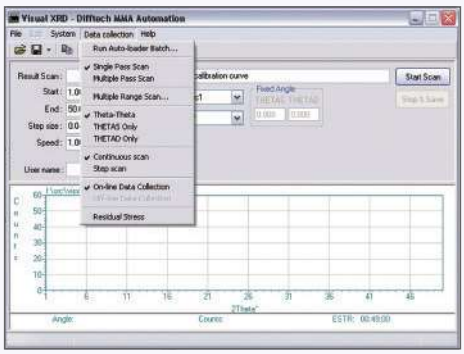




Residual Stress



Isometric Multi-Scan Display



Data Collection

Specifications

Hardware Specifications

X-ray Generator

Type

Medium Frequency, IGBT type, 3kW, 60 kV, 80 mA, stability 0.005% for10% change in supply voltage

X-ray Tubes

Type

Glass envelope

- Cu Long-Fine Focus (0.4 x 12 mm) standard
- Anodes Cu, Co, Cr, Fe
- Power 2.2 kW for Cu

Goniometer

Type

- Twin co-axial Harmonic gearbox
- Independent axes
- Minimum step size each axis 0.002°
- Reproducibility <0.0001°
- Zero backlash
- Radius 180–250 mm
- Maximum range –12 to +160° depending on configuration

Primary Beam Optics

Types

- Divergence slit assembly with Soller slit
- Auto slit with Soller slit
- Polycapillary optic for parallel beam
- PXWR X-ray waveguide resonator

Secondary Beam Optics

(Detectors and Optics)

Types

- Scatter slit to match divergence slit
- Auto scatter slit
- Parallel beam detector with long Soller
- Curved graphite monochromator

Detectors and Counting Electronics

Types

- Xe proportional detector for focussing geometry with Graphite monochromator
- Xe proportional detector for parallel beam geometry
- High speed multi-strip solid state detector, MtriX

Sample Stages

Types

- Standard stage for 53 mm dia. standard holders
- Spinning stage for 53 mm dia. sample holders
- Bulk sample stage, for 150 mm x 20 mm samples, max. weight 3 kg
- Bulk sample stage for 50 mm x 150 mm samples
- Capillary Spinner stage

Remote Diagnostics

Easy to install, user friendly software enables GBC to provide you with complete on-line remote instrument diagnostics and trouble shooting. The Emma has an IP address, so can be driven from anywhere on the internet, (firewalls etc. permitting).

Ancillaries

Closed Circuit Water Chiller

Dimensions

1100 mm wide x 750 mm depth x 1830 mm height

Weight approx. 225 kg

Packed weight approx. 400 kg

Electrical Requirements

220–240 V AC, 50/60 Hz, 20 Amps

An auto-transformer rated for 3 kW will be needed if only 110 V AC is available

Software Specifications

VisualXRD Software

- Simple routine operation
- File Save and recall Parameter sets
- Software configuration to set user Folder
- Hardware configuration for Tube Anode
- Accessory configuration to select interchangeable options
- Manual control for computer-aided alignment
- Pulse Height Analysis used with Xe proportional detector
- Data collection modes – Single, Multi Pass, Multi Range, θ/2θ, θ only, 2θ only
- Continuous, Step scan, Residual Stress, Texture (Texture requires VisTex software suite)

Tracesv6 Software Specifications

- Process scans from Emma and other manufacturers
- Tool buttons with tool tips and menus
- Zooming, scrolling and graphical peak labeling
- 16 million colours with graphical selection
- Work with up to 50 scans
- 3D Graphics – perspective, trend lines, etc
- Automatic and manual cubic background fit and strip
- Export scans in many formats
- Scan manipulation, add, subtract, trim, spike removal
- Smoothing, cubic, Kα2 stripping
- Peak area, with quantitation, Log scale, toggle on/off
- Peak FWHM determination, Particle Size by Scherrer method
- Search PDF-4+, PDF-1, PDF-2 and PDF-4+ line markers displayed
- Print preview mode 2D and 3D display
- Print PDF Cards from PDF-2 and PDF-4+
- Line widths, line-styles and fonts selectable
- Powder Pattern Generator
- Peak fitting and deconvolution – Least Squares or Genetic algorithm
- Full Windows HELP system and manual included
- All scan colours and PDF stick-figure colours preserved
- Common functions by right mouse button click
- Retained Austenite, with VisualXRD data collection
- Residual Stress, with VisualXRD data collection

Options

- DSearch Search/Match against PDF-1 extracted from PDF-2 or PDF-4+ Hanawalt Search with 1–9 strongest lines, Chemistry pre-screen
- INDEX Indexing of Powder Patterns by the methods of Appleman and Evans, US Dept of Commerce Geologic Div. Nat. Tech Service, 1972
- UnitCell – refinement of Unit Cell dimensions using the method of B. Rupp, ref. Scripta Metallurgica 22, 1 (1988)

PART NO.	DESCRIPTION
99-0501-00	GBC Emma, Theta/2 Theta version. Basic unit includes cabinet with shutter control, tube shield, divergence slit optics, fail-safe warning lamp, X-ray tube Cu as standard, goniometer, X-ray generator, Standard Stage, detector arm, software VisualXRD and Traces.
99-0501-01	GBC Emma, Theta/2 Theta version. Basic unit includes cabinet with shutter control, tube shield, divergence slit optics, fail-safe warning lamp, X-ray tube Cu as standard, goniometer, X-ray generator, Standard Stage, detector arm, software VisualXRD and Traces. Floor standing with base cabinet.
99-0550-00	GBC Emma, Theta/Theta version. Basic unit includes cabinet with shutter control, tube shield, divergence slit optics, fail-safe warning lamp, X-ray tube Cu as standard, goniometer, X-ray generator, Standard Stage, detector arm, software VisualXRD and Traces.
99-0550-01	GBC Emma, Theta/Theta version. Basic unit includes cabinet with shutter control, tube shield, divergence slit optics, fail-safe warning lamp, X-ray tube Cu as standard, goniometer, X-ray generator, Standard Stage, detector arm, software VisualXRD and Traces. Floor standing with base cabinet.
99-0693-00	GBC Emma, Theta/2 Theta with MtriX multi-strip solid state detector. Basic unit includes cabinet with shutter control, tube shield, divergence slit optics, fail-safe warning lamp, X-ray tube Cu as standard, goniometer, X-ray generator, Standard Stage, detector arm, software VisualXRD and Traces.
99-0693-01	GBC Emma, Theta/2 Theta with MtriX multi-strip solid state detector. Basic unit includes cabinet with shutter control, tube shield, divergence slit optics, fail-safe warning lamp, X-ray tube Cu as standard, goniometer, X-ray generator, Standard Stage, detector arm, software VisualXRD and Traces. Floor standing with base cabinet.
99-0692-00	GBC Emma, Theta/Theta with MtriX multi-strip solid state detector. Basic unit includes cabinet with shutter control, tube shield, divergence slit optics, fail-safe warning lamp, X-ray tube Cu as standard, goniometer, X-ray generator, Standard Stage, detector arm, software VisualXRD and Traces.
99-0692-01	GBC Emma, Theta/Theta with MtriX multi-strip solid state detector. Basic unit includes cabinet with shutter control, tube shield, divergence slit optics, fail-safe warning lamp, X-ray tube Cu as standard, goniometer, X-ray generator, Standard Stage, detector arm, software VisualXRD and Traces. Floor standing with base cabinet.
95-0707-00	MtriX multi-strip solid state detector.
95-0655-00	Xe Proportional detector for Cu with graphite monochromator, built-in counting electronics and cable set.
97-2473-00	Xe Proportional detector for Co with graphite monochromator, built-in counting electronics and cable set.
95-0658-00	Parallel beam Xe proportional detector with large window tube, long Soller slit collimator, Ni or Fe filter, built-in counting electronics, mounting arm and cable set.
56-1040-00	Bifurcated arm, 22° angle, for simultaneous mounting of 2 detectors.
97-2500-00	Xe proportional detector only. Small window, includes preamp and cable set.

PART NO.	DESCRIPTION
99-0504-00	Auto loader stage includes 10x sample holders, electronics and cable set.
99-0534-00	Spinning stage for single samples, step motor driven, includes motor driver.
95-0660-00	Large Sample Stage. Accommodates discs up to 150 mm dia. x 20 mm thick, locate any point for analysis in the beam by rotation and translation.
95-0661-00	Long Sample Stage. Accommodates ingots up to 52 mm dia. x 100 mm thick.
95-0664-00	Capillary sample holder with XYZ crystal head and alignment microscope.
97-2474-00	Polycapillary optics, 6 mm diameter (10 mm diameter on request), recommended for texture. Includes X-Y mounting. Must be used with a parallel beam detector.
97-3808-00	Parallel beam mirror, Ni/C, suppresses Cu K β . Includes tube-shield mounting and tube shield angle offset bracket. Can be used with parallel beam detector or dual fine slits.
97-3765-00	PXWR Optic. Includes mounting and alignment. Can be used with a parallel beam detector or dual fine slits.
96-0101-00	Water Recirculator, 220V/50 Hz.
96-0101-01	Water Recirculator, 115V/60 Hz.
99-0510-00	Emma cabinet on castors.
95-0666-00	Autoslits available for divergence and scatter positions.
31-0279-00	Software ICDD PDF-4 Minerals Subfile – Commercial (1 year license).
31-0279-01	Software ICDD PDF-4 Minerals Subfile – Academic (1 year license).
31-0277-00	Software ICDD PDF-4+ Commercial (1 year license).
31-0277-01	Software ICDD PDF-4+ Academic (1 year license).
31-0280-00	Software ICDD PDF-2 Commercial (5 year license).
31-0280-01	Software ICDD PDF-2 Academic (5 year license).

Designed and manufactured by GBC Scientific Equipment Pty Ltd
A.C.N. 005 472 686
GBC reserves the right to change specifications without prior notice
GBC publication number
01-0924-03 October 2016

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Manufacturer of world-class scientific instruments and accessories
— AAS, HPLC, ICP-OES, ICP-TOFMS, Rheometry, UV-Vis and XRD

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