NEW

ITAL STRUCTURES

HRD 3000 HIGH RESOLUTION X - RAY DIFFRACTOMETER

SOLUTIONS FOR YOUR ANALYTICAL PROBLEMS
SINCE 1966

High-performance materials characterisation...
Seven motorised degrees of freedom...

HRD 3000 HIGH RESOLUTION X - RAY DIFFRACTOMETER

The new dimension in X-ray diffraction

Since its founding in 1966, Ital Structures has developed and applied innovative technologies to X-ray diffraction.

Ital Structures offers the advantages of quality, reliability and technical support by experienced factory trained engineers.

The system of safety interlocks ensures the safe operation of the equipment at all times and will not allow X-rays to be emitted unless the safety shielding is closed. Scattered radiation is contained by transparent PVC.

The HRD 3000 high resolution diffraction system incorporates the most advanced digital electronics, computers and Microsoft's Windows NT/2000/ME operating system. Exact angular positions of the goniometer circles are guaranteed by a well-devised combination of stepping motors and optical encoders. The goniometer circles are positioned at high speed.

The HRD 3000 diffractometer system can be used on a wide range of analytical problems, from texture to thin film analysis, strain measurements and reflectometry.

With this high performance, high resolution diffractometer, you can obtain outstanding results with amazing ease, when determining layer thickness and composition in semiconductors. The high resolution reflectometry studies can be performed with the HRD 3000 to characterise layer thickness, density, surface and interface roughness.

Seven independent degrees of freedom of movement allow every possible sample position.

The high efficiency of the various components permits analytical results of high quality.

Different kind of source and optical components, several detectors and special attachments can be added to meet all your requirements. You have the choice of a large number easily mounted components. For more information on our system, attachments, and custom design accessories, contact us directly.

Powerful, user-friendly software makes measurement easier than ever and includes many sophisticated features to aid in the interpretation of the results.

HRD 3000 HIGH RESOLUTION X - RAY DIFFRACTOMETER

The latest diffraction system manufactured by Ital Structures for material research and development

Features

- Ultra stable X-ray generator with an on board microprocessor controlled via a PC serial port.
- High brilliance glass and ceramic X-ray tubes, quickly rotatable between line and point focus positions.
- X-Y and rotatable stage for the tube shield.
- Parallel-beam optics using a Göbel mirror.
- Big Eulerian cradle open chi-circle to align the sample in space.
- High, fast precision goniometer positioning by stepping motors with optical encoders.
- Seven degrees of freedom, all motorised.
- Motorised sample holder of large dimensions with X-Y-Z translation, 150 mm in X and Y, 25 mm in Z to accommodate wafers of 200 mm or other types of sample.
- Secondary monochromator for Cr, Fe, Co, Cu and Mo radiations.
- High mechanical stability of the goniometer supported by a granite table.
- Xenon gas-filled proportional, scintillation counters, solid state, linear and curved position-sensitive detectors for either low background or high intensity.
- Microsoft's Windows NT/2000/ME operating system in a 32-bit environment for instrument control, acquisition and elaboration of data.

Included in the standard configuration

Tools for optical alignment

X-ray tube rotatable between line and point focus

Motorised sample holder X-Y-Z translation

X-Y and rotatable stage for tube shield

Main Specifications

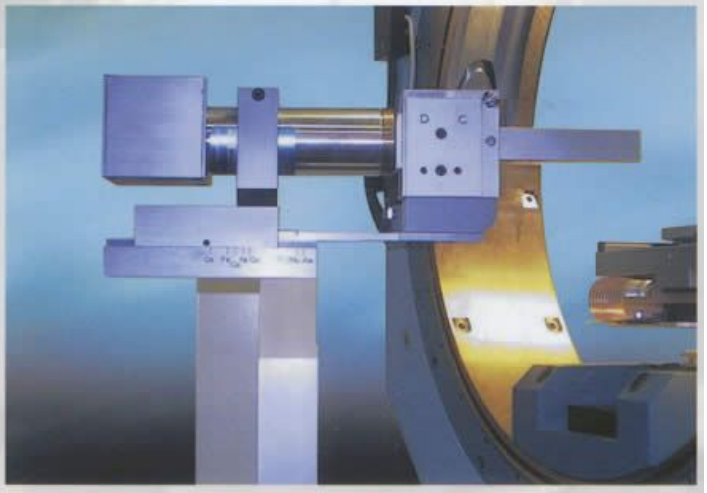
HRD 3000 Diffractometer - Standard configuration

X-ray generator (PC controlled)	Maximum output power	3 kW
	Output stability	< 0.01% (for 10% power supply fluctuation)
	Max. output voltage	60 kV
	Max. output current	60mA
	Voltage step width	0.1 kV
	Current step width	0.1 mA
	PC control serial mode	X-ray ON/OFF, settings of kV and mA, shutters
	Safety devices	Door interlock mechanism, emergency push button; X-ray ON lamp
	Weight	45 kg
	Size	Width 48.3 cm, height 22 cm, depth 63 cm
X-ray tube	Type: rotatable (line and point focus)	Glass, Cu anode, fine focus
	Focus	0.4 x 8 mm
	Max. output	1.5 kW
Tube shield	Type	X-Y and rotatable stage
Goniometer	Type	Indipendent theta/2 theta horizontal
	Variable scanning radius	175 - 220 mm
	Horizontal scanning angular range	- 110 < 2 theta < + 165°
	Smallest selectable stepsize	0.001° (2 theta)
	Angular reproducibility	± 0.001° (2 theta)
	Scanning speed	0.05° - 50°/min
	Divergence slits	4°; 2°; 1°; 1/2°; 1/4°
	Anti-divergence slits	4°; 2°; 1°; 1/2°; 1/4°
	Receiving slits	0,3; 0,2; 0,1 mm
	Soller slits	2°; 5°
Eulerian cradle	Type: big open Chi-circle	-3° ≤ Chi ≤ + 158°; - ∞ < Phi < + ∞ ; -75 mm ≤ X, Y ≤ + 75 mm; -1 mm ≤ Z ≤ +24 mm
	Inner diameter	400 mm
Detector	Type	Scintillation counter NaI
	Countrate	500.000 c/s
	HV/PHA	High voltage supply 600 - 2000 V, gain, low, central and high level control
Case	Dimensions	Width 1190 mm, heigh 1777 mm, depth 800 mm
	X-ray leakage	< 1 mSv / Year
Alignment kit	Type	Adjustment microscope and tools
Processing Unit	Computer type	Personal Computer, the latest version
	Items controlled	X-ray generator, goniometer, detector, counting chain
	Basic data processing	Qualitative and quantitative phase analysis. Rietveld analysis, crystalline structural analysis, crystallite size and lattice strain, crystallinity calculation, texture, strain, reflectometry. Pattern simulation, ODF calculated with different methods.

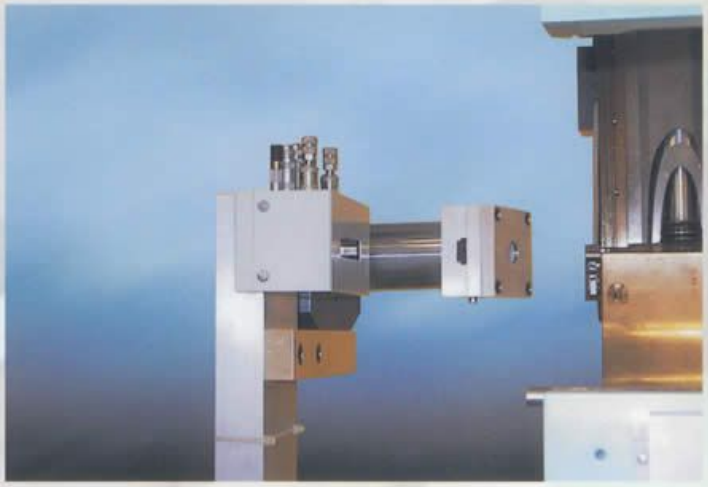
Flexibility and modularity

Along with our basic system, many accessories, including those shown below, are available as optional extras.

Parallel-beam monochromator using a Göbel mirror



Secondary monochromator for Cr, Fe, Co, Cu and Mo radiations



PSD and scintillation detectors on the same support

Curved Positions Sensitive 120° detector

HRD 3000 HIGH RESOLUTION X - RAY DIFFRACTOMETER

Installation Requirements

ELECTRICAL SYSTEM

Power connection	230V single phase ±10%, 50 - 60 Hz
Maximum mains current	40 A
Main fuse	32 A
Maximum power consumption	5.5 kW
Ground terminal	6 mm²

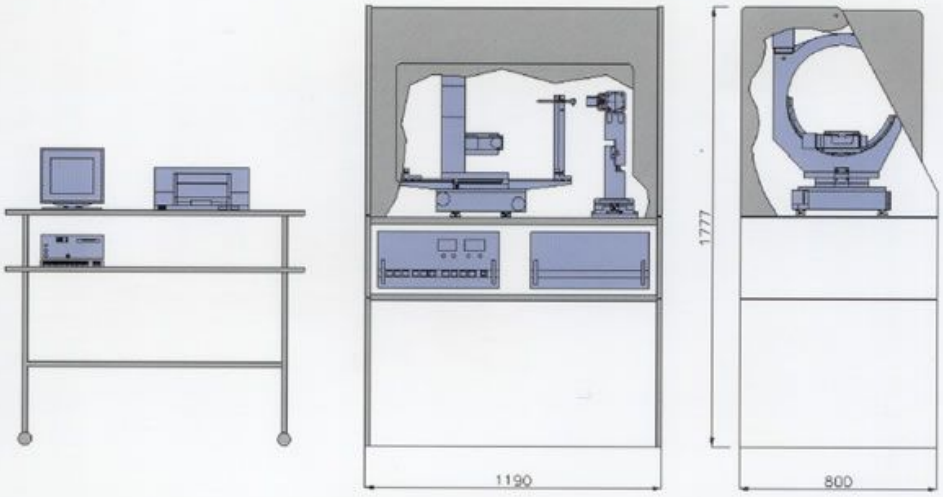
Power supply voltage fluctuation must not exceed 10%

COOLING WATER

Minimum flow rate	4 l/min
Maximum pressure	6 bars
Maximum inlet temperature	35° C (minimum depends on dew point)

If the flow rate is lower than 4 l/min, the safety circuit for protection of the X-ray tube is activated, disabling the X-ray generating circuit. When minimum conditions of flow-rate cannot be fulfilled, use the water chiller, available as an optional extra.

EXTERNAL DIMENSIONS



Total Weight: 560 Kg

Local Agent

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ATTACHMENTS FOR HRD 3000 DIFFRACTOMETER

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Detectors

Scintillation NaI counter and xenon gas filled proportional counter

Scintillation NaI and xenon gas filled proportional counters are our standard detectors.

Scintillation Counter

Linear position sensitive proportional counter

Designed for simultaneous data collection, allows to reduce the recording time by a factor of 100 to1000. It can measure the intensity distribution of a region of 10° or more with good spatial resolution. This detector is ideally suited for phase transformation studies as a function of temperature and stress analysis.
The counter (Ar/CH4 or Xe/CH4 90:10) operates under a pressure of 7.5 bar.
The detector incorporates 2 charge-sensitive preamplifiers.
As option the detector can be run on different gases depending on the customer's application.

Main specifications:	
Window length	50 mm
Window height	10 mm
Spatial resolution	< 60 µm
Quantum efficiency CuKa (argon-methane)	50 %
Quantum efficiency CuKa (xenon-methane)	90 %

It is possible to optimal quantum efficiency, spatial resolution and energy resolution by proper choice of the operating parameters, gas, pressure and high voltage.

Linear position sensitive proportional counter

ATTACHMENTS FOR HRD 3000 DIFFRACTOMETER

Curved position sensitive proportional counters

The CPS 120 and 590 have, as their main characteristics, the simultaneous detection of diffracted X-rays over a range of 120 and 90 degrees. The anode construction perform position analysis by applying high bias voltage and causing electron avalanche, which gives an excellent signal to noise ratio. The Curved Position Sensitive Proportional Counters can be used for a variety of applications: powder, pole figure, stress, kinetic studies etc.

Main specifications:	
CPS 120	CPS 590
Focusing radius: 250 mm	Focusing radius: 500 mm
Window height: 8 mm	Window height: 8 mm
Measuring angle range: 120° (2 theta)	Measuring angle range: 90° (2 theta)
Angular resolution: 0.03° (2 theta)	Angular resolution: 0.02° (2 theta)
Gas: Argon/Ethane high purity	Gas: Argon/Ethane high purity
Gas pressure: 5.5 bars/gas flow	Gas pressure: 5.5 bars/gas flow
Integral non-linearity: ± 1%	Integral non-linearity: ± 1%

CPS 120

CPS 590

Principle of the curved detector

The principle is similar to that of a linear detector. Near the curved anode (within a radius of a few tenths of a micron) an intense electric field is applied. To maximize mechanical stability, the anode was designed as a very thin curved blade (object of patent). The X photons ionize the gas in the detector. The electrons are immediately accelerated, and additionally have sufficient energy to ionize other argon atoms. A very fast multiplication phenomenon appears, so called "avalanche". On the cathode readout strips an inducted charge arrives perpendicular to the impact point of the avalanche.
The position of this charge is determined by the delay-line method. The charge travels to the left and to the right along this delay line to both ends of the line. The difference in arrival times of the charge at each end correlates to the avalanche position on the anode.

Advantages of the curved detector

In order to save time and to digitally record data, it became necessary to create an acquisition device faster than existing ones, offering easy computational treatments. Linear detectors were developed, but because of parallax errors, were not suitable for accepting a wide angular range of detection. To address these issues, the curved position sensitive detector, also called gaseous blade chamber, was designed. Because of the curvature, diffracted X-rays arrive perpendicular to the detector anode.

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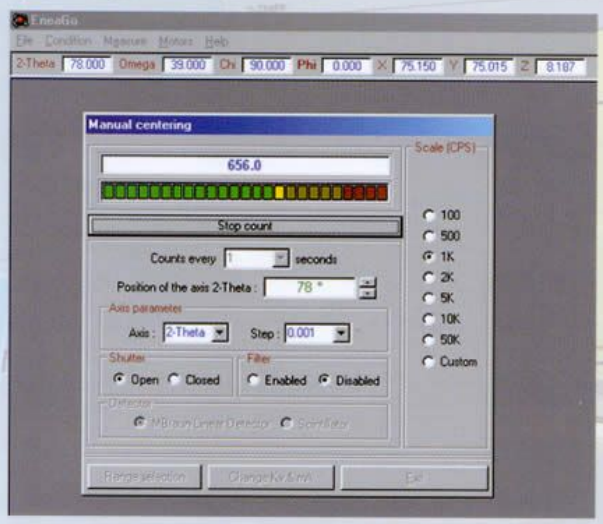
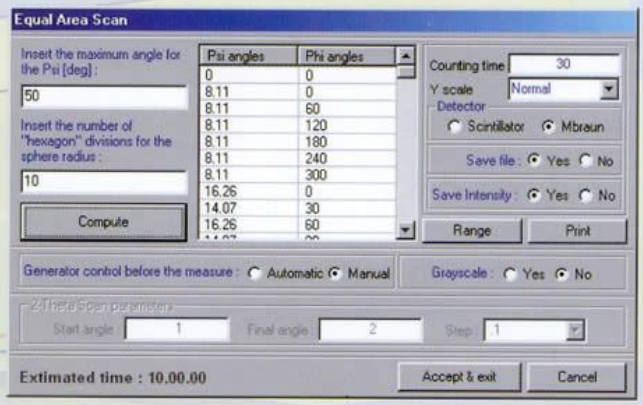
Application software

Data collection Programs

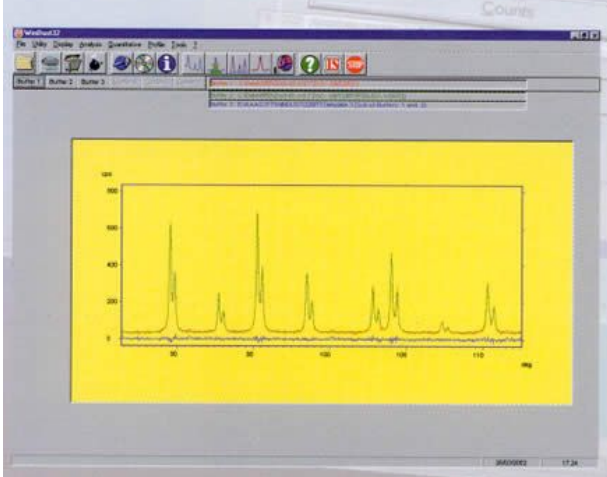
ITAL STRUCTURES offers a large variety of acquisition programs, for standard as well as for custom hardware configurations. All programs run under Windows®. The list includes the programs for powder and high resolution diffractometers, data acquisition of stress (plane and triaxial), retained austenite and textures (Equal area scan, Hexagonal Scan).
The programs can control scintillating counters, proportional detectors, position sensitive detectors, solid state detectors, High and Low-Temperature chambers and other devices.
Upgrading of old diffractometers.





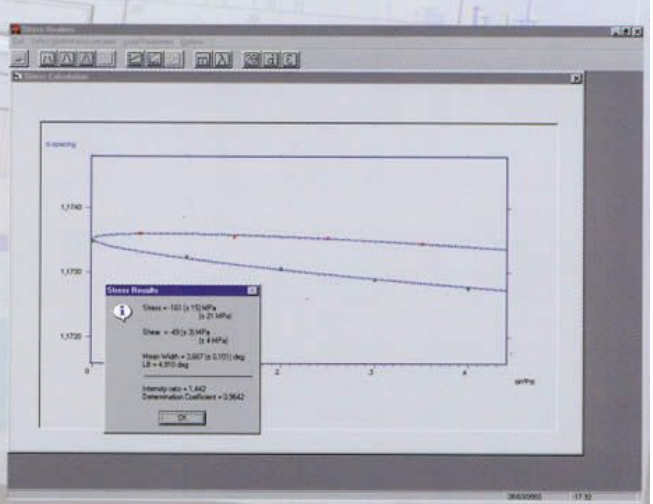
WinDust32

Single peak analysis; peak treatment. Background subtraction, smoothing, deconvolution and peak localisation.



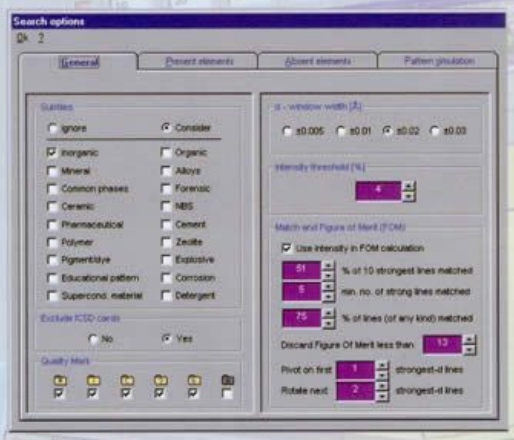
Stress analysis

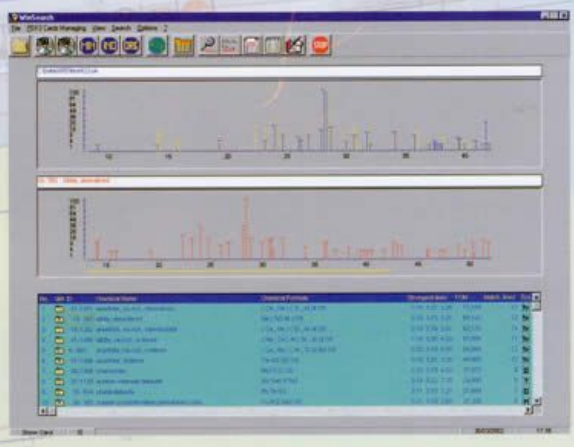
WinStress32 allows to calculate residual stress on any polycrystalline material. Different peak position methods (centroid, chord, maximum, parabola, Marquardt Fit) are available. Plane and/or triaxial stress. Linear or elliptic interpolation.



Search and Match

Easy to use, quick, powerful. WinSearch32 explores the ICDD archive and finds the solution, even in presence of many phases.

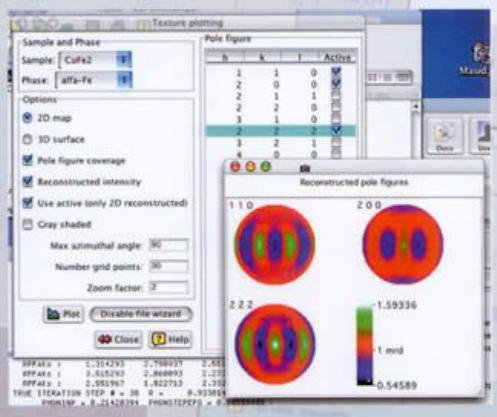


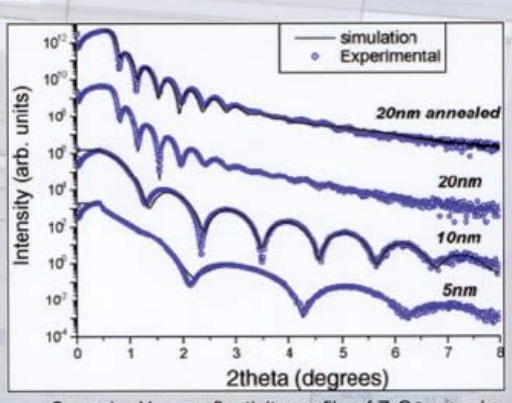


Peak analysis

IS-MAUD
Rietveld Analysis, Crystalline Structural Analysis, Crystallite Size and Lattice Strain, Crystallinity calculation, Texture, Strain, Reflectometry, Quantitative Analysis, all in ONE PROGRAM!

IS-MAUD (Ital Structures-Material Analysis Using Diffraction) is the definitive program in X-Ray Diffraction Analysis. Includes pattern simulation, ODF calculated with different methods.





Specular X-ray reflectivity profile of ZrO2 samples

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