

Crystal plane orientation measurements

GM Series

X-Ray Goniometers

- * Over 35 years experience in manufacturing production grade X-Ray systems
- World-wide reputation. Several hundreds of equipment in operation around the world
- Standard or customized equipment for all applications

The GM Series X-ray measurement systems are general purpose heavy duty production units especially designed for measuring the orientation of crystal products with respect to a selected crystallographic plane. In particular cases, orientation processes of small to medium size crystals can be performed with the help of dedicated holders and jigs. All single crystals can be processed, for all applications such as semiconductors, opto-electronics, optics, etc.

APPLICATIONS

- Orientation measurements
- Crystal face (Wafer, blank, block, bar, etc..). Depending of sample size, dedicated holder(s) may be required.
- Ingot flat
- Wafer flat and wafer notch (optional holder)
- Seed axis of round or square seeds (optional holder)
- Orientation processes
- Flat orientation on medium size OD ground ingots
- Crystal face, with specific adjustable holders.

VERSIONS AND CONFIGURATIONS

Capacities

- for loads up to 10 kg
- for loads up to 25 kg
- special versions for loads up to 100 kg
- Custom made versions
- Dual-station, including mixed versions with a station of GM.SI or GM.WS series.
- Dedicated holders for all applications

Double diffraction option

The GM series goniometers are available either for single diffraction operation, which is sufficient for most applications relating to semiconductors, or in double diffraction configuration with an incident beam monochromator.

The standard monochromator is a Quartz crystal with plane (01-1).

Different configurations with other crystals such as Lif, Si, Ge, etc.. can also be supplied.

RANGE OF OPERATION

- Goniometer rotation range : <0 to approx. 70°, with fast/coarse and slow/fine rotation control over the whole rotation range.
- Detector setting range : <0 to approx 110°. Detector can be indexed at several dedicated positions (option).

PERFORMANCE (Standard accuracy / Single diffraction)

• Measurement accuracy : ± 0.005° to ± 0.02°, depending (in particular) of crystal type, plane and surface condition.

PERFORMANCE (High Accuracy / Double diffraction)

 Measurement accuracy : ± 2 seconds to ± 15 seconds depending of crystal type, plane and surface condition.

Examples : Quartz (01-1) \pm 1 sec repeated over 20 measurements. Quartz (02-3) \pm 2 sec/30 measurements.

Measuring tests can be made on customer's samples.

DIGITAL ANGLE DISPLAY

Display options

- Decimal : resolution 0.01° 0.001°
- Degrees, minutes, seconds : 1 or 5 seconds
- PC and software : decimal and deg. min. sec. Any resolution. Simultaneous display of absolute and relative angle values (delta theta). Standard or customized software. Storage of various data.

All display versions enable reset to zero at any position. Automatic delta-theta reset for each crystal plane. Automatic recalibration at start-up or at any time.

> **DOUBLE DIFFRACTION VERSIONS** In a single diffraction goniometer, the

sharpness of the reflection peak depends

mainly on the beam divergence, which

comes out of the collimator. Even in the

very best conditions, it is not possible to

get a reflection peak enabling a measuring

accuracy better than \pm 10 to15 seconds.

With the double diffraction configuration a

first crystal "monochromator" is mounted directly on the path of the incident X-ray

beam. This allows the beam to be made

parallel by Bragg reflection on a family of

is only of a few seconds of arc. After

sharp reflection peak. Our unique electronics with "peak amplifier" enables

reflection on most samples, it becomes

monochromatic resulting in an extremely

its detection with an accuracy of 1 to 2" of

reticular planes. Its divergence in this case



Standard single station GM series X-ray unit with 8" wafer holder

X-RAY GENERATOR

- Output voltage : 30 kV DC
- Maximum rating : 30 mA
- X-ray tube : copper target, water cooled. Other targets on request.

arc.

- Apparent focus : linear fine focus. Spot focus when required.
- Mains : 220 V 50/60 Hz, 1-phase, 10 A
 - Water supply : 2.5 bar. Flow rate 3.5 l/min

DETECTION UNIT

Proportional counter linked to a special integrator with peak amplifier, giving a high detection accuracy.

Optional long window detectors for detection of a beam reflected by strongly tilted planes (crystal plane is inclined, not parallel to goniometer axis).

Voltage is adjustable from 1000 to 1850 V

Voltmeter and adjustment potentiometer are located in the casing facing the operator



Stainless steel vacuum holder for wafer face orientation measurement. Engraving for accurate positioning of the wafer flat or notch. Models for wafers up to \oslash 300 mm.

SPECIMEN HOLDERS

One of the greatest advantages of the GM series X-ray units is the capability which is offered to install an infinite number of attachments such as specimen holders, tables, slides, jigs and other fixtures in order to use the equipment for different applications.

Besides, the mechanical concept of the unit enables such changes without the need of any beam re-alignment, mechanical setting or calibration. Depending of the attachment, time involved for this operation ranges from a few seconds to a few minutes.

The sample can be maintained on all types of holders either by an adjustable spring pusher or by vacuum.

Although small crystal sections can still be measured with good accuracy (for ex. wafer flats of 0.3 x 8 mm) the best measurement reliability is ensured when the crystal face is sufficiently large for being properly and accurately hold on the specimen holder. Further process steps such as dicing can be made after orientation check, since such process does not affect the crystal face orientation.

A large number of specimen holders is already available for all kind of applications. When needed, customized models can be offered.



samples which are larger than the narrowest part of the window. Incident and reflected beam angles from 7° to ca. 55°



Holder for wafer flat orientation measurement. To use with with vertical window holder.



Horiz. window type.

Provides excellent

holding for all

Commonly used in many applications.



Holder for small incident angle beams. Must be used for ex. with LiNbO3, LiTaO3



Holder for orientation process of ingot flat.

The ingot holder is

used to transfer the

ingot orientation to the grinder



holder for wafer orientation measu-rement. PC calculates total plane offset and offset direction



Holder for wafer flat and notch orientation measurement. Wafer diameter from 100 to 300 mm.

SAFETIES AND PROTECTIONS

The equipment has been designed to offer both maximum protection and easy operation.

- Electromagnetic rotary shutter controlled by a non latching foot switch.
- Shutter interlock switch actuated by the sample in measuring position
- Green / Red control lights : indication of shutter status.
- "X-ray ON" light with automatic equipment shut-off in case of lamp failure.
- Shields and screens stop direct or scattered radiation

Delta technologies permanently improves his products. Equipment may differ from the data mentioned in this non contractual document



Delta Technologies Int'l 88 avenue Victor Hugo F-33700 Merignac France Tel. +33-5 56 75 23 99 Fax +33-5 56 45 23 99 Email : info@delta-technologies.net





Overhanging configuration. The beam passes over the holder to reach the crystal maintained on its face. Used for all incident and reflected beam angles, when other holders are not suitable.



Holder for seed orientation measurement. Instantly mounts on the goniometer table.



PC display option (See page 1) Displays decimal and sexagesimal degrees. Standard or customized soft ware. Stoage of up to 4 mesurements per sample.



Special tilting holder for measurement of crystals with inclined planes. In some cases, long window detectors can be used as an alternative.

CUSTOMIZED EQUIPMENT

Despite of the large variety of equipment and accessories offered, the equipment must often be customized in order to fulfill the user's requirements, particularly with respect to the size and shape of samples. This catalog does not show all available holders.

If the samples to be measured cannot be properly hold by the standard holders mentioned in this catalog, or already supplied for similar applications, we can still offer specific solutions.

This can be the case for instance when the samples to measure are smaller than the X-ray beam aperture of the sample holder fitted to the goniometer.

For any such application, consult us.

55°

Double resting surface

Provides excellent holding

for samples larger than the

width of the slit. Used in

case of small incident

beam angles. Reflected

beam angle limited to ca.