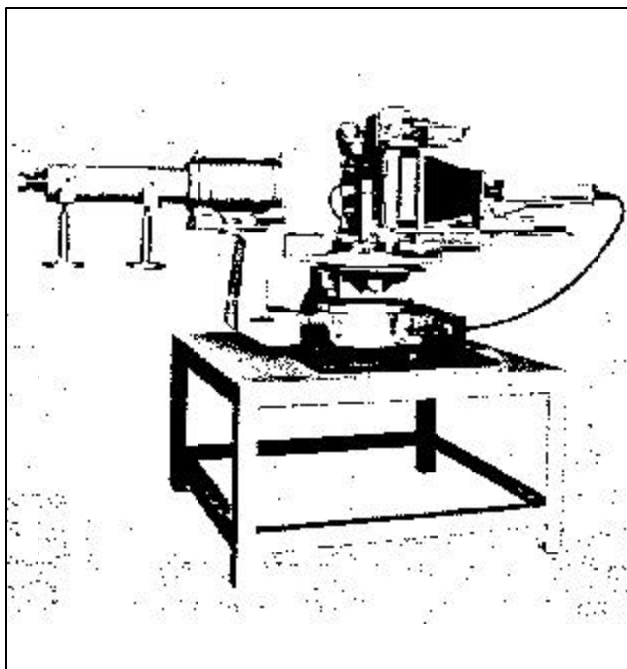


## Product Information

### Computer-Controlled X-ray Topographic Imaging System



X-ray diffraction topography is being widely used, especially in semiconductor industry, as it permits the observation of a direct image of structural defects of single crystals, e.g. dislocations and stacking faults. Compared with other similar techniques such as the etching method or electron microscopy, X-ray diffraction topography has the advantage of a non-destructive observation of these structural defects allowing a random sampling test of crystals at each stage of the manufacturing process of semiconductor devices like IC, LSI, etc. Thus X-ray diffraction topography has been taking a part in the betterment of the yield as a method of evaluating the improvement of the manufacturing conditions in terms of elimination process induced defects.

In parallel with the striking development of semiconductor technologies, crystals as materials are becoming larger and larger in diameter so that wafers of 6" dia. are now being put into the process. Semiconductor devices are toward a higher degree of integration and the circuitry wiring width has attained the order of submicrons. Today the characterization of

the crystal perfection by X-ray diffraction topography is holding an ever more important position accordingly.

The computer-controlled X-ray topographic imaging system introduced here has been developed to meet these requirements of semiconductor industry. Firstly, the system permits the observation of up to 8" dia. crystals to cope with the trend toward larger diameters of wafers. Secondly, it has removed the difficulties in X-ray topography by the use of an X-ray TV camera coupled with computerized automated operation. That is, topography has so far needed fairly skilled operators versed in X-ray crystallography because of the complicacy of topographic equipment. This problem has now been resolved. Lastly, the system has accomplished a sharp reduction in the exposure time as a result of the combined operation with an exceedingly powerful X-ray generator (RU-500 or RU-1000). The exposure time required to get a topograph has hitherto been considerably long placing an obstacle to efficient testing. With the system, particularly in the case of the TV synthesis mode using the X-ray TV camera and video frame memory, the time for synthesis is only two minutes approximately. Even when the time required for such procedures as crystal installation, automatic azimuth adjustment and others are taken into account, it takes no more than ten minutes or so before the topographic image comes out on the video monitor. The image quality itself is also sufficient for the observation of the presence of a slip and the distribution of precipitates.

The system is configured of 1) a high-power rotating anode X-ray generator (RU-500 or RU-1000), 2) a topographic goniometer for large wafers, 3) an X-ray TV camera and 1 6-bit video frame memory and 4) a computer for automatic control.

#### Features:

- ⌘ A traverse topograph, or projection topograph of a crystal of 8" dia. in maximum can be not

only recorded on X-ray film but displayed on the video monitor.

- ⌘ Step scanning section topography is available, such that section topographs are recorded successively on X-ray film by stepwise moving of the traverse stage at constant intervals.
- ⌘ The sample is free from contamination as it is held, being sandwiched with mylar foil.
- ⌘ The overall photography of a 8" wafer can be made by the use of a conic incident beam slit.
- ⌘ A warp correction is made by the Bragg angle control so that even complex warps can be handled.
- ⌘ The X-ray TV is based on the indirect method employing a high-sensitivity camera which uses a fluorescent screen and a SIT (silicon intensified target) tube. The field of view is variable ranging from 4" dia. to 8" dia. The image synthesis is conducted with a video

frame memory whose memory size is of 512x512 piccells and 16-bit depth.

- ⌘ The following programs are available for automatic control by the computer.
  - \* Measurement of a calibration curve for the automatic azimuth adjustment.
  - \* Crystal azimuth adjustment by the control of the co-angle and rotation in the plane.
  - \* Width setting of the 3rd slit (between crystal and fluorescent screen).
  - \* Measurement and display of a warp of the crystal.
  - \* Synthesis and display of a traverse topograph on the video monitor.
  - \* Photography of a traverse topograph and a step scanning section topograph.
  - \* Storage of the content of the video frame memory on the floppy disk for subsequent regeneration.