

ORION: NIR Inspection of Silicon Bricks and 3D Geometry Measurement

Area of application

In the manufacturing of solar cells and modules one has a variety of different high added value production steps. It is therefore reasonable to sort out faulty parts as soon as possible or even better to avoid processing them.

From the silicon raw material a crystal ingot is grown which is then sawed (band or wire) into the silicon bricks. After the brick squaring follows a polishing step which gives the brick the correct geometry for later processing (wafer sawing) and reduces induced stress from the squaring.

The 3D geometry measurement is located after the squaring process generating proposals for the polishing system to reduce the polishing effort. The NIR inspection then generates cutting proposals for the following wafer sawing process.



The dark regions show a 3D reconstruction of SiN and SiC impurities in a silicon brick due to contaminations in the crystal growth process. These contaminated regions shall not be processed further.

Our silicon brick inspection systems offer a fully automated solution for the inspection task before the two process steps polishing and wafer sawing.

Preconditions for deployment

The automatic inspection of silicon bricks is suitable for continuous automated production as well as for manual operation as a stand-alone system, e.g. for the laboratory.

A cleaning and drying station can be integrated to assure the purification of the brick surface, e.g.

to clean the residues from the polishing, so that the inspection results are getting very reliable.



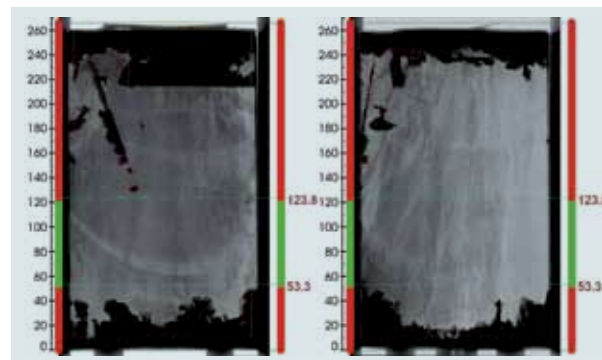
Our inspection system ORION covers both the 3D geometry measurement and the NIR inspection of silicon bricks in examination cycles of some minutes per brick.

The optical probes incorporated in the inspection system are mostly housed to compensate for any variations in ambient lighting. As a result, no restrictions need to be made on the environmental lighting conditions.

Technical Data

Components of the inspection system

The manually operated optical inspection system consists of a linear transfer system moving the bricks from the loading position into the inspection unit. There the brick can be rotated via a rotary table and the camera, lighting and/or laser units can be moved in vertical direction with a linear axis. The brick is inspected from **all four sides** to achieve high accuracy.



Detail of the GUI: Cutting proposal (brick with large inclusions)

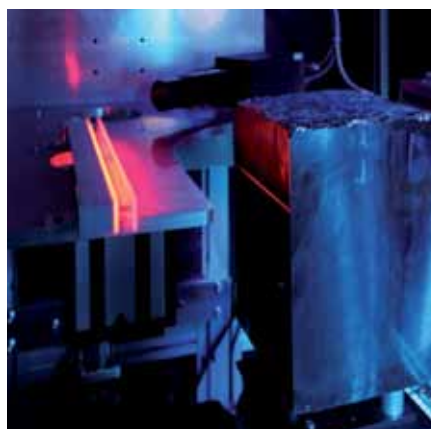
ORION: NIR Inspection of Silicon Bricks and 3D Geometry Measurement

For automatically operated inspection systems some of the actuating components can be omitted, depending on the integration into the production.

Results are shown on an user monitor, where system parameters can be changed, inspection results can be supervised, and external operating signals can be tapped. The results can also be communicated to an existing automation and/or the MES (e. g. by Digital I/O, Profibus, XML).



High-Res: Probably SiC in combination with SiN needles.



Laser triangulation of the brick surface

The image resolution for inline use is 200 μm and can be lowered to 100 μm . There is also a high-resolution option with resolutions down to 10 μm available. Also a 3D reconstruction of the inclusions of individual bricks and of whole ingots is possible.

Performance data

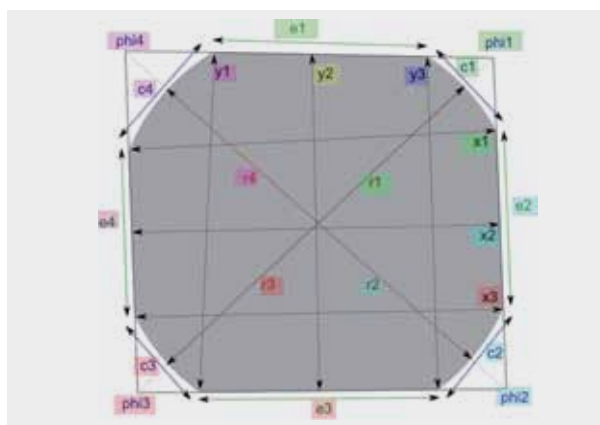
Both systems can handle brick sizes up to 210 \times 210 \times 1000 mm³ and have cycle times from 1 to 5 min per brick depending on system concept, brick length and of the required accuracy.

3D geometry measurement

- Measurement of length, width and height
- Ascertainment of angularity, rectitude and flatness
- Detection of defects, rills and stages
- Roughness measurement
- Top measurement
- Precise chamfer measurement
- Generation of grinding proposals
- Weighing
- Bar code scanner

NIR inspection

- Detection of smallest structures of SiN/SiC inclusions
- Generation of cutting proposals
- Maintenance free NIR lighting
- Combination with lifetime measurement possible
- Marking station for cutting proposals



Example of possible geometry measurements (cutaway of brick)

Attention: Too rough surfaces lead to uncertainty of measurement. We offer to make a free feasibility analyses to judge the effect of the surface of your bricks.

Contact

Intego GmbH

Henri-Dunant-Straße 8
D-91058 Erlangen

Fon +49 9131 61082-0

Fax +49 9131 61082-999

Email info@intego.de

Web www.intego.de