

Solar Measure

Metrology Solutions for Thin Film Solar Modules:

Enhance Your SolarInspect System with State-of-the-Art Measurement Options



Dr. Schenk offers all-in-one quality assurance and process control systems for the production of solar panels.

The SolarInspect system for the detection of local irregularities can be combined with the advanced measurement options of SolarMeasure to create a comprehensive process control solution.

The products of the SolarMeasure family perform electrical and physical measurements and are available as add-on options to the optical analysis or as stand-alone systems.

Quality Control

- Establish quality standards and sort out panels that do not meet them
- Create price categories according to quality ratings

Process Control

- Improve YIELD by quickly identifying the source of a defect and fixing the problem right away

Solar Measure Options

- TCO resistivity measurement
- Layer thickness monitoring
- Glass sheet dimension measurement
- Haze monitoring
- Edge deletion depths measurement
- Warpage measurement
- Drill hole measurement

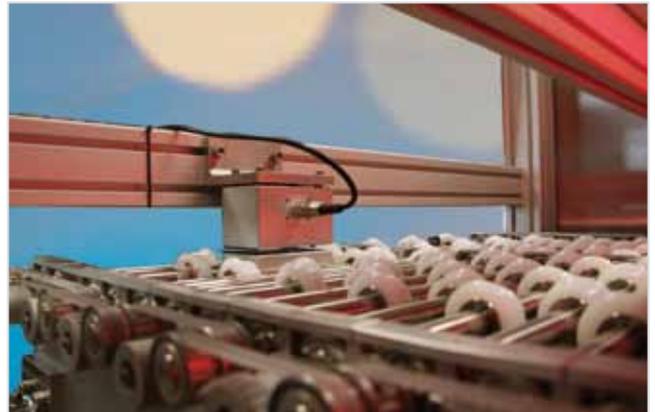
For further options please see page 5 of this brochure.

Solar Measure

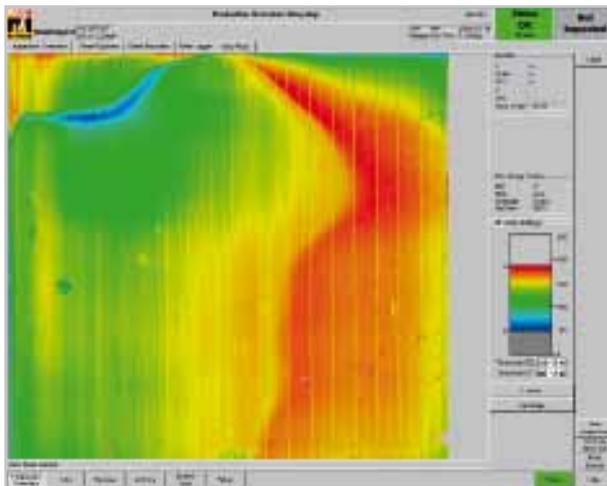
Resistivity Measurement

This add-on to thin film module inspection measures the sheet resistance of a solar panel's electrode coating. For optimized panel efficiency, the conductivity of the coating layer should be at a maximum even at low layer thickness.

Dr. Schenk offers a highly sensitive sensor, that performs a non-contact resistivity measurement. This in-line measurement makes use of the Eddy current principle. In its down-web movement along the line, the coated solar glass passes through the magnetic field of the sensor. The measurement results are connected with the SolarInspect system and its analysis software. The visualization system displays the output of the measurement and issues a warning in case the preset values are exceeded.



An optional sensor measures the resistivity of the TCO layer on the glass substrate



False color image of layer thickness

Layer Thickness Monitoring

With this innovative option PV manufacturers can monitor relative local thickness variations after layer deposition steps covering the entire panel area. It supports the control of the coating process.

- Layer thickness monitoring and inspection run in parallel
- Monitoring system takes advantage of the already existing hardware of the defect inspection system
- Enhanced technology to process the optical signals
- Real time 2D visualization map (see image on left)

Thickness monitoring uses the high-resolution, low-noise cameras of SolarInspect. As high performance LED illumination units operating at selective wavelengths are applied, the integration of this measurement option into the inspection system is best planned at an early stage. This saves the expense for a second hardware set and the solar panel inspection system becomes a true all-around solution.

For layer thickness measurement, e.g. in-line spot test or in off-line laboratory situations, Dr. Schenk offers an alternative technology using a white light spectrometer. These units enable absolute measurement of the coating thickness and can be used to calibrate the relative monitoring results.

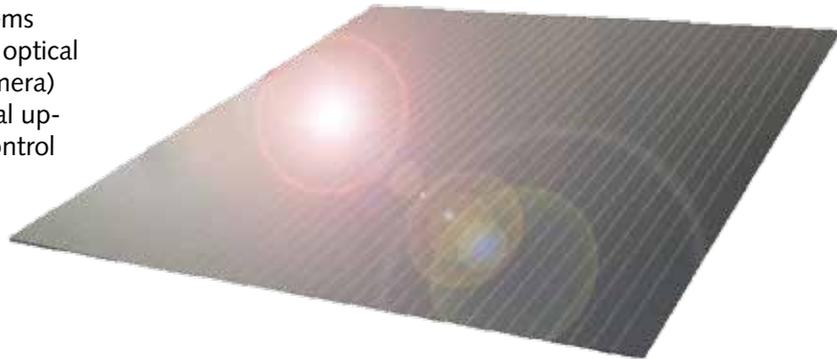


Measurement Solutions for Solar Panels

Dimension Measurement

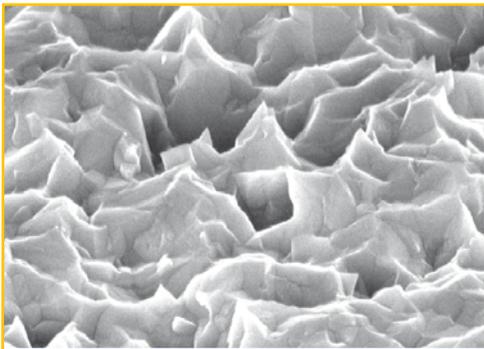
This measurement option focuses on length, width and squareness of the glass panels, which are primarily analyzed at the beginning of the production line.

The Dimension Measurement option for Dr. Schenk's solar inspection systems offers an additional feature using the optical devices (illumination unit and line camera) of SolarInspect. This renders it an ideal upgrade, leading to automatic in-line control of the incoming glass panels.



Haze Monitoring

In order to increase the efficiency of thin film solar panels, specific layers of the panels receive a surface structure. This layer roughness or haze will increase the light trapping effect, which is especially important to the TCO layer of a-Si PV modules. Manufacturers are aiming to keep this effect constant and at an optimized level throughout the production run in order to guarantee highest panel efficiency.



The ideal haze intensity of solar panels' conductive layers will optimize the light trapping effect and thus, the cell efficiency

Dr. Schenk's Haze Monitoring option was developed to check the layer structure of incoming TCO coated glass delivered by the glass supplier as well as solar glass after the coating step at the fab. As soon as process deviations occur, the system reports a variation in the panels' haze intensity and operators can react quickly to adjust production parameters.

Using the same optical devices as Dr. Schenk's SolarInspect system, the Haze Monitoring option is a perfect enhancement for quality and process control.

- Same hardware set-up as defect analysis system
- Haze monitoring and inspection run in parallel
- Enhanced technology to process the optical signals
- Real time 2D visualization map

For in-line spot tests or for use in off-line situations Dr. Schenk offers alternative sensors which calculate absolute values for the haze intensity at a given panel position.

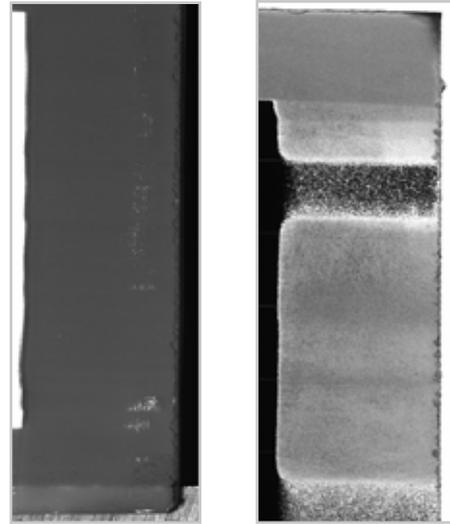
Your Reliable Partner

Solar Measure

Edge Deletion Depth Measurement

After coating the glass panels with the final layer, the coating material has to be deleted at the edges of the glass. This allows proper sealing of the solar module when bonding the front and back glass.

This measurement solution helps manufacturers of solar modules to control the edge deletion process. Residual layer material in the area of the butyl sealing strip or a tilted glass surface induced by deletion irregularities can cause leakiness, which reduces the lifetime of the module. The Edge Depth Deletion Measurement represents the final quality check after front-end processing is completed.

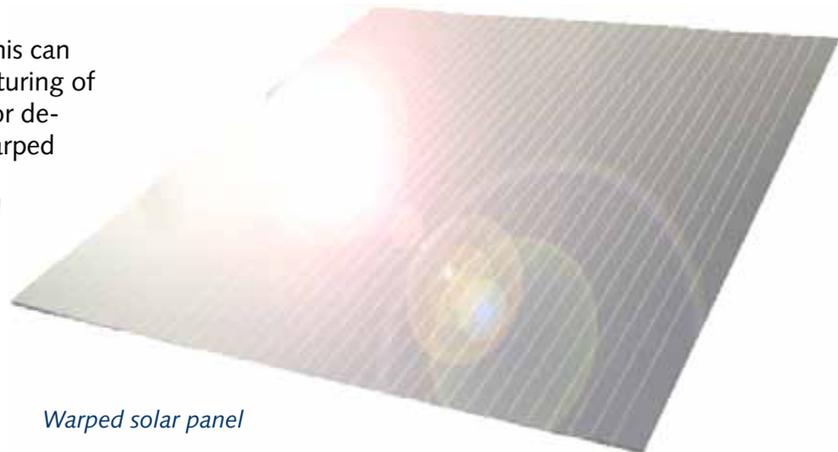


Examples of layer residue and inhomogeneous edge deletion

Warpage Measurement

Warpage of the glass panel can be measured with the Dr. Schenk Warpage Measurement Option.

When a glass panel becomes warped this can indicate a problem during the manufacturing of the panel (such as incorrect annealing or deviations in the coating process). The warped surface of the glass creates problems during handling and leads to unwanted results during lamination and scribing. Furthermore, warpage can also initiate the breakage of the glass in later production steps. Using warpage measurement, this can be detected reliably and early on in the process.



Warped solar panel

Measurement Solutions for Solar Panels

Drill Hole Measurement

The Drill Hole Measurement Option enables precise measurement of dimension and position of drill holes in the back glass. It allows the detection of drill hole edge defects which indicate a poor-quality drill process. The effect of this is an increased probability for glass breakage.

Drill hole in a solar panel backside glass



Even more measurement options for even better results

In addition to the previously described measurement options Dr. Schenk offers more quality-enhancing measurement solutions that can be used in-line or as stand-alone units. True to the meaning of metrology, all measurement options provide manufacturers with data to adjust and optimize production.

The Dr. Schenk SolarMeasure **Microscope Station** measures the distance between and the width of scribe lines.

The Dr. Schenk SolarMeasure **Electrical Insulation Tester** performs electrical insulation tests between the solar cells after scribing.

The Dr. Schenk SolarMeasure **I-V Curve Tracer** enables measurement of every single cell's electrical performance as well as that of the whole panel.

And last not least the SolarMeasure **TCO Tester** completes the measurement portfolio with the in-line measurement of layer thickness, haze and resistivity of TCO coatings.

For more detailed information on these options please refer to our specific descriptions and data sheets.

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Dr. Schenk's modern production site

Dr. Schenk GmbH, established in 1985, is an innovative high-tech company based in Munich, Germany. For the third decade now, the range of products and services offered by Dr. Schenk comprises comprehensive solutions for automated quality assurance and production process monitoring for the flat glass, film and foil, converting, paper, solar, optical media and semiconductor industries. In these areas Dr. Schenk continues to set new standards for the inspection of surfaces through the utilization of the latest technical advances in optics and electronics. The company's primary objective is to achieve complete satisfaction of our customers on a long-term basis. This vision is realized by a perfect synergy between innovative solutions and practical ideas. Global sales and service facilities ensure local support, technical service, training and consulting at any phase of a project. From modular standard units to complex and highly customized systems – Dr. Schenk's high performance test and inspection products have precision in focus!

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