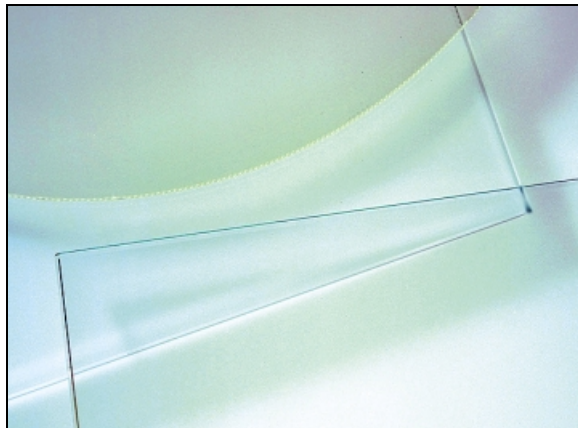


## G/SOLAR for Photovoltaics



Glass plate

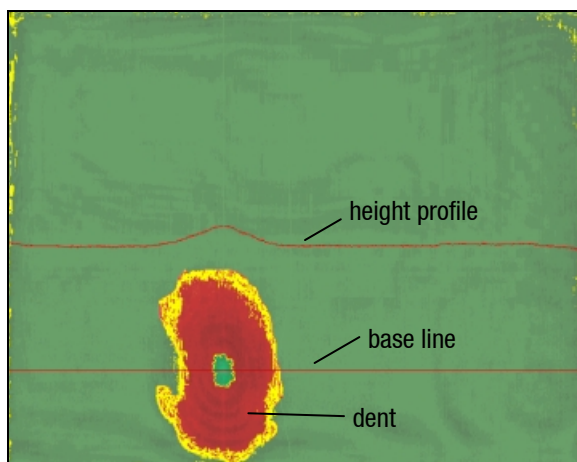


Image of gradients

### > Challenge

For assuring the quality of solar modules, Graphikon provides inspection systems designed for various process steps. These systems ensure easy adaptation to various coating processes. All system configurations enable the storage of images, faults and statistics in a database for subsequent systematic evaluations.

### > Inspection of Substrates

#### Optical Inspection of Glass Substrate after Washing

The systems recognize and classify water spots, dirt marks, finger prints, faults in glass as well as edge flaws and cracks that remained after washing and drying.

The system acquires data using grayscale-matrix-cameras which are moved continuously in a meander-shaped manner in rectangular direction to the transport direction of the module. Flash light illumination ensures contrasty images of faults on both sides of the glass substrate. In addition, a retroreflector increases the reproducibility.

The commonly applied resolution is ca. 0.075 mm at a transport speed of the glass plate from 1.000 to 1.500 mm/min.

#### Measurement of Deformations of Glass Plates

For evaluating deformations, height profiles, gradients and/or curvature are calculated. Different colors indicate when tolerance limits are reached or exceeded. Local deformations, e.g. waves and dents, are derived.

The common accuracy of measurement is  $\pm 50 \mu\text{m}$  for a maximum deformation size of 20 mm and cycle times from 30 to 60 sec/1.000 mm module length.

# Inspection of Thin-film Solar Modules



## › Optical Inspection of Coatings

The systems recognize and classify the quality of the edges and the grooves, inhomogeneities of color values or their deviations from standard values as well as holes, spots, scratches and flitters.

The system acquires data using a Color-matrix camera which is moved several times in a meander-shaped manner in rectangular direction to the transport direction of the module.

When moving the camera unit forward on top of the module, those areas that reflect light diffusely are displayed brightly thus ensuring a reproducible color classification and recognition of color spots. When moving back the camera unit in the reflected light mode, the directionally reflecting areas are displayed brightly. This mode is especially suitable to display non-through-type holes, scratches and flitters. Using additional transmitted light, i.e. in the transillumination mode, it is possible to clearly distinguish through-type holes and scratches from other faults.

The commonly applied resolution is ca. 0.05 mm at a transport speed of the modules from 800 to 1.000 mm/min.

## › Advantages

- Cost-effective solutions requiring only a few cameras
- Robust detection of all relevant faults
- On-line detection and reaction
- Fault classifying
- Statistical evaluation
- Effective lighting
- Easy adaptation to process changes

## › Contact

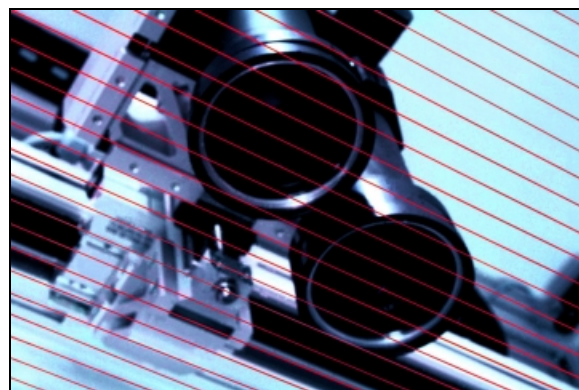
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## G/SOLAR for Photovoltaics



Solar module



Acquisition unit