

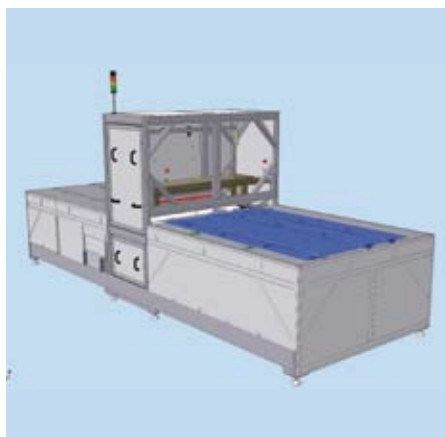
■ ■ ■ VELA: Layup/Matrix and Laminate Inspection Systems

Technical Data

Components of the inspection system

The standard inspection system consists of a housed inspection unit with cameras and lighting, an evaluation unit and an internal transfer system stepping the parts from the loading position through the inspection unit to the unloading position.

The evaluation unit is integrated into the system. Results are shown on a user monitor, where system parameters can be changed, inspection results can be supervised, and external operating signals can be handled. The results are also communicated to the automation, preferably via an OPC interface.



Drawing of the laminate inspection system with internal transfer system (conveyor belts) and integrated evaluation unit.

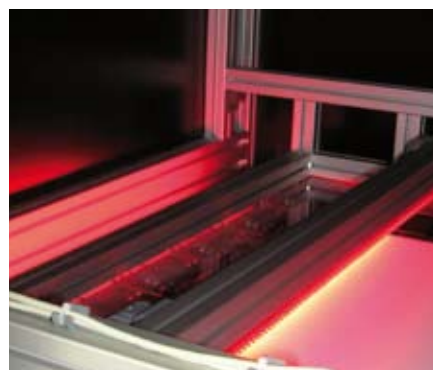
A permanent storage of both the inspection results and the optical image data in a storage loop is included. This, in combination with individual labels or barcodes, allows for interpretation of the inspection results at a later point of time.

A bar code scanner or similar device can also be integrated into the inspection systems. The results can be integrated in the statistics of the inspection system.

Performance data

Both systems can handle layups/matrices and laminates with sizes up to 1.4 x 2.0 m² within the typical production cycle times.

Both inspection systems inspect the front and back side simultaneously.



View inside the laminate inspection system.

Layup/Matrix inspection tasks

- Measurement of distances between cells and to the frame
 - Measurement of string alignment and orientation
 - Detection of cracks, holes or chippings on the cells
 - Recognition of misaligned ribbons
 - Detection of impurities resp. inclusions (especially conducting contaminations which can cause shunts) between and on cells
 - Control of colour homogeneity
 - Optional: reading of labels e.g. barcodes
- Laminate inspection tasks

Layup inspection tasks

- Measurement of distances between cells and to the frame
- Detection of cracks, holes or chippings on the cells
- Recognition of misaligned ribbons
- Detection of impurities resp. inclusions (especially conducting contaminations which can cause shunts) between and on cells
- Control of colour homogeneity
- Print inspection of the cells
- Detection of damages and bubbles on both sides
- Recognition of non-laminated areas
- Optional: reading of labels e.g. barcodes

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Area of application

For the manufacturing of crystalline solar modules, single solar cells are soldered to strings. These strings are laid in matrix form to a front substrate, typically glass, and then laminated irreversibly to a high value module.

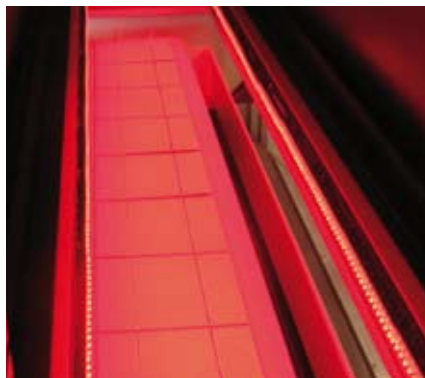
The lamination process conserves all faults in the panel, so only perfect layups/matrices should be processed. The layup/matrix inspection is therefore located prior to the lamination process to sort out faulty parts for manual repair, which saves the faulty layups/matrices.

The laminate inspection however is designed as a final control of the complete laminates and is thus located after the laminator. It is also capable of inspecting other types of modules, for instance thin film devices.

The optical probes incorporated in the inspection systems 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.



Layup/matrix inspection system for integration into an existing automation (simulated by the roller table).



A layup/matrix is processed through the inspection system.

The inspection system can be delivered with a complete internal transfer system or as an in-built system to an existing automation.

One side of the inspection system with an internal transfer system is reserved for the loading and unloading. There the supply can either be managed by hand or by an automatic system integrated into the production.

Our two inspection systems offer a fully automated solution for the two inspection tasks prior to and after the lamination process step.

Preconditions for deployment

The automatic inspection of layups/matrices or laminates is suitable for continuous automated production as well as for manual operation as a stand-alone system.

A cleaning station can be integrated in the laminate inspection system to assure the purification of the surfaces, e.g. to clean away dust particles. Consequently, high pseudo-error rates caused by surface impurities are averted.

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