Fault Detection in Solar Cells

This invention permits to detect faults in solar cells during the production process. It includes a fastening device and uses a measurement tool for optical excitation of the solar cell elements in various zones. Interpretation of the resulting magnetic field permits to check whether the solar cell is faulty or not.

The fault detection procedure is contact-free. It uses several laser sources to permit parallel, simultaneous checking of a large solar cell area. A new technology hinders interferences between the various magnetic fields.

Description

Mechanical and electrical faults are frequent during solar cell production. Such faults may reduce the performances of the product and even lead to a total loss of function. Reliable and economical fault detection is therefore crucial. Common fault detection procedures use a single light source and a single magnetic field, or infrared heat detection. The new procedure, however, uses several light sources, each of them being connected to a magnetic field sensor.

Besides fault detection this invention allows to measure power performance of the solar cell without contacting the cell.

The invention is based on several new technology features, including a modulation procedure that permits to excite several solar cells in parallel without interferences between the resulting magnetic fields. Multiplication of the measurement spots on the solar cell results in a considerable acceleration of the fault detection procedure.

The invention — that permits contact-free, position resolved fault detection — includes both the device and the process.

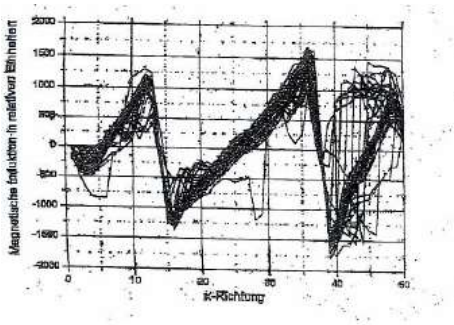

Figure 3a

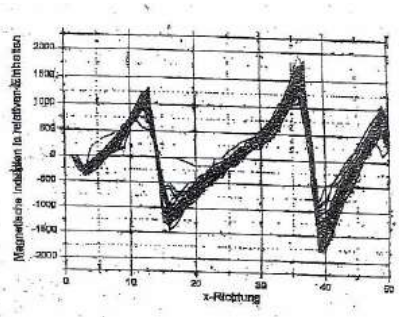

Figure 3b

Figure 3a shows a fault in a solar cell element (to the right). It also evidences (to the left) that no interferences exist between the magnetic fields despite the use of several laser sources. Figure 3b shows a solar cell without defect.

Main Characteristics

- Permits position resolved fault detection in any solar cells
- Compatible with industry production processes
- Magnetic field interpretation follows optical excitation of the solar cell element
- Compatible with automatic fault detection during solar cell

Advantages

- Parallel, simultaneous excitation of several solar cell zones
- New technology hinders interferences between the various magnetic fields
- Contact-free fault detection procedure
- Contact-free power measurement of the solar cell

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Applications

The invention permits a 4-step process:

1. A special device performs contact-free optical excitation of the solar cell element.

2. A sensor measures the resulting magnetic field.

3. The measurement evidences whether the solar cell element is faulty or not.

4. The solar cell element moves and steps 1 to 3 resume.

Parallel optical excitation of several zones results in a considerable acceleration of the fault detection procedure. A special disposition of the light sources and a new modulation procedure permit to hinder interferences between the various magnetic fields.

Business Advantages

- Speeds up the fault detection procedure
- Reduces the fault detection costs
- Highly reliable technology
- Permits simultaneous measurements on large areas

Patent Information

Application for German and PCT patents (both of them will most likely be granted).

Development maturity: the process has been tested with lab data and needs an invest of approximately 50.000 Euros to be integrated in production.

Conditions of use: the patent can be licensed nationally and internationally.

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PTB is the national metrological Institute providing scientific and technical services. PTB measures with the highest accuracy and reliability the SI units and disseminates them.
PTB is fostering technology transfer through industrial cooperations, patents and spin-off enterprises.

PTB has core competence in metrological physics, engineering and explosion protection. Its annual budget is app. 120 mill. EUR. Of the 1500 employees 50% are scientists or engineers.

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