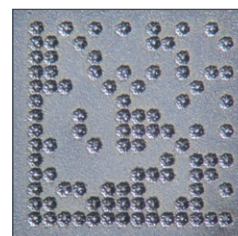
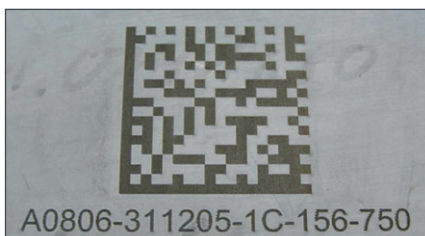


Solar / Photovoltaics

Keep Track of the Wafer: Laser Marks on Solar Cells, Modules and Thin-Film Substrates



Polycrystalline solar cell



Left: Engraving on silicon block. Laser marked with a Nd:YAG laser system.

Middle: Solar cell with hardmark (the silicon is engraved with a depth of at least 70-90µm in order to avoid a damage to the mark in subsequent processing steps). Marked with a 20W fiber laser marker.

Right: 2D engraving on silicon wafer. Laser marked within 400ms.

Ecological awareness and diminishing fossil fuel resources have pushed photovoltaics from a niche business to become a global alternative to conventional power generation. In order to reduce production costs while at the same time increasing efficiency, manufacturers of solar cells invest in fully automated production lines. In such factories, the utilization of laser markers for product identification and tracing purposes guarantees high efficiency and throughput at best achievable marking quality and without damage to the sensitive material.

Challenges

Nowadays, consumers require up to 25 year warranties on solar modules. Therefore, wafer marking in solar cell manufacturing is key to traceability and improved manufacturing processes. For these product tracking and tracing purposes, solar cells, modules and the support materials of thin-film cells are laser marked with clearly readable alphanumeric symbols, data matrix codes and manufacturer logos. The marks are usually rather small: Their size ranges from semi visible (font size of about 75µm) to several centimetres. The minimum font width amounts to 10µm. The demands on the marking quality are high: Marks have to be machine-readable, should not affect other manufacturing steps and should enable doubtless identification - even at the end of the production process.

Solution

With an entire range of laser markers available including CO₂, Nd:YAG and Fiber systems, Alltec offers the optimum laser marking solution for the respective solar appli-

Continued on the reverse

The Industry

Laser marked solar products:

- **Cells:** direct marking on monocrystalline and polycrystalline solar cells
- **Thin-film cells:** laser mark is usually applied on base material of the thin-film cell (e.g. glass) but can also be applied on the very thin silicon layer

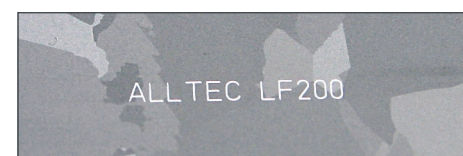
It's all about track & trace:

- Laser marks enable tracking the solar wafers throughout the production process for reason of internal quality assurance.
- Laser marks are used to identify panels/ cells even years after installation (warranty issues; tracing purposes).

Laser marking systems ...

... usually apply number codes on solar wafers and substrates - generally these numbers are represented by a 2D code (to save space and for reasons of readability).

Alltec systems apply these 2D codes „on the fly“ (mark wafers while they move)!



Solar cell with softmark (locally melted silicon surface to avoid dust and debris). Marked with a 20W fiber laser marker.

ation - be it for the direct marking of solar wafers or the marking on the substrates of thin-film cells or the drilling of holes for the processing of back side contacts.

Materials and Marking Contents

Alltec laser marking and engraving systems apply marking data (ID matrix codes, serial numbers, logos, etc.) to a variety of metallic and nonmetallic materials. In the solar energy sector, they brilliantly mark silicon wafer material and the substrates of thin-film cells (e.g. glass, metal or others) for purposes of traceability and process optimization. Especially our fiber laser markers are the best and most economic solution as they deliver high speeds and highly focussed spots that guarantee fine and high resolution marks.

High Marking Speeds for High Throughputs

Alltec's proprietary scan technology guarantees high efficiency and throughput at best achievable marking quality through highest marking speeds. **In contrast to all other suppliers of laser markers for the solar energy sector, Alltec systems are characterized by their ability to even mark 2D codes „on the fly“ - when the wafer is moving.** With Alltec systems the production line does not have to be stopped just for the sake of marking.

Absolute Traceability Thanks to Durable Identification

Laser marking has proven to be the best solution to wafer manufacturers, because it produces permanent, machine-readable, high quality marks fulfilling manufacturers' most stringent requirements. Especially, the cost-efficiency and higher throughput of Alltec's fiber laser markers pay off in these tough economic times.

Best Marking Quality

The demands on the marking quality are high, and the results our systems deliver against these requirements are without compromise: Minimal substrate damage and machine-readable code allow faultless identification and tracing throughout the entire production process and afterwards. Last but not least, the high beam qualities and a range of marking fields guarantee for very small, fine and high resolution marks.

Easy and Cost-Effective Installation

Space in cleanrooms comes at a premium so marking equipment has to be small and compact to be easily installed in these environments. Due to their small size, compact mechanical design and many available options our systems can be perfectly and cost-effectively integrated even into critical production environments. Especially noteworthy is our new fiber laser marking system ALLTEC LF100/200.

Additional Advantages

Superior Service

Time and again the service and support within our global sales and service organizations is emphasized by our customers.

Our Laser Markers Especially Suited for Solar Applications ...

... span fiber systems for high resolution applications that require footprint, Nd:YAG systems for high speed applications and CO2 laser coders for less demanding/ lower resolution applications.

Fiber Laser Markers (10/20W pulsed)



Nd:YAG Laser Markers (50/100 W)



CO2 Laser Markers (10/30/50 W)



Solar References

Norway: Raw silicon blocks are laser coded with a 2D mark after cutting the blocks into thin wafers for internal track and trace purposes.

Germany: Solar panel manufacturer uses Alltec systems for the application of 2D codes on solar modules.

Sweden: Application of laser marked 2D codes for track and trace reasons onto the glass backside of thin-film cells.

German OEM: Alltec's 20W fiber laser marker drills holes into silicon wafers for the processing of back side contacts.

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