

# Videojet® Solar / Photovoltaics

Industry Laser Case Study

Keep Track of the Wafer:

Laser Marks on Solar Cells,  
Modules and Thin-Film Substrates

## Laser.

Ink Jet.

Thermal Transfer.

Labelers.

Track & Trace.

Supplies.

Parts & Service.

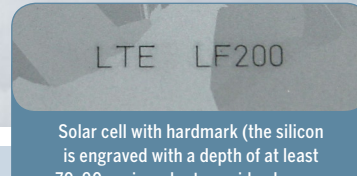


Polycrystalline solar cell.

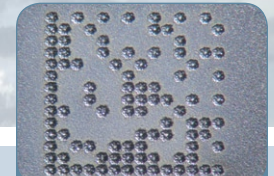


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Engraving on silicon block.  
Marked with a Nd:YAG laser system.



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



2D engraving on silicon wafer.  
Marked within 400 ms.

Ecological awareness and diminishing fossil fuel resources have pushed photovoltaics from a niche business into a global alternative to conventional power generation. In order to reduce production costs and increase 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 with exceptional marking quality, without damage to the sensitive material.

## Challenges

Consumers are now requiring up to 25-year warranties on solar modules, making wafer marking in solar cell manufacturing key to traceability and improved manufacturing processes. For product tracking and tracing, these solar cells, modules and the support materials of thin-film cells are laser marked with clearly readable alphanumeric symbols, 2D data matrix codes and manufacturer logos. The marks are usually rather small, with their size ranging from semi-visible (font size ~ 75 µm) to several centimeters. The minimum font width amounts to 10 µm. The demands on the marking quality are high: marks have to be machine-readable, should not affect other manufacturing steps and should enable clear identification – even at the end of the production process.

## Solution

Videojet offers an entire range of laser markers, including CO<sub>2</sub>, Nd:YAG and Fiber systems. We offer the optimum laser marking solution for the respective solar application, whether it is direct marking of solar wafers, marking on the substrates of thin-film cells or the drilling of holes for the processing of back side contacts.

## 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 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.

**Videojet systems apply these 2D codes "on the fly" (mark wafers while they move)!**

## Materials and Marking Contents

Videojet laser marking and engraving systems apply marking data (2D matrix codes, serial numbers, logos, etc.) to a variety of metallic and non-metallic materials. In the solar energy sector, they precisely mark silicon wafer material and the substrates of thin-film cells (e.g. glass, metal or others) for purposes of traceability and process optimization. Our fiber laser markers are the best and most economic solution as they deliver high speeds and precise focussing to guarantee clean, high resolution marks.

## High Marking Speeds for High Throughputs

Videojet's proprietary scan technology guarantees high efficiency and throughput at best achievable marking quality and highest marking speeds.

**Unlike other suppliers of laser markers for the solar energy sector, Videojet systems are characterized by their ability to even mark 2D codes "on the fly" – when the wafer is moving.** With Videojet systems the production line does not have to be stopped for the marking process.

## Absolute Traceability and Durable Identification

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

## Best Marking Quality

The demands on the marking quality are high, and the results our systems deliver against these requirements are unmatched. Minimal substrate damage and machine-readable codes allow faultless identification and tracing throughout the entire production process and afterwards. Plus, the high beam qualities and a range of marking fields guarantee 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 laser systems can be perfectly and cost-effectively integrated even into critical production environments.

## Additional Advantages

### Superior Service

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

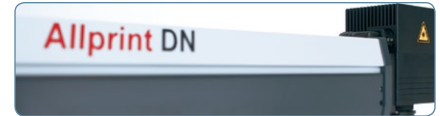
## Laser Markers Especially Suited for Solar Applications

Our laser marker portfolio spans fiber systems for high resolution applications that require small footprint, Nd:YAG systems for high speed applications and CO2 laser coders for less demanding/lower resolution applications.

### Fiber Laser Markers



### Nd:YAG Laser Markers



### CO2 Laser Markers



## 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 laser systems for the application of 2D codes on solar modules.

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

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



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