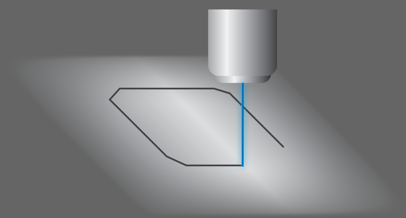
LASER MICROJET® APPLICATIONS IN PV

Wafer or cell cutting

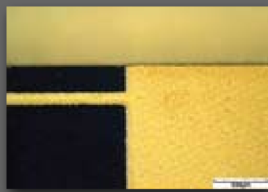
Solar wafers, such as those produced from Si ribbons, have to be cut to their final dimension.



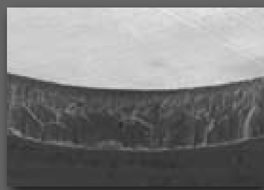
The LMJ is the ideal solution to cut mono Si, multi-Si, ribbon Si and III - V solar cells.

LMJ advantages:

- Damage-free edges, no HAZ, no microcracks
- No edge etching necessary
- 2.5 higher fracture strength compared to dry laser
- No contamination or surface deposition
- No slag/burr formation
- Parallel and smooth cut walls



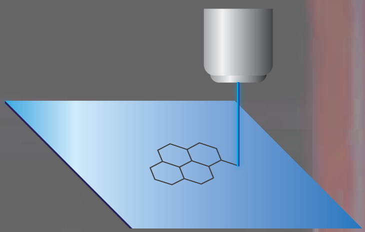
Mono crystalline Si solar cell
Cutting speed: 125 mm/s
Thickness: 230µm



Si ribbon solar cell
Cutting speed : 75 mm/s
Thickness : 330µm

Dicing for concentrated pv

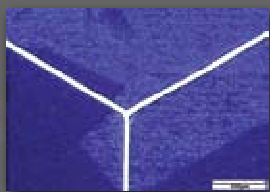
At the heart of concentrated photovoltaic modules are mainly high-efficiency photovoltaic cells. The shape of the high efficiency cells used in CPV applications is obtained by cutting large cells into smaller units. The methods applied should not influence the electrical efficiency of the cell.



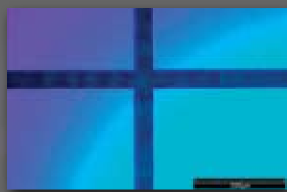
The LMJ process is able, thanks to its cooling water jet, to cut solar cells without influencing the electrical efficiency and can dice photovoltaic cells in any possible shape with fast throughput and damage-free quality.

LMJ advantages:

- No influence on electrical properties
- No micro-cracks
- Excellent fracture strength
- Omni-directional cut



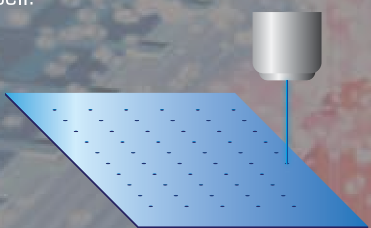
Hexagonal Dicing of Si Cell
4" wafer hexagonal shape
900 chips/wafer
Throughput: 1.67 s/chip



Triple junction solar cell
Cutting speed: 100 mm/s
Thickness: 150µm

Drilling (metal wrap through)

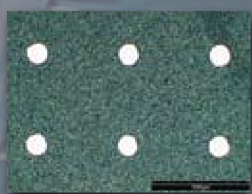
An innovative process, called Metal Wrap Through (MWT), improves the overall cell efficiency of multi-crystalline Si cells by bringing all electrical connections to the backside of the cell. This is made possible by drilling via holes through the entire cell.



The LMJ cools the edges and prevents particle contamination, advantages that are essential for drilling silicon wafers with high quality.

LMJ advantages:

- No influence on electrical properties
- No thermal damage
- Damage-free edges
- No surface contamination



Polycrystalline solar cell
Cutting speed per hole: 1.8s
Hole diameter: 100µm

Si solar cell
Cutting speed per hole: 2s
Hole diameter: 210µm

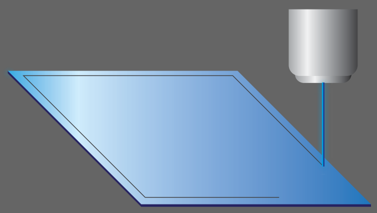
For more information contact: www.synova.ch // info@synova.ch // + 41 21 694 35 00

SYNOVA

LASER MICROJET® APPLICATIONS IN PV

Edge-isolation

Edge isolation (EI) is required to prevent shunts between front and back sides of solar cells.

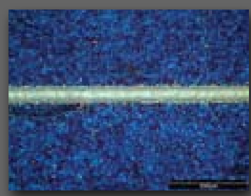


Carrying out PV cell EI with the LMJ is a fast and reliable process. The PV material is not subjected to damaging mechanical forces, it is protected from possible detrimental thermal effects and no contaminants or deposition of ablated material are left behind requiring additional measures.

LMJ advantages:

- Grooving speed 300 mm/s, depth ~ 30µm with 1 pass
- Constant lower n2 values for LMJ caused by reduced emitter damage
- Single process with proven higher breakage forces
- Back surface edge isolation successfully demonstrated
- Better groove quality and homogeneity

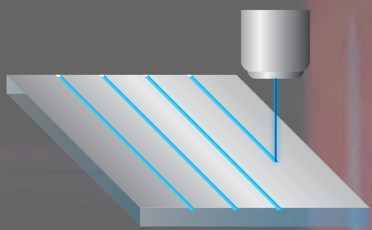
Grooving speed: 300 mm/s
Depth: 30µm with 1 pass
300ns



Groove
Grooving speed: 350 mm/s
Grooving depth: 25µm

Thin film scribing

Thin film solar cells, made by sequentially depositing layers of material on to an inert substrate area, must be grooved in 3 steps (P1, P2, P3).

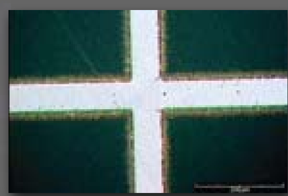


The LMJ can scribe/ablate or selectively remove one or more surface layers, with no de-lamination, leaving the underlying layers untouched. The water jet has no effect on the groove quality.

LMJ advantages:

- Non-flat surfaces are processed fast and easily
- Smooth and straight edges
- No contamination
- Narrow line width
- No thermal damage

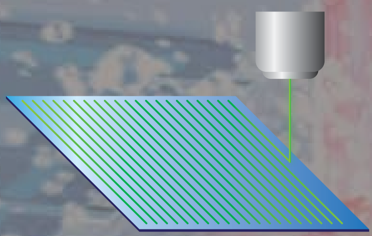
Metallic layer on glass (front view); groove width ~65µm
Electrical isolation R>1MW
Cutting speed: 1000 mm/s



CIS + Mo on glass,
groove width ~70µm
Electrical isolation R>20MW
Cutting speed: 500 mm/s

Laser doping of si cells

Efficiency of solar cells can be increased by using local diffusion underneath front contacts, so-called selective emitters.

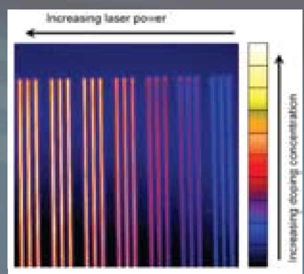


In replacement of water, the LMJ uses a phosphorus acid jet which offers a revolutionary technique to locally dope Si cells. The Laser Chemical Process (LCP) is a new technique for the formation of selective emitters, co-developed with Fraunhofer ISE.

LMJ advantages:

- Local emitter formation
- 20.4% efficiency already proved
- No need for separate damage etch and diffusion
- Fast process compared to existing selective emitter techniques
- P-type back surface field doping successfully demonstrated

Locally doped selective phosphorus emitter with a front metal finger



Courtesy of Fraunhofer ISE

Fraunhofer ISE Institut Solare Energiesysteme