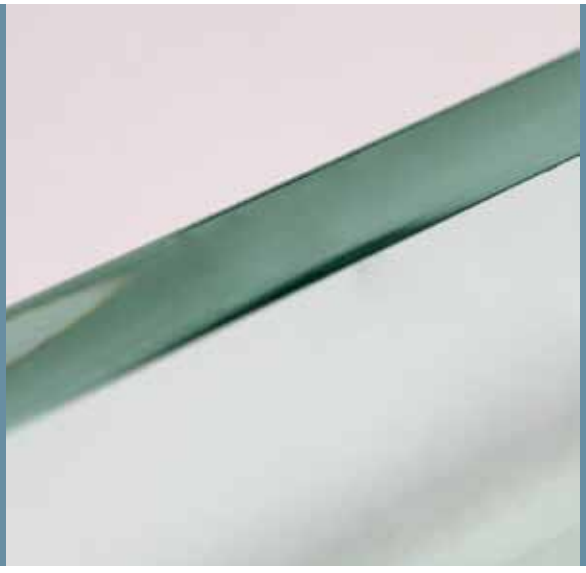
JENOPTIK

Bystronic glass

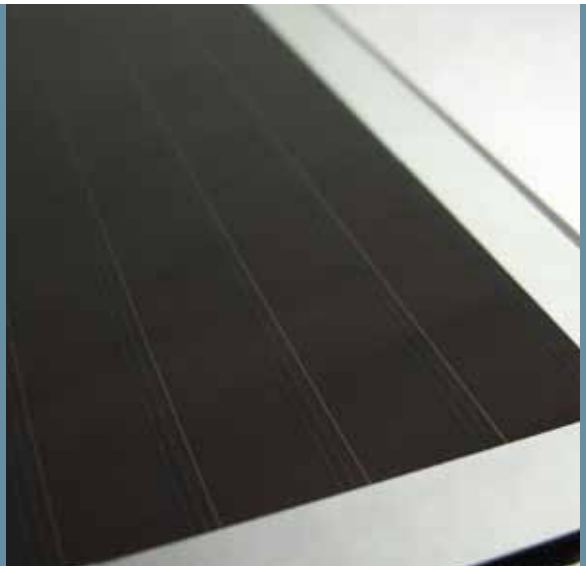
JENOPTIK - VOTAN™ Solas 400

Laser systems for the production of thin film photovoltaic modules

TLS - Thermal Laser Separation



Laser Edge Deletion



Microcrack free glass edges reduce manufacturing costs

- shorter heating and cooling cycles in the coating process
- higher production uptime due to less glass breakage

Microcrack free glass edges increase PV module properties

- very high bending strength
- more resistant to temperature fluctuations

Low cost of ownership

- high productivity, ablation speed up to 50 cm²/s
- low maintenance effort, no wear parts, no consumables

High quality

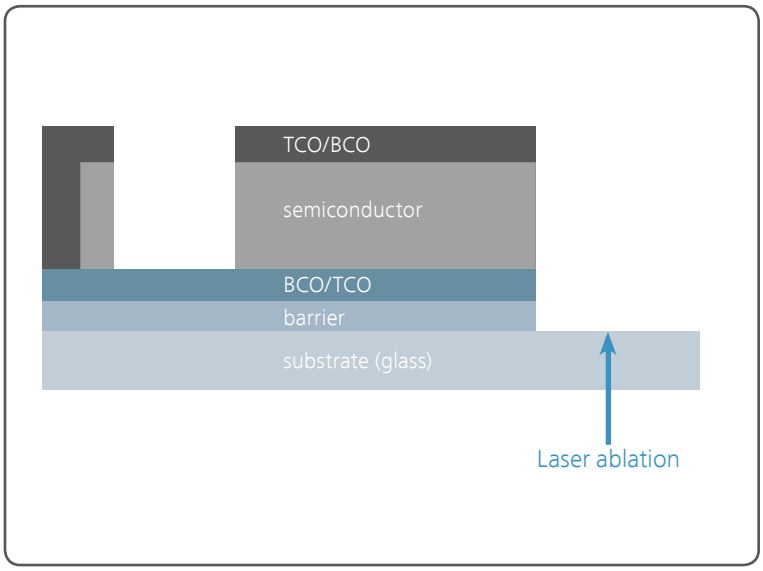
- no delamination, no lift off, no glass damage
- high transparency of ablated areas
- electrical resistance > 1 GOhm

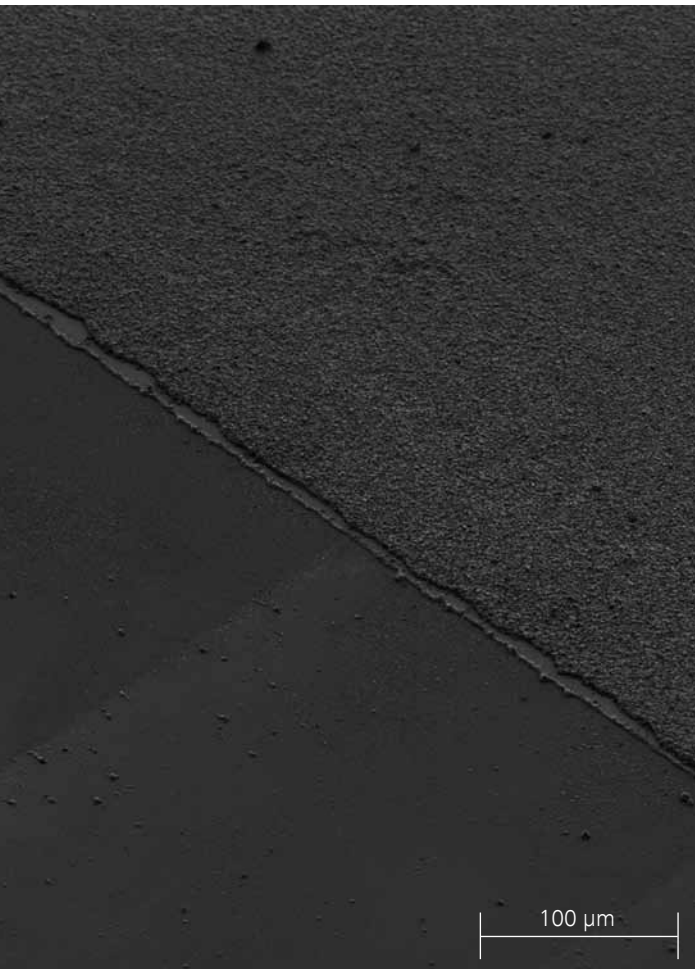
Available for all thin film technologies on any substrate size

Laser Edge Deletion (LED)

Principle

- A short-pulsed high-performance laser will be shaped into a homogeneous beam spot.
- While superposing a moving beam with a transversal movement the laser spot traces the complete deletion area by an uniform motion
- The deletion process is carried out through the glass substrate. This ensures a high throughput and the risk of melting effects at the edge of the deletion area is eleminated





Laser deleted area (REM)

The laser edge deletion technique will facilitate the deletion of surface areas of coated sheet glass in economical way and in top quality. This will make it possible to simplify the production process of thin-film photovoltaic modules and to reduce the maintenance effort, as to achieve an improved product quality at lower costs. Deletion rates of between 25 cm²/s and 50 cm²/s will be attained almost independently of the layer configuration. Due to the short pulse the deletion process leaves a completely undamaged and smooth glass surface.
The minimal quantities of waste, which are generated in the process without any media being added, will be removed through an efficient extraction system and disposed subsequently in a simple way.

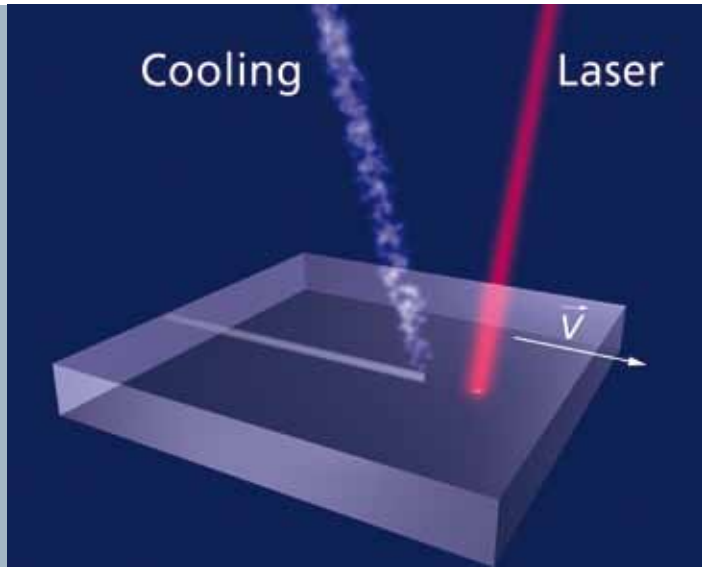
The benefits at a glance:

- customer-specific process parameters
- high transparency of the deletion area
- no delamination, no damage to the glass
- electrical resistance > 1 GOhm
- deletion rate up to 50 cm²/s
- highest productivity

Thermal Laser Separation (TLS)

Principle

- Laser beam (red) heats up the material, whereby compressive stress is induced into the material
- Directly after the laser beam, a coolant (blue) is applied to the surface, causing tensile stress in the material
- Starting from the initial crack, a crack propagates along the working line



As laser processing is superior to mechanical processes, it opens up completely new perspectives. The advantages of TLS technique make it possible to integrate laser cutting into various stages of the production process.

The benefits at a glance:

- Ultra-thin as well as thicker glass can be safely and perfectly processed with the laser technology
- Laser cuts with a high and controlled precision
- Glass surfaces and cover layers will remain clean and undamaged, since no glass residues or splinters are generated
- The coating will remain flawless right up to the edge and thus fully functioning
- Splinter-free laser scoring or cutting will increase both edge quality and strength
- Wear free laser tools–long service life
- It is possible to save process steps, such as grinding and cleaning
- Highest flexibility & process stability-low process costs

TLS-glass edge

JENOPTIK-VOTAN™ Solas 400

The JENOPTIK-VOTAN™ Solas 400 production line combines the know-how of the glass machine manufacturer Bystronic glass and the laser expertise of JENOPTIK Automatisierungstechnik GmbH.

The product portfolio comprises machines for:

- laser edge deletion
- TLS – thermal laser separation (TLS)
  as well as
- both processes combined in one compact machine including the separation unit

The JENOPTIK-VOTAN™ Solas 400 can be operated as a stand-alone system and be integrated into all back-end or pre-processing lines in the most optimal way. Highly efficient and complete solutions will be created in combination with the TPS® I.G. lines for production of thin-film photovoltaic modules.

Advantages

- compact machine design
- modular configuration
- simple line integration
- cycle time neutral depaneling

Technical specification

System	JENOPTIK-VOTAN™ Solas 412 C		JENOPTIK-VOTAN™ Solas 426 C	
Glass format	min. 900 mm x 600 mm max. 1600 mm x 1200 mm		min. 1600 mm x 1600 mm max. 2600 mm x 2600 mm	
Glass thickness	min. 2 mm max. 6 mm	further thich-nesses on request	min. 2 mm max. 6 mm	further thich-nesses on request
Positioning accuracy	+0.2 mm		+0.2 mm	
Cutting speed	max. 600 mm/s		max. 600 mm/s	
Removal rate at edge deletion	max. 50 cm²/s		max. 50 cm²/s	
Working height	950 mm + 20 mm		950 mm + 20 mm	

The right is reserved to make technical improvements at all times.

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Cooperation product of JENOPTIK Automatisierungstechnik GmbH and Bystronic Maschinen AG:

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