

## Applications Datasheet –

### Edge Deletion for thin film photovoltaic modules

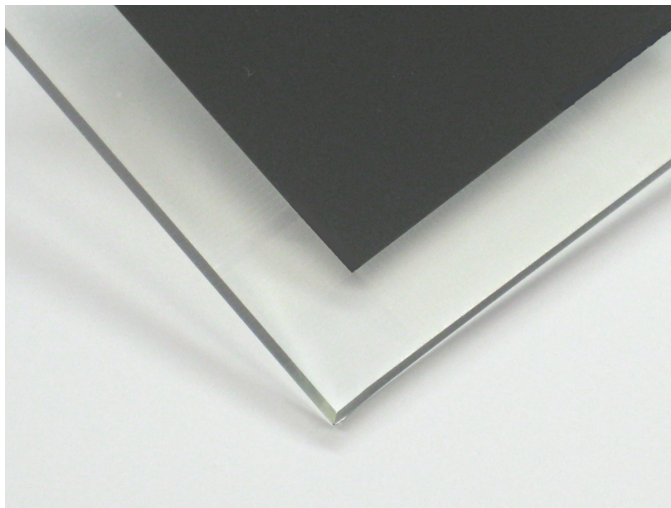
Using the Powerlase Starlase range of lasers

#### Introduction:

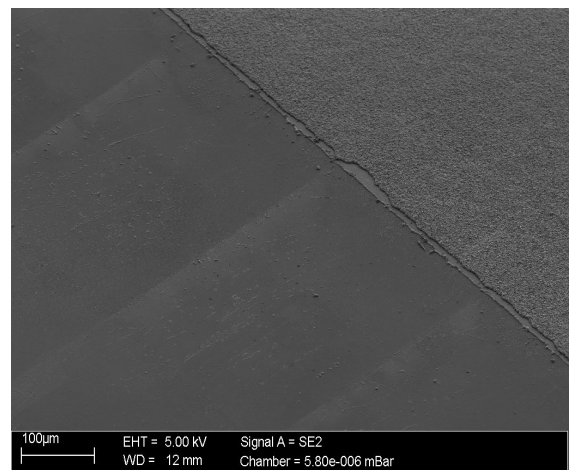
Following the scribing and deposition processes of the thin film PV production line, the last stage before encapsulation and framing is the removal of the coatings around the edge of the panel. This is known as edge or border deletion. The process is required for two reasons – firstly to electrically isolate the active photovoltaic regions from the metal frame, and secondly to allow the environmental sealing process to bond directly to the glass. Typically the width of the deleted border is 10 to 15 mm, so in order to meet high volume manufacturing requirements with large area panels; removal rates in the order of 30 to 50 cm<sup>2</sup>/sec are needed.

Earlier methods of edge deletion included sand blasting and grinding, however the most reliable method is to use laser ablation through the use of high average power, nanosecond pulse duration, diode pumped solid state (DPSS) lasers. The Powerlase Starlase range feature average output powers from 200 W to 1600 W, and these lasers can produce high quality edge deletion results at the required process speed that meet production requirements for electrical isolation and residue levels.

All of the Starlase range can use optical fibre beam delivery, and for this application Powerlase recommends using square optical fibres. This type of fibre produces a square, top-hat beam profile which enables efficient material removal.



Typical laser processed edge deletion sample



SEM image of processed sample

## Sample description

Substrate: Typically soda lime glass (between 3 to 6 mm thick).  
Coating: Multilayered, including: transparent conductive oxide, semiconductor and metal coatings  
Solar Cell types: a-Si, Cd-Te and CIGS designs, plus others.

## Typical Customer Targets

Edge deletion: 10 to 17 mm wide  
Electrical isolation: 1G $\Omega$  at 1kV  
Residue: None  
Damage to substrate: None

## Achieved results

Total ablation of coating: Complete (Through Glass Ablation Process)  
Edge width: 12mm  
Processing rate: up to 50 cm<sup>2</sup>/sec  
Electrical resistance: Fully isolated, >999 M $\Omega$  at 1kV  
No damage to glass: (no micro-cracks in substrate and no surface damage)

## Laser System

Model: Starlase AO2, AO4, AO6 or AO8 (process speed depends on average output power & specific threshold removal fluence requirements)  
Pulse repetition range: 6 to 10 kHz (typical range for this application)  
Pulse duration: 37 ns (at 6 kHz)  
Wavelength: 1064nm

## Optical setup

Beam delivery: Via square fibre (600  $\mu$ m, 800  $\mu$ m and 1000  $\mu$ m available)  
Scanner type: Galvanometer  
Scanner objective lens: F-Theta Lens, Focal Length 163 mm  
Collimating lens: Focal Length 130 mm  
Homogeniser used: None  
Mask used: None

## Typical Processing Rate (by Laser type)

