Application Note #01

Laser Scribing for Thin Film PV Panels with IPG's Novel Pulsed Green Fiber Laser

Introduction

Thin film photovoltaic cells (as compared to wafer based crystalline silicon cells) are made up of different combinations of coating layers. These coating combinations are commonly referred to as “film stacks.” Large numbers of individual cells are then created by electrically isolating them from each other by scribing. Laser scribing is the widely preferred technique, well established for some of these films, most notable the Transparent Conductive Oxide (TCO) film deposited initially directly onto the glass substrate. This film is routinely scribed in volume production using near infrared lasers. An even more challenging application for lasers is the P2 scribe. In this case the laser beam may pass through the TCO layer and must remove cleanly the strongly absorbing P2 photovoltaic active layer. This requires great precision and is not always possible with a near infrared laser. There are many advantages to using a frequency doubled green laser with an emission wavelength of 532 nm vs. a near infrared laser for the P2 scribe.

A recent IPG product release document describes a new fiber laser that emits a high brightness laser beam at the green wavelength. The experimental work presented here shows preliminary scribing results that have been achieved using a commercially available scribing system and the IPG laser on the P2 layer of a Cadmium Telluride (CdTe) thin film stack.

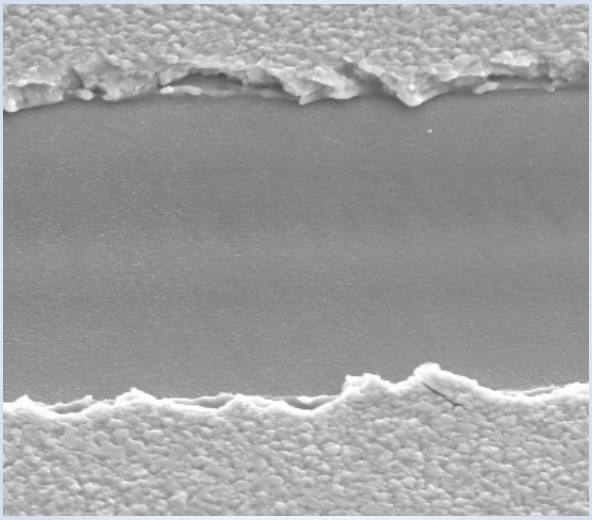

Figure 1: 200 kHz, 300mW 1 m/s, scribe width 3 m

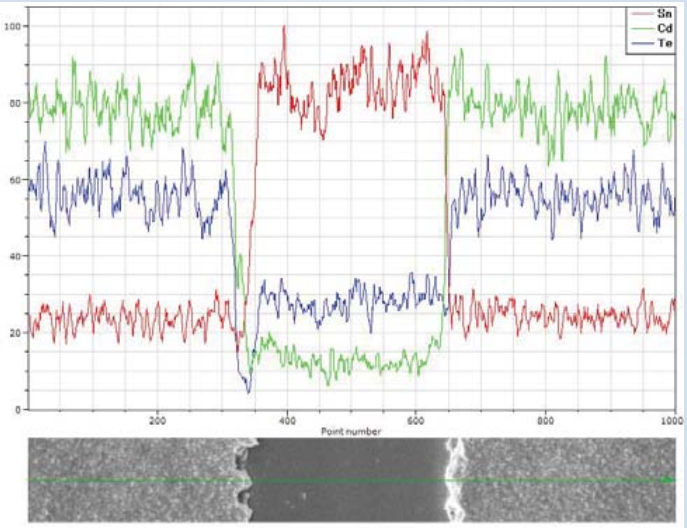

Figure 2: Elemental Line Trace showing removal of P2, no damage to SnO_2 layer

Set Up

Laser: YLP-G_5
System: Vytek ProtoScribe, www.solarscribing.com
Focus lens: 125 mm singlet

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Experimental Trials

Preliminary scribing trials were performed with the laser beam passing through the glass to identify appropriate laser parameters for removal of the acrive layer cleanly from the TCO layer. Focus position, process speed, laser power and pulse energy were all changed incrementally to achieve the approximately optimized removal (Figure 1).

EDAX analysis was then performed on a series of scribes to check for complete removal of the active layer from the underlying layer, which in this case was tin oxide (SnO_2), see figure 2.

Conclusions

- Preliminary scribing trials performed with the laser beam passing through the glass
- No damage to the ITO layer
- Commercially acceptable speed at very low power

Contact

IPG Photonics looks forward to helping our customers with their laser applications; our Application Facilities will work with end users and systems integration partners from proof-of-concept through process development for all materials processing applications.

Contact any of IPG's worldwide application facilities to arrange complimentary sample processing, evaluation and project planning.
Go to www.ipgphotonics.com for more information on all of IPG's products.

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