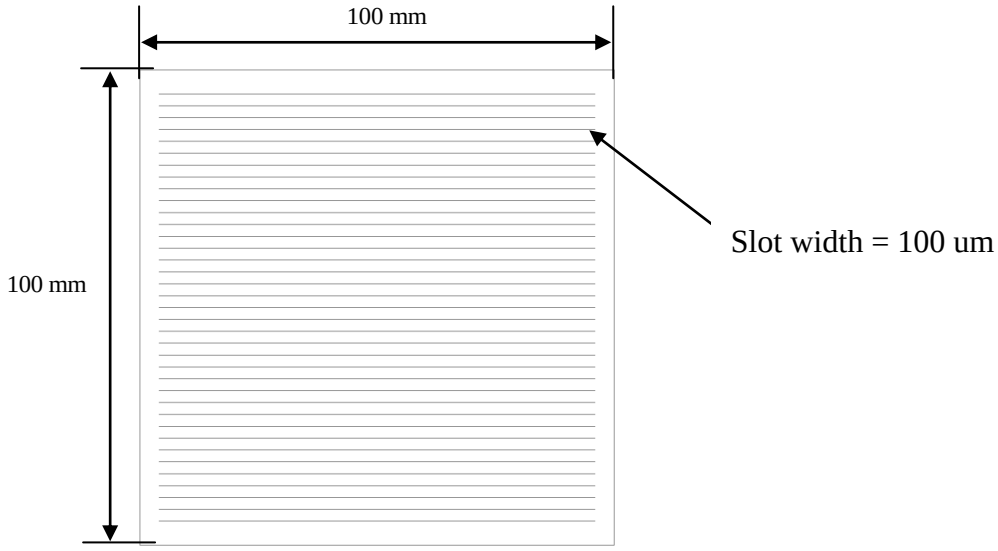
REPORT: Thin film solar cell by Laser-MicroJet®

for Anonymous

by M. Stephane Sung; Synova SA

TASK

The Laser-MicroJet® technology has been tested for manufacturing of an evaporation mask for grid manufacturing as below.



Release of application report			
Project Leader		Responsible Application Group	
Name:	Stephane Sung	Name:	Dr Benjamin Carron
Date:	21.03.2012	Date:	26.03.2012
Visum:		Visum:	

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE	Material	Stainless steel
	Dimension	100 X 100 *mm*
	Thickness	200 *µm*
	Quantity	1 *pcs*

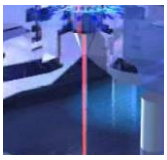
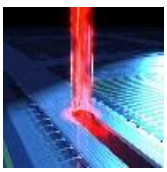
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, the LCS150 has been used as the machine configuration in our lab.

Major advantages of Laser-MicroJet® technology with regards to this application are:

- Negligible heat damage to the material
- No slag/burr formation
- Excellent wall surface quality
- Parallel cut

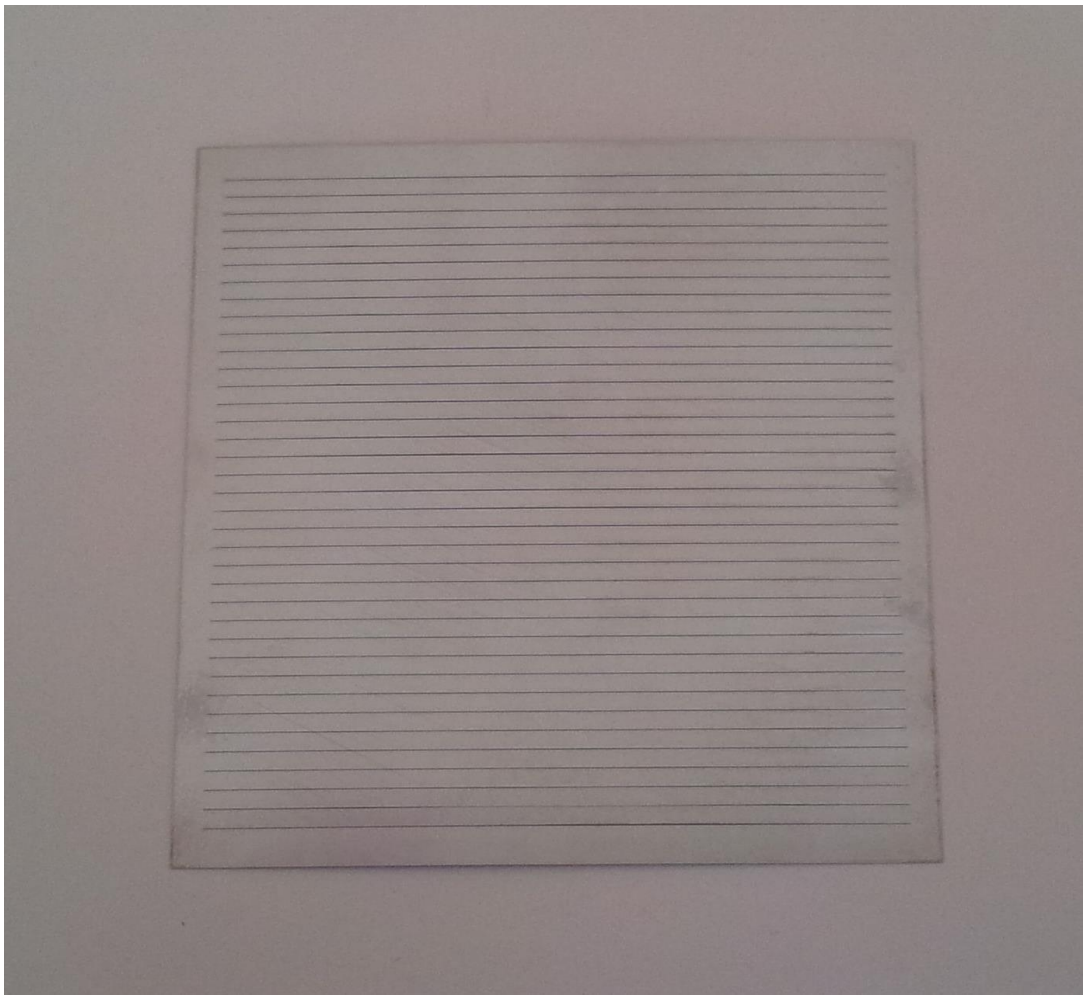
In the table below, the optimized processing parameters used in the experiments are summarized:

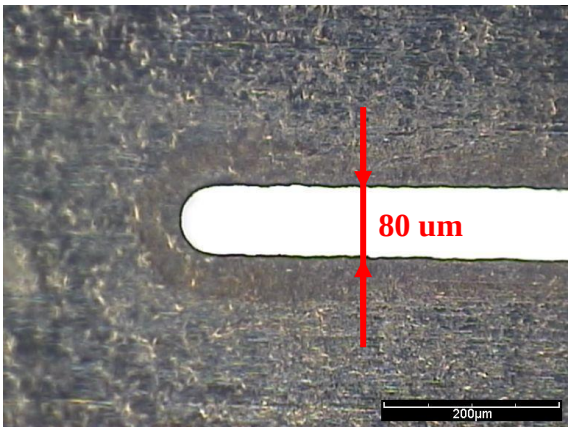
	SYSTEM	Machine type	LCS150
			
	**MICROJET® PARAMETER**	Nozzle diameter	80 *µm*
		MicroJet® diameter	68 *µm*
		Water pressure	220 *bar*
		Assist gas	He
	**LASER PARAMETER**	Laser type	L101G
		Wavelength	532 *nm*
		Pulse frequency	14 *kHz*
		Average power	34 *W*
	**CUTTING PARAMETER**	Cutting speed	6 *mm/s*
		Number of passes	4
		Overall speed	1.5 *mm/s*
		Process time	41 *min*

RESULTS

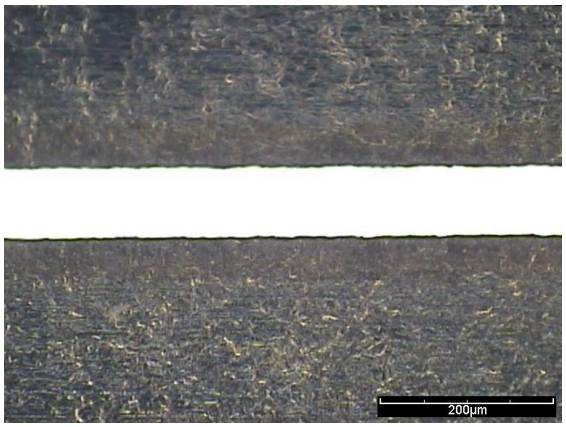
Some tests have been processed with different cutting parameters, which enable to check for the quality and allow selecting the parameters that are best suited for this application.

The following pictures give an overview on the quality obtained with the Laser-Microjet® technology.

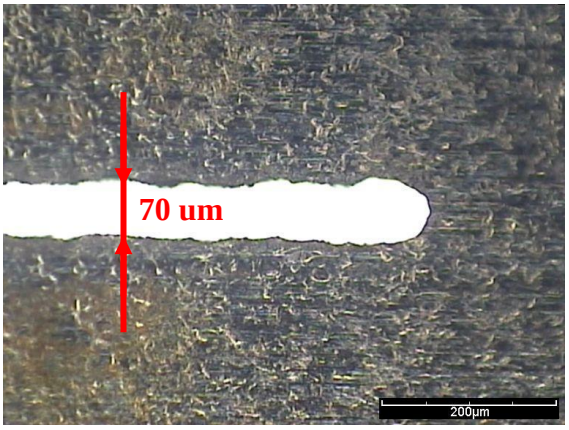




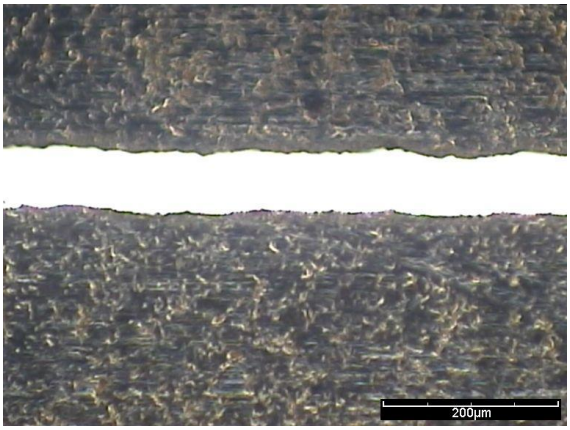
PICTURE 2: Microscope image of an extremity, front side.



PICTURE 3: Microscope image of center, front side



PICTURE 4: Microscope image of an extremity, back side.



PICTURE 5: Microscope image of center, back side.

	What are your priorities? (please put a cross)	Quantified expectations or improvements
• Burr-free:	X	OK
• Heat-damage free:	X	OK
• Chipping/Cracks:	X	OK
• Edge Roughness:	X	OK, but irregular
• Tolerances:	X	Need to check which tolerances the customer is referring to; there is no tolerances on provided drawing
• Fracture strength:	X	OK, but noticeable camber on processed sample

CONCLUSION

The cutting of stainless steel sample has been performed on SYNOVA LCS 150. This machine is based on the MicroJet® technology and combines the advantages of the high energy pulsed laser with a hair-thin water jet. While the laser is used for material ablation, the water jet is used for guiding the laser light, cooling the edges and preventing the sample from particle contamination, advantages that are essential for cutting stainless steel with high quality.

These tests show that we have fulfilled all customer's requirements except;

- The slot width is rather 80µm instead of required 100µm. We may need to retry this sample using 100µm nozzle to get a larger kerf.
- Back side cut is quite irregular with smaller slot width; ~70µm.
- Tolerances: customer needs to specify tolerances range.

There are possibilities to improve cut quality on backside by increasing laser power and process the cut in one pass. The process speed as well can be improved. We first would like a feed-back on the process time and cutting quality before investigating further this application.

We thank you for your interest in our technology and we hope our results meet your requirements. Our Sales Director Joerg Pausch will contact you soon to obtain a feedback about the analysis of these results and to discuss with you the further steps. Indeed Synova is very interesting with challenging and exciting projects and we would be very interested to work again with you on this application.