

REPORT: Aluminum slotting by Laser-MicroJet®

for Anonymous

by Mr Stéphane Delahaye; Synova SA

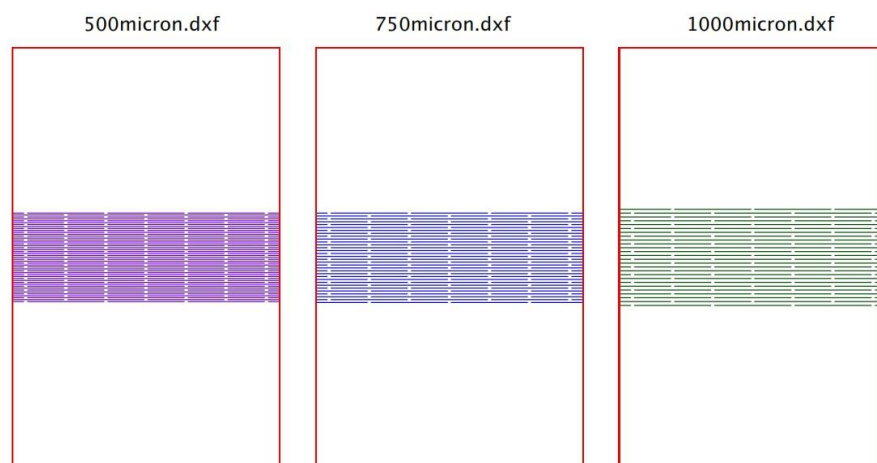
TASK

The Laser-MicroJet® technology has been tested for cutting slots into anodized aluminum coupons. The highest priority was to obtain high quality samples.

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE	Material	Aluminium
	Dimension	70*110 mm
	Thickness	800 µm
	Quantity	10 pcs

10 plates were provided for the tests. 3 different samples have been produced according to the drawings below:



Picture 1: drawings used for the cut

Release of application report			
Project Leader		Responsible Application Group	
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Date:	14/03/2012	Date:	14/03/2012
Visum:		Visum:	

PROCESS: INSTRUMENT & TEST PARAMETERS


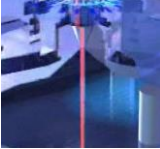

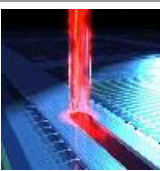
For these experiments, the LCS150 equipped with a frequency-doubled Q-switched Nd-YAG laser has been used as the machine configuration in our lab.

It is a manually loaded machine allowing to cut, drill, groove, scribe, trench, mark, or grind a wide range of materials.

Major advantages of Laser-MicroJet[®] technology with regards to your application are:

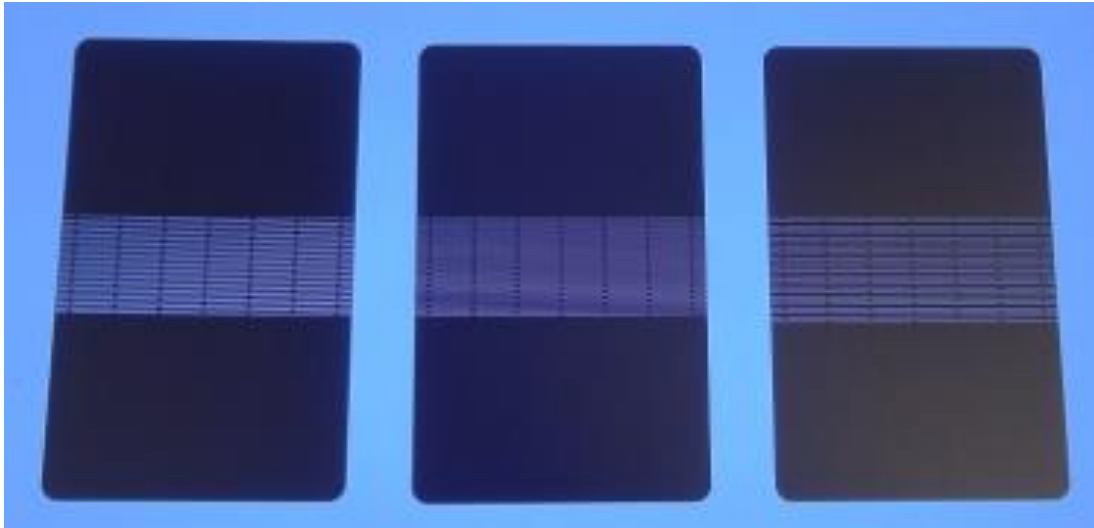
- Cutting of arbitrary shapes
- No heat damage to the material
- No slag/burr formation
- Negligible contamination / re-deposition

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

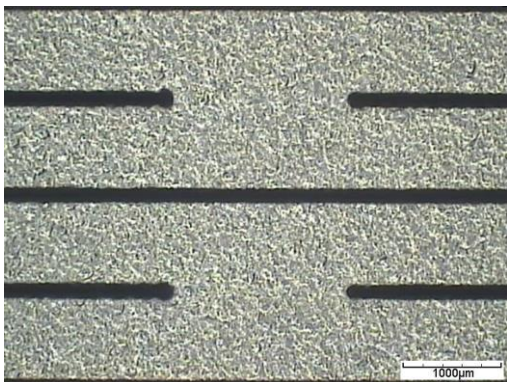
	SYSTEM	Machine type	LCS150
	MICROJET[®] PARAMETER	Nozzle diameter	60 μm
		MicroJet [®] diameter	~48 μm
		Water pressure	300 <i>bar</i>
		Assist gas	He
	LASER PARAMETER	Laser type	L101G
		Wavelength	532 <i>nm</i>
		Pulse frequency	14 <i>kHz</i>
		Average power	39 <i>W</i>
	CUTTING PARAMETER	Cutting speed	12 <i>mm/s</i>
		Number of passes	8
		Overall speed	1.5 <i>mm/s</i>
		Fixture	clamps

RESULTS

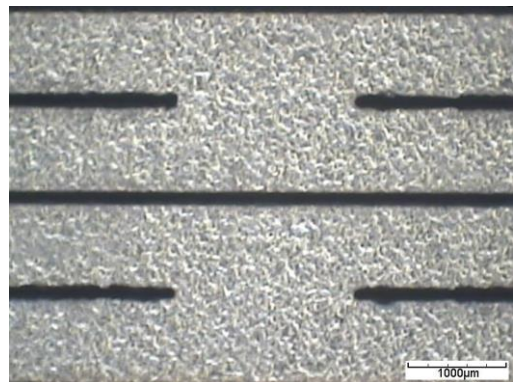
The following microscope picture give an overview on the quality obtained with the Laser-Microjet[®] technology.



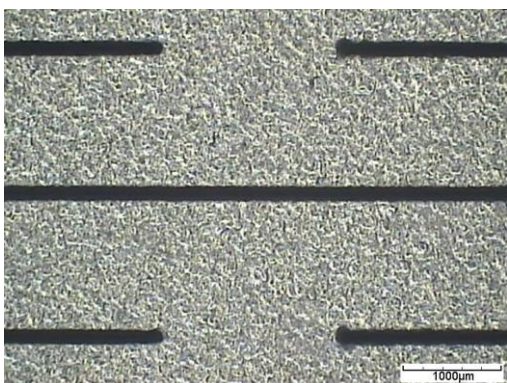
Picture 2: digital camera picture of the 3 processed samples



PICTURE 3: Microscope image of the “500micron” sample (dark field illumination; frontside view)



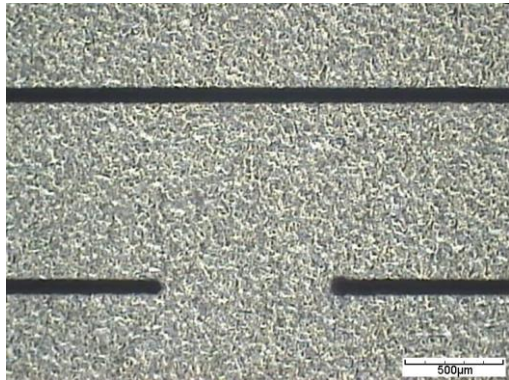
PICTURE 4: Microscope image of the “500micron” sample (dark field illumination, backside view)



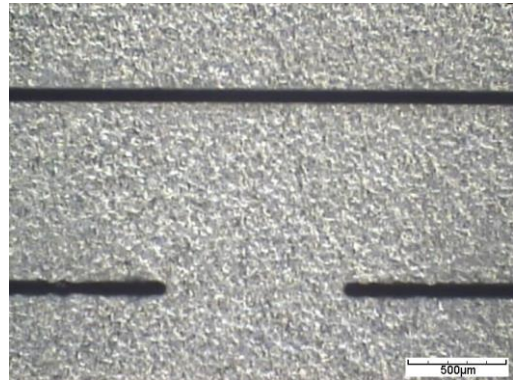
PICTURE 5: Microscope image of the “750micron” sample (dark field illumination; frontside view)



PICTURE 6: Microscope image of the “750micron” sample (dark field illumination, backside view)



PICTURE 7: Microscope image of the “1000micron” sample (dark field illumination; frontside view)



PICTURE 8: Microscope image of the “1000micron” sample (dark field illumination, backside view)

The table below presents a comparison between your expectations and the actual results.

	What are your priorities? (please put a cross)	Quantified expectations or improvements
Speed / throughput:	X	~ 32 min/“500micron”sample ~ 27 min/“750micron”sample ~ 22 min/“1000micron”sample
Kerf-width:		~ 70µm
Burr-free:	X	Only few small burrs are visible on the backside
Contamination/Particles:	X	No
Heat-damage free:	X	No HAZ

CONCLUSION

The cutting of slots into aluminium was investigated on SYNOVA LCS150. 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 slots with high quality.

These tests show:

- The overall quality is good especially on the frontside
- No heat-damage has been observed
- Almost no burr are visible on the backside
- Backside start/end of the slots are sometimes not perfectly parallel

We thank you for your interest in our technology and we hope our results meet your requirements. Our sales agency 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.