REPORT: Aluminium cutting by Laser MicroJet®

for Anonymous

by Florent Bruckert, Synova SA

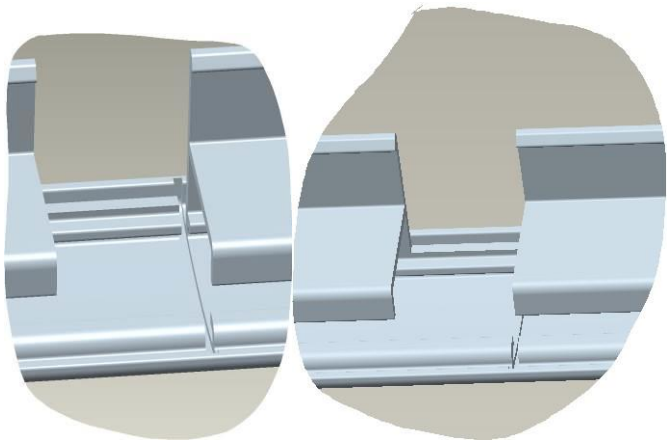
1. TASK

The Laser MicroJet® technology has been tested for cutting and scribing an aluminium rail. The aim was to first test for feasibility using the Laser MicroJet® technology.

2. SAMPLE DESCRIPTION

The tests were performed on a rail of aluminium with the following specifications:

SUPPLIED MATERIAL		**Worpiece**
	Material	Aluminium
	Thickness [µm]	1200
	Quantity	2



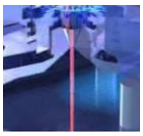
PICTURE 1: Drawings of the final workpiece (blank=part to remove)

Release of application report			
Project Leader		Industry BU Responsible	
Name:	Mr F. Bruckert	Name:	D[r] Carron Benjamin
Date:	25.02.2013	Date:	28.02.2014
Visum:	FBR	Visum:	BC

3. PROCESS: INSTRUMENT & TEST PARAMETERS

For this application, an LCS300 equipped with a frequency-doubled, Q-switched, Nd:YAG laser, has been selected as the best machine configuration available in the lab.

The table below summarizes the general parameters used in the experiments.

	**SYSTEM**	Machine type	LCS300
		Fixture	Clamped
	**MICROJET® PARAMETER**	Nozzle diameter	80 *µm*
		Working distance	25 *mm*
		Assist gas	He
		Water pressure	100 *bar*
	**LASER**	Laser type	L101G
		Wavelength	532 *nm*
		Repetition rate	10 *kHz*
		Power in the laser head	47 *W*
		Power in the waterjet	28 *W*
		Pulse duration	150 *ns*

4. RESULTS

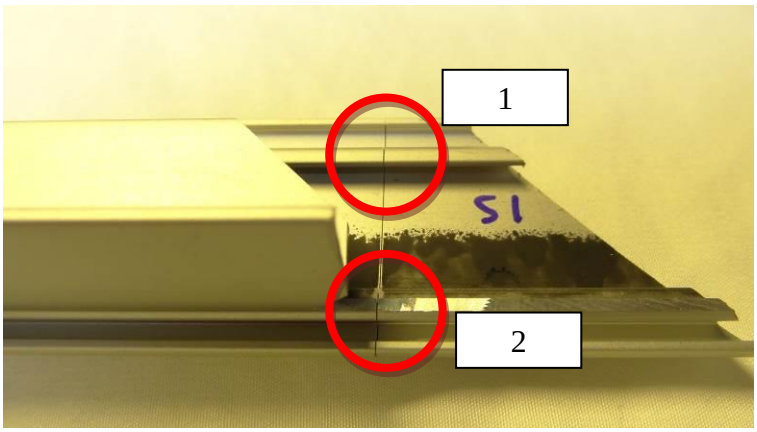
In this section, you can find a summary of the steps done to cut the 2 samples.

4.1. SCRIBING

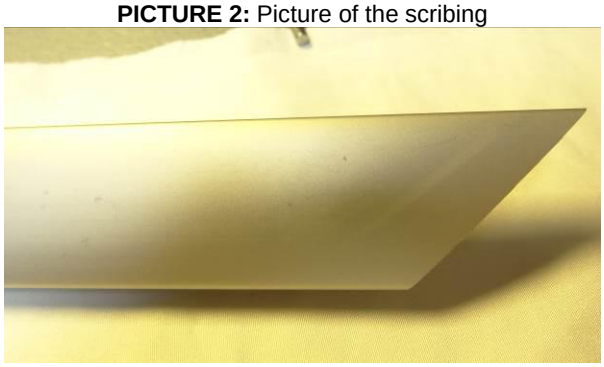
The aim was to scribe from the backside of the rail in order to weaken it. The scribing had to be blind (not visible on the other side) but deep enough to allow the rail to be broken in two pieces by hand.

To that purpose, the scribing has been processed in 3 steps:

- First line: 25 mm length, 13 passes @ 20mm/s. Duration:17s
- Second line on the thicker part 1 : 1.3 mm, 90 passes @ 20 mm/s. Duration: 5s
- Third line on the thicker part 2 : 1.0 mm, 90 passes @ 20 mm/s. Duration: 5s



PICTURE 2: Picture of the scribing



PICTURE 3: Backside of the scribed part

As can be seen in picture 3, the back side of the rail does not show any flaw from the scribing process.

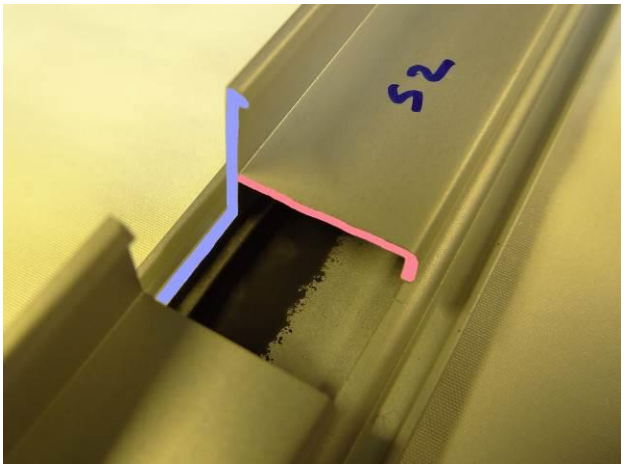
4.2. CUTTING

In order to cut through the varying thicknesses of the rail, the cutting process was divided in two separate steps.

1) A rectangle was cut through the edge of the rail. The rectangle is visible in picture 5. The cutting profile is highlighted in blue in picture 6. The side highlighted in red was cut during the second step as described below.
   The cut was done in 27 passes @ 20mm/s taking 1'10" (rectangle 15.4mm x 12mm)

2) A rectangle was cut through the perpendicular side of the first cut. The cutting profile is highlighted in red in picture 6. It is important to stress that a backstrike protection (in PTFE) was used in this cut in order to prevent any damage to the lower side of the rail.
   The cut was done in 50 passes @ 20mm/s taking 1'55" (rectangle 15mm x 12mm)

PICTURE 4: rectangle cut in the first step



PICTURE 5: Profiles of the two cutting steps

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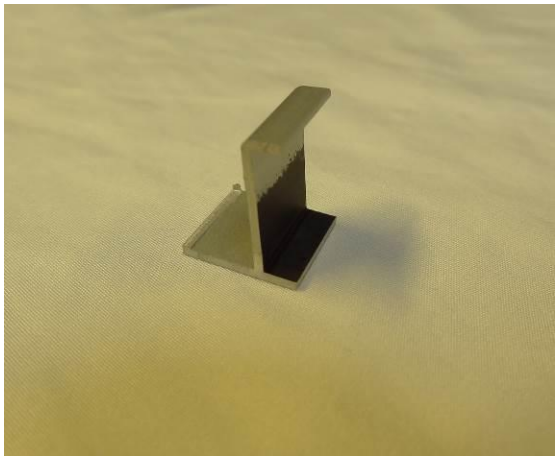
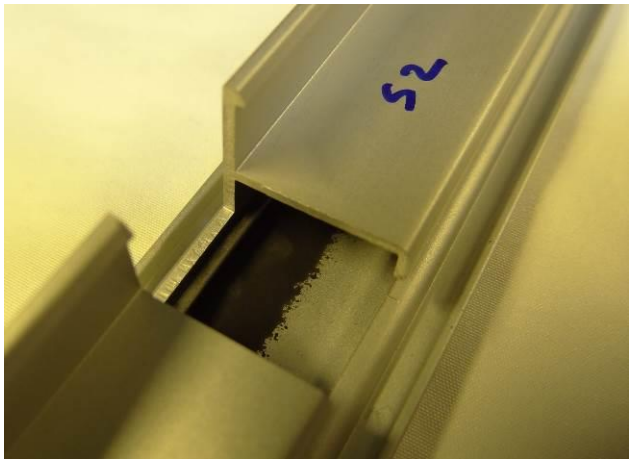
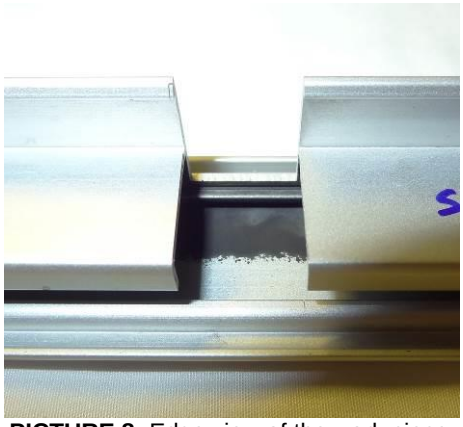
The removed part and edge views of the work piece can be seen in pictures 7, 8 and 9.



PICTURE 6: Picture of the removed part

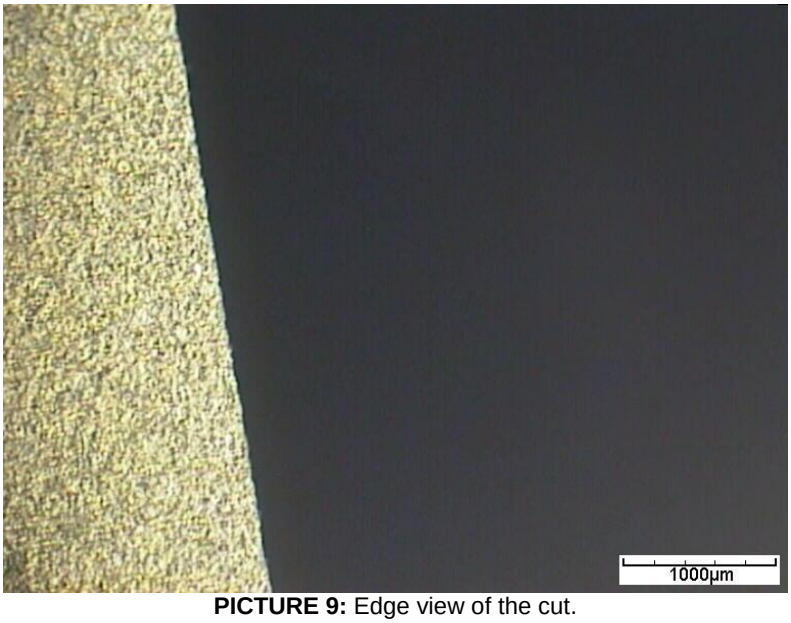


PICTURE 7: Edge view of the work piece



PICTURE 8: Edge view of the work piece.

A microscopic view of the cut edge is presented in picture 10.



PICTURE 9: Edge view of the cut.

5. CONCLUSION

The cutting of the aluminium rail has been performed with a Synova LCS300. This machine is based on the Laser MicroJet® technology and combines the advantages of a 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.

This application demonstrated the feasibility of the process using the Laser MicroJet® technology.

We are open to further discuss your needs regarding:

- The process time;
- The work piece cleaning;

- The pattern;
- The handling;
- The sequence regarding a potential rotary axis

We thank you for your interest in our technology and we hope our results meet your requirements. Our sales agent will contact you soon to obtain a feedback about the analysis of these results and to discuss with you the further steps.