REPORT: Ti cutting by Laser-MicroJet®

for Anonymous

by Stephane Delahaye; Synova SA

TASK

The Laser-MicroJet® technology has been tested for cutting Ti samples. The goal was to optimize the cutting speed while maintaining a good cutting quality.

SAMPLE DESCRIPTION AND PREPARATION

Six samples were available for the tests.

SAMPLE	Material	Ti CP grade 1
	Dimension	~150*150 *mm*
	Thickness	400 *µm*
	Quantity	6 *pcs*

Release of application report			
Project Leader		Responsible Application Group	
Name:	Mr Stéphane Delahaye	Name:	Dr Benjamin Carron
Date:	17.04.2014	Date:	17.04.2014
Visum:	SDE	Visum:	BC

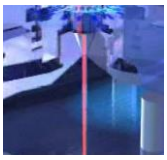
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, the LCS 300 machine equipped with a dual-cavity frequency-doubled Q-switched Nd: YAG laser has been used as the machine configuration in our lab. It is a manually loaded machine, allowing cutting and drilling any kind of metal piece.

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

- Cutting of arbitrary shapes
- Low heat damage to the material
- Négligeable contamination / re-deposition

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

	**SYSTEM**	Machine type	LCS 300
	**MICROJET® PARAMETER**	Nozzle diameter	80/60 *µm*
		MicroJet® diameter	~64/48 *µm*
		Water pressure	300 *bar*
		Assist gas	He

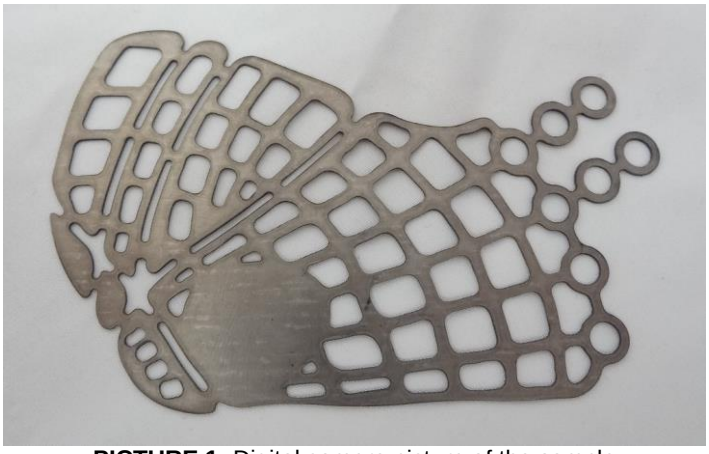
RESULTS

As mentioned above the highest priority was to optimize the cutting speed. Two different strategies have been used and 3 samples have been processed

Sample	1	2	3	
Strategy	Monopass	Multipass	Multipass	
Nozzle size	80	80	60	
Pulse frequency	10*	10*	10*	*kHz*
Average power	100	100	100	*W*
Pulse width	~155	~150	~150	
Cutting speed	3.7	12.5	12	*mm/s*
Number of passes	1	6	6	
Process time	11'30''	~12'2''	13'	*min*

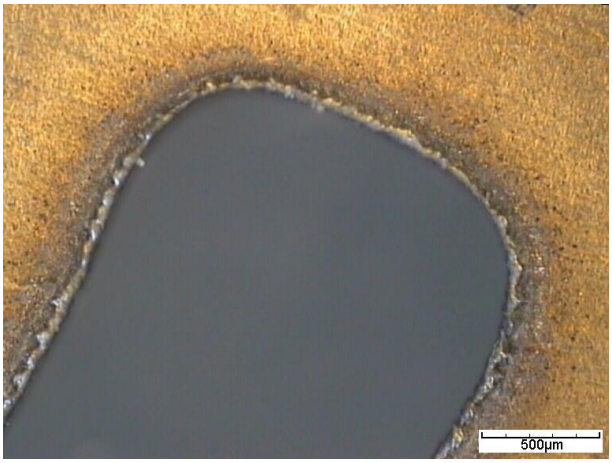
*: for each cavity of the dual laser

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

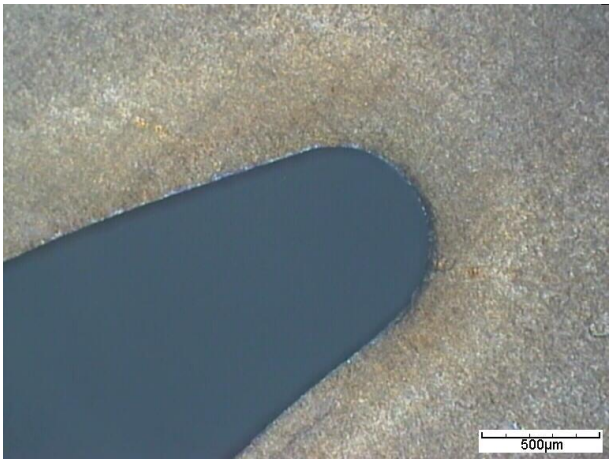


PICTURE 1: Digital camera picture of the sample

1. Sample 1

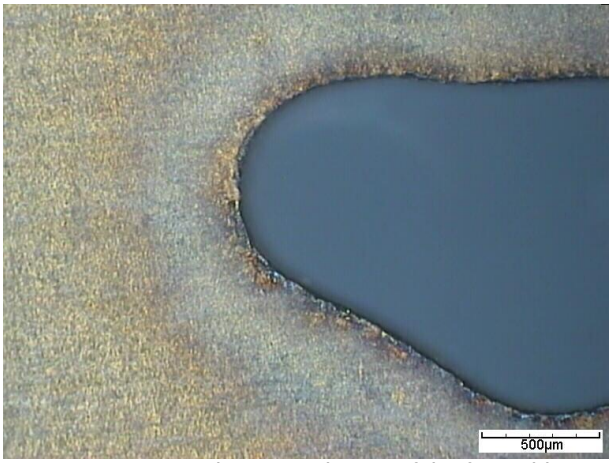


PICTURE 1: Microscope image of the front side (dark field illumination)

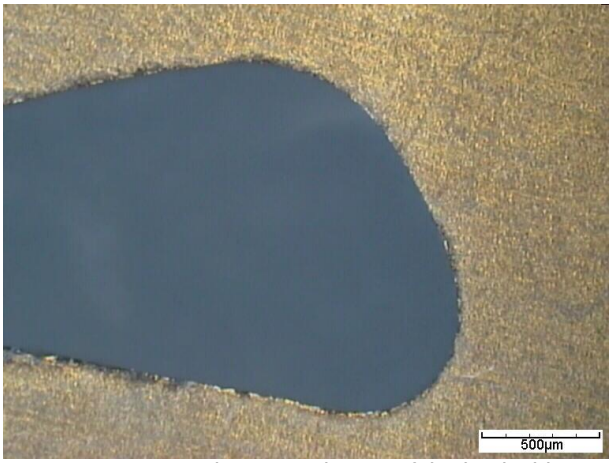


PICTURE 2: Microscope image of the back side (dark field illumination)

2. Sample 2

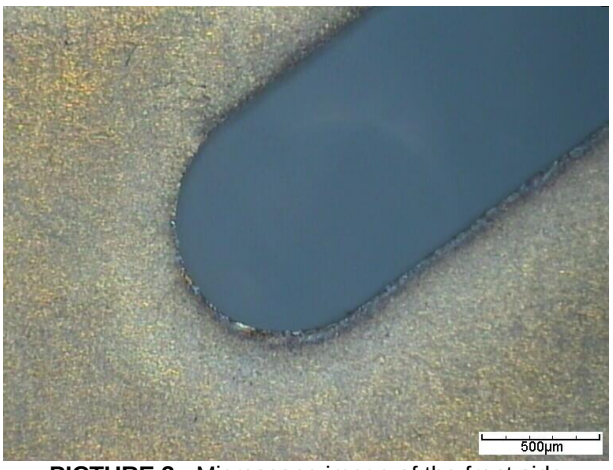


PICTURE 3: Microscope image of the front side (dark field illumination)

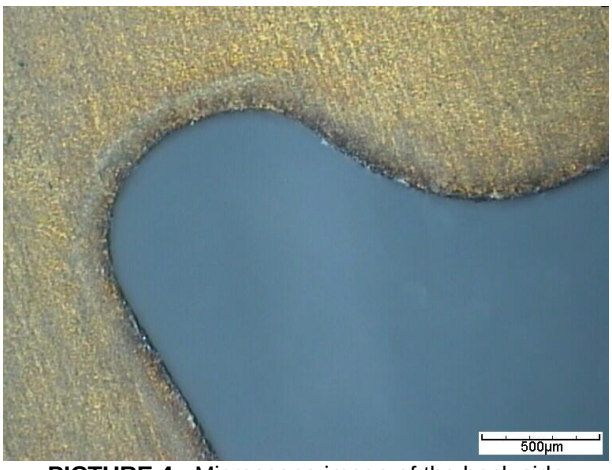


PICTURE 4: Microscope image of the back side (dark field illumination)

3. Sample 3



PICTURE 3: Microscope image of the front side (dark field illumination)



PICTURE 4: Microscope image of the back side (dark field illumination)

The table below summarizes Anonymous expectations and our results

	What are your priorities? (please put a cross)	Quantified expectations or improvements
Speed	XXX	Similar to your current process
Burrs	XX	Some burrs are visible
Heat-damage free:	XX	Limited heat damage visible (~<300 µm)
Re-deposition	XX	Limited

CONCLUSION

The cutting of Ti samples was investigated on SYNOVA LCS 300. 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 allowing an excellent accuracy, advantages that are essential for cutting metallic samples with high quality.

These tests show that:

- It is possible to cut the sample with a minimum process time of 11min30sec which corresponds to your current process time.

- Some heat affecting zone is visible because a high average power is necessary to achieve high cutting speed. This effect is more important on sample 1 because of the “monopass”

strategy. Indeed cutting with “slow” speed at such power leads to widened thermally affected areas of material. So a “multipass” strategy is recommended

- With a non-suitable fixing system the sample may be marked by the laser at the end of the process if it partially falls down during the cut.

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