

REPORT: Watch part cutting by Laser-MicroJet®

for Anonymous

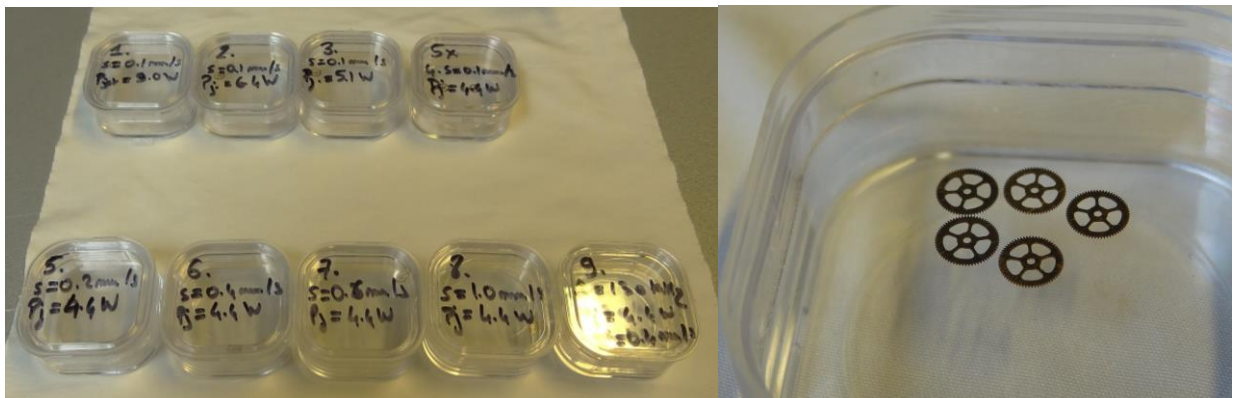
by Florent Bruckert, Synova SA

TASK

The Laser-MicroJet® technology has been tested for cutting a functional watch part. The aim is to prove that the Laser MicroJet® technology allows to cut wheels with expectations from the watch-industry (picture 1 and picture 2).

SAMPLE DESCRIPTION

SUPPLIED MATERIAL	Material	Brass
	Thickness	0.15 mm
	Quantity	13



PICTURE 1: Pictures of the processed samples

Release of application report			
Project Leader		Industry BU Responsible	
Name:	Mr Florent Bruckert	Name:	D ^r Carron Benjamin
Date:	28.05.2013	Date:	29.05.2013
Visum:	FBR	Visum:	BC



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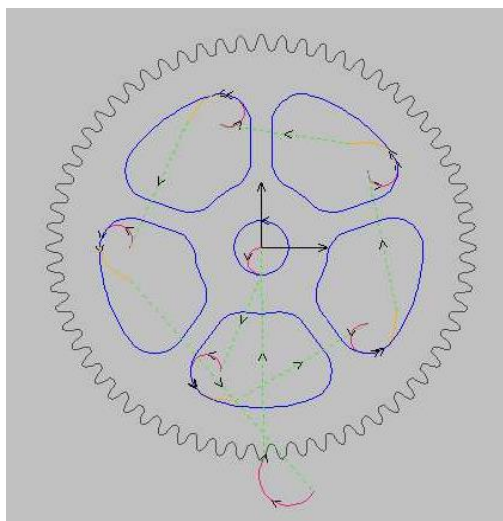
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Switzerland
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APPLICATION REPORT

Report No: 135-7

Sample No: 2.2.1242

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PICTURE 2: Processed pattern of the "third wheel"

PROCESS: INSTRUMENT & TEST PARAMETERS

For this application, the LCS300, equipped with a frequency doubled, pulsed Rod-type fiber laser, has been selected as the best machine configuration available in the lab.

In the tables below, the optimised processing parameters used in the experiments are summarised:

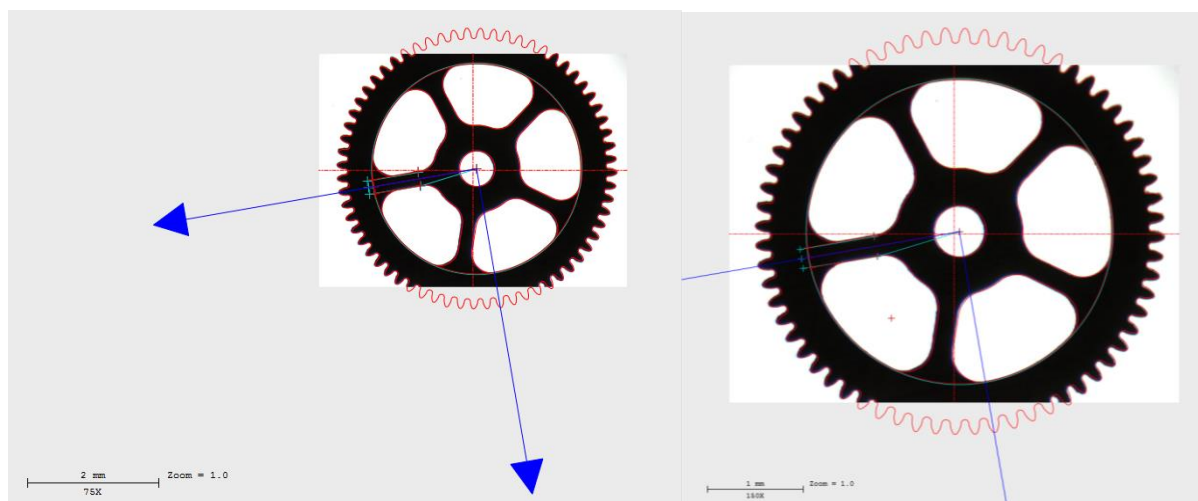
	SYSTEM	Machine type	LCS300
		Fixture	Clamped
	MICROJET[®] PARAMETER	Nozzle diameter	30 μm
		Kerf width	28 μm
		Water pressure	300 <i>bar</i>
		Working distance	9 <i>mm</i>
		Assist gas	He
	LASER AND CUTTING PARAMETERS	Laser type	EO31G
		Wavelength	515 <i>nm</i>
		Laser repetition rate	100 <i>kHz</i>
		Pulse width	14 <i>ns</i>
		Number of passes	1

Sample	Image reference	Power in the laser head [W]	Power in the water jet [W]	Effective cutting speed [mm/s]	Process time [min-s]
1	4-5-6	12.3	9.0	0.1	9 min 10 s
2	-	8.8	6.4		
3	-	7.0	5.1		
4*	3-7-8-9	6.0	4.4	0.2	5 min
5	-			0.4	3 min
6	-			0.6	2 min 15 s
7	-			1.0	1 min 39 s
8	10-11			0.4	3 min
9	-				

(*) The sample 4 has based cut 5 times to evaluate the repeatability of the process.

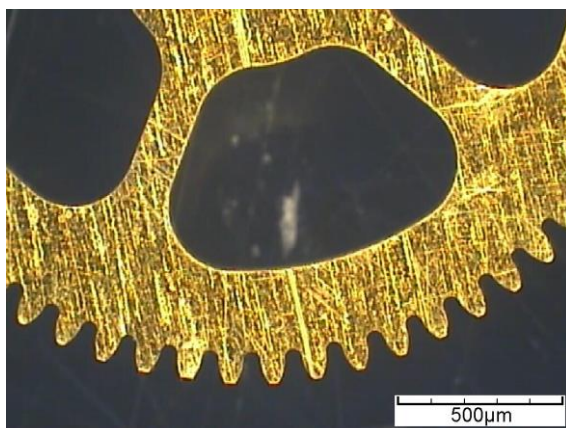
RESULTS

You can find below the superposition pictures of the cut watch wheel and the original drawing (.dxf).

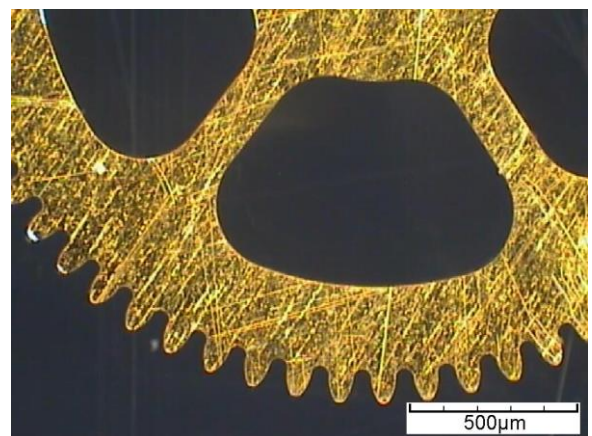


PICTURE 3: Superposition of the cut part (sample 4) with the drawing.

You can see below the pictures related to the previous tests.



PICTURE 4: Microscope image of the sample 1
(front side view)



PICTURE 5: Microscope image of the sample 1
(back side view)



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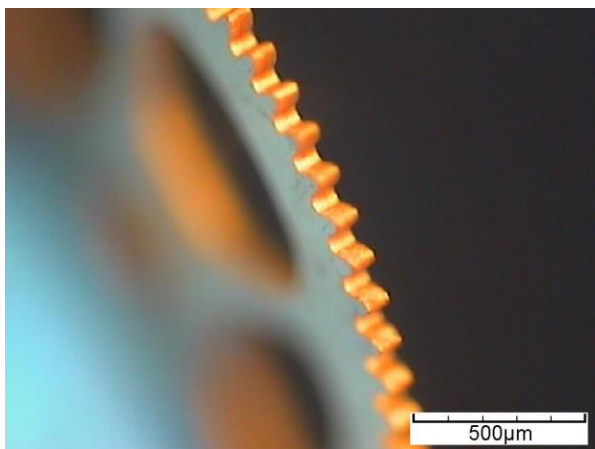
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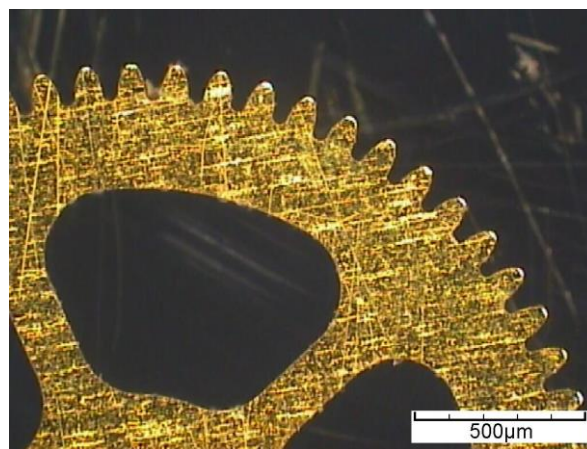
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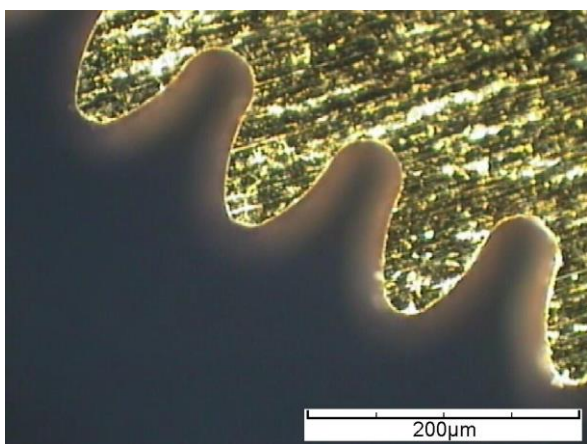
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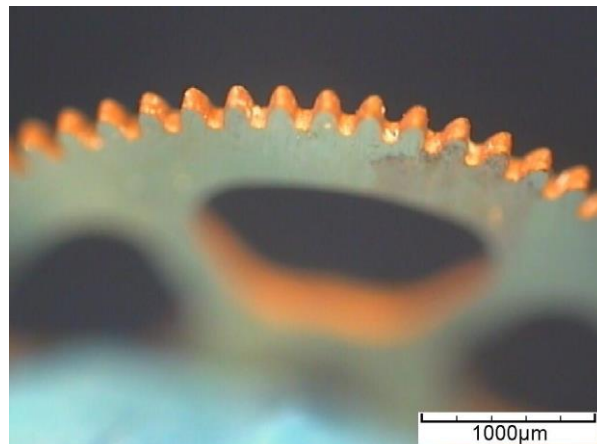
PICTURE 6: Microscope image of the sample 1
(edge view)



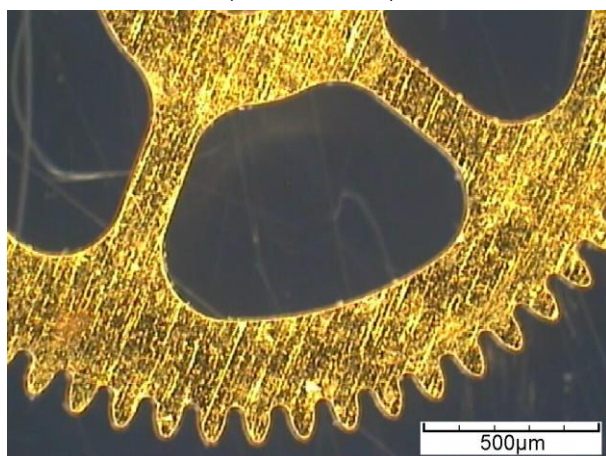
PICTURE 7: Microscope image of the sample 4
(front side view)



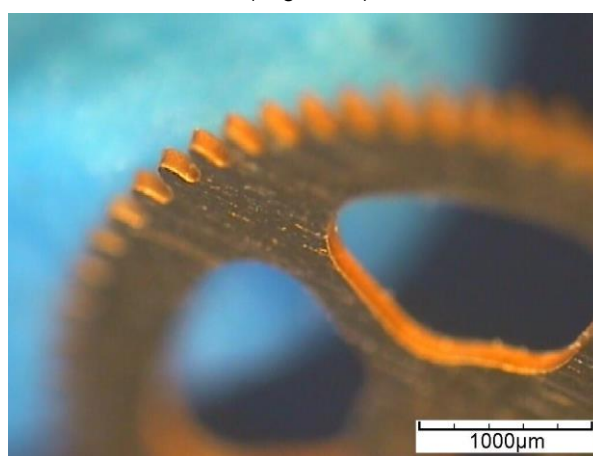
PICTURE 8: Microscope image of the sample 4
(back side view)



PICTURE 9: Microscope image of the sample 4
(edge view)



PICTURE 10: Microscope image of the sample 8
(back side view)



PICTURE 11: Microscope image of the sample 8
(edge view)

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REQUIREMENTS ANALYSIS

	Priority	Anonymous expectations	Quantified expectations or improvements)
• Kerf width:	X	-	28 µm
• Chipping / cracks:	X	-	None
• Edge roughness:	X	The lowest	< 0.5 µm (to be measured*)
• Burrs free:	X	-	No Heat damage *
• Tolerances:	X	-	See picture 3 (to be measured) *

*All quantifications were determined by optical analysis.

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CONCLUSION

The cutting of functional watch parts has been performed with a 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 preventing the sample from particle contamination, advantages that are essential for watch parts with high quality.

These tests show that:

- It is possible to cut a wheel in a one-time process with an excellent quality.
- There is a good repeatability of the process for this material.
- The quality is good on the front/ back side and on the edge.
- The cutting walls are parallel by optical analysis.

We are open to further discuss your needs regarding:

- The edge roughness homogeneity.
- The pattern.
- The process time.

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.