REPORT: Functional watch parts cutting by laser MicroJet®

for Anonymous

by Florent Bruckert, Synova SA

OBJECTIVE

The Laser-MicroJet® technology has been tested for cutting CuBe2 and fine carbon steel (+lead) substrates. The aim was to respectively cut "minutes wheels"" and "springs" in 0.2mm-CuBe2 and 0.25mm-fine carbon steel (see Figure 1 to Figure 5).

SAMPLES DESCRIPTION

SAMPLE	Material	CuBe2	Fine carbon steel+Pb	
	Thickness	0.2	0.25	mm
	Quantity	10	10	strips

Release of application report			
Project Leader		Responsible Application Group	
Name:	Florent Bruckert	Name:	Benjamin Carron
Date:	23.04.2015	Date:	23.04.2015
Visum:	FBR	Visum:	FBR

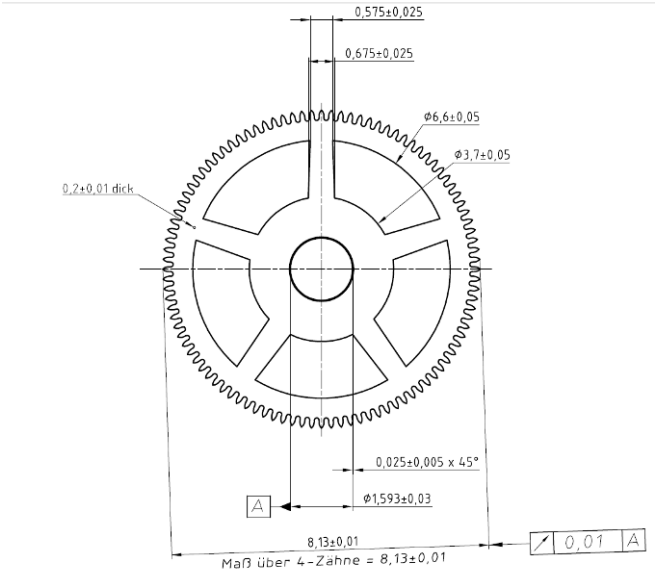


FIGURE 1: Drawing showing the wheel cutting pattern.

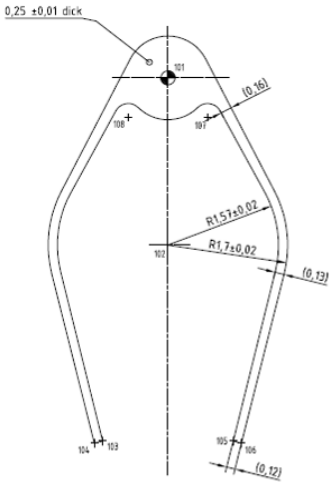


FIGURE 2: Drawing showing the cutting pattern concerning the spring.

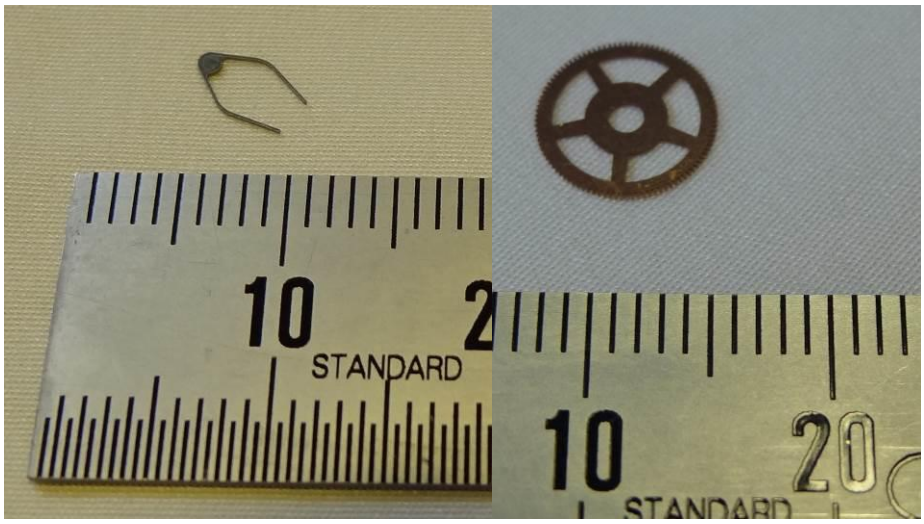


FIGURE 3 and 4: Pictures showing the cut parts.

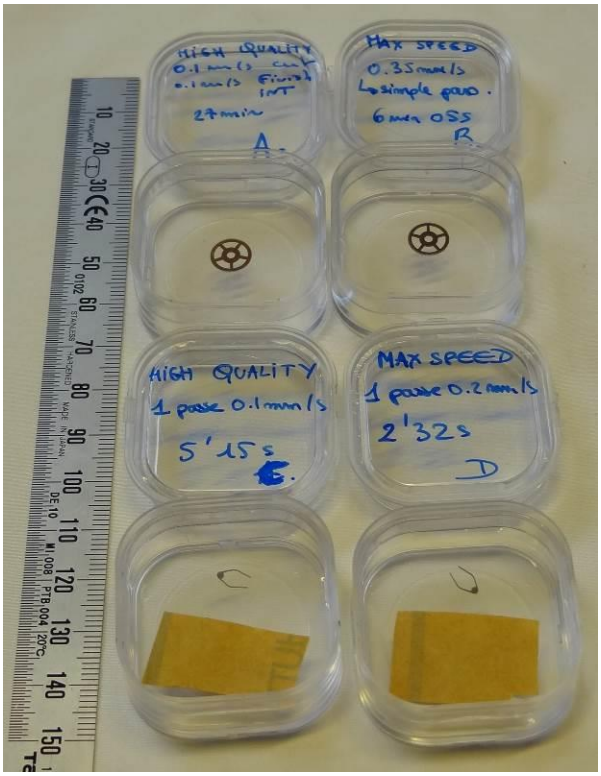


FIGURE 5: Pictures showing the 4 cut parts.

PROCESS: INSTRUMENT & TEST PARAMETERS

Major advantages of Laser-MicroJet® technology with regards to thin metals cutting are:

- Advantageous process rates
- Negligible contamination / re-deposition
- Negligible heat damage to the material
- Negligible burrs formation
- Optimized roughness at the edge

For these experiments, the LCS300, Nd:YAG laser, has been selected as the most suitable machine configuration available in the lab.
In the tables below, the optimized processing parameters used in the experiments are summarized:

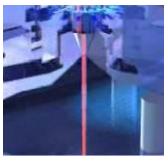
	**SYSTEM**	Machine type	LCS 300	
		Fixing type	Clamped	
	**MICROJET® PARAMETERS**	Nozzle diameter	30	*µm*
		Waterjet pressure	650	*bar*
		Protect gas: Helium	1.1	*L/min*
		Working distance	8	*mm*
	**LASER PARAMETERS**	Laser type	VG21G	
		Wavelength	532	*nm*

TABLE 1: Optimized tooling parameters

A 30 µm nozzle has been in order to optimize the contour definition as well as the resulting roughness.

Sample reference	**Substrate**	**Rep Rate. (kHz)**	**Pulse width (ns)**	**Power in jet (W)**	**Cutting speed Main cut (mm/s)**	**Cutting speed Finishing only applied on the inner contour (mm/s)**	**Process time (sec-min)**
A (Max quality)	CuBe2 0.2mm	100	9	7.0	0.1	0.1	27min
B (Max speed)	CuBe2 0.2mm	100	9	11.0	0.1	No finishing	6min05s
C (Max quality)	Steel 0.25mm	80	20	8.1	0.1		5min15s
D (Max speed)	Steel 0.25mm	80	20	8.1	0.2		2min32s

TABLE 2: Optimized cutting parameters

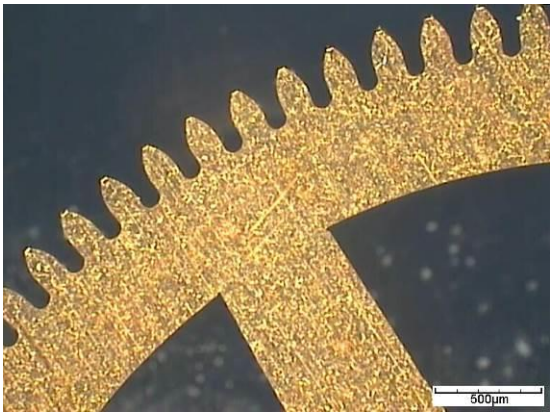


FIGURE 6: Sample A, front side view

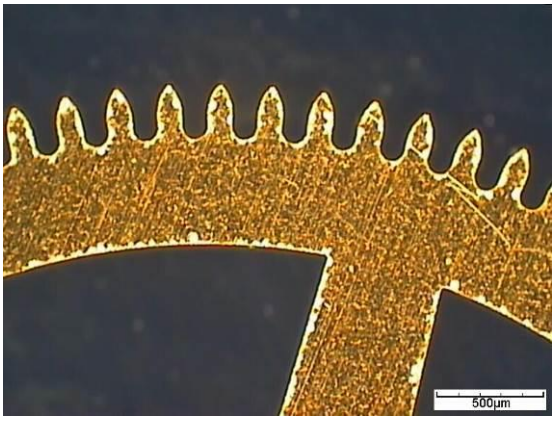


FIGURE 7: Sample B, front side view

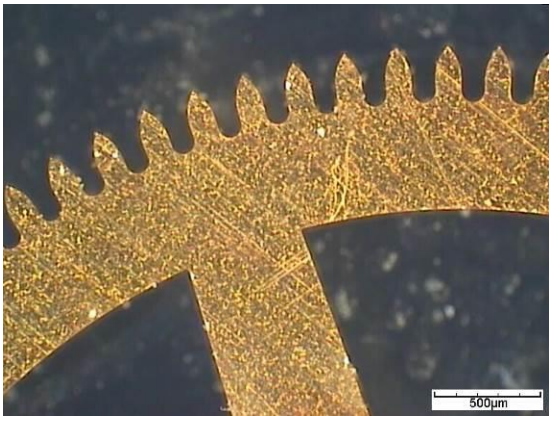


FIGURE 8: Sample A, back side view

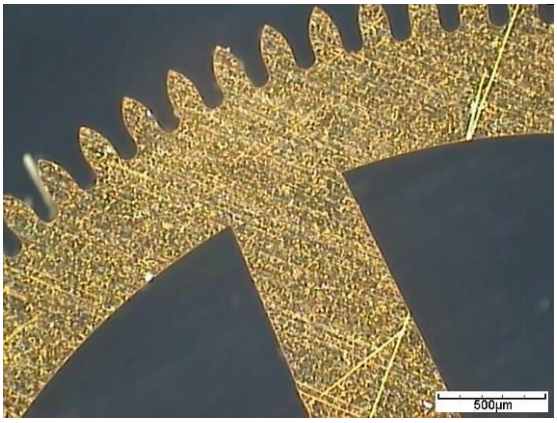


FIGURE 9: Sample B, back side view

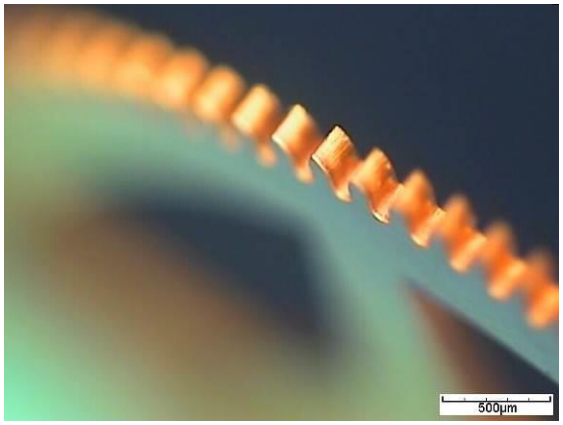


FIGURE 10: Sample A, edge view

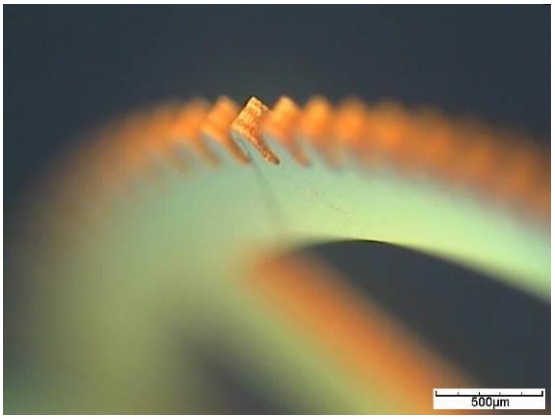


FIGURE 11: Sample B, edge view

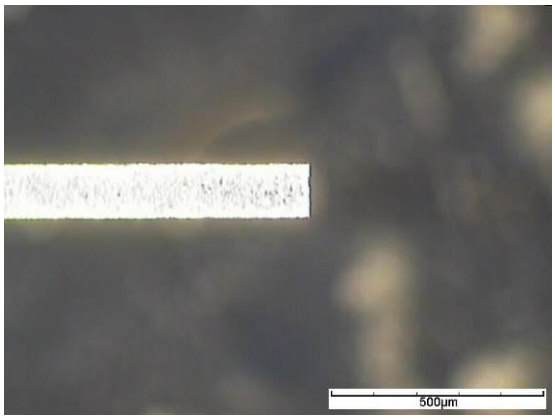


FIGURE 12: Sample C, front side view

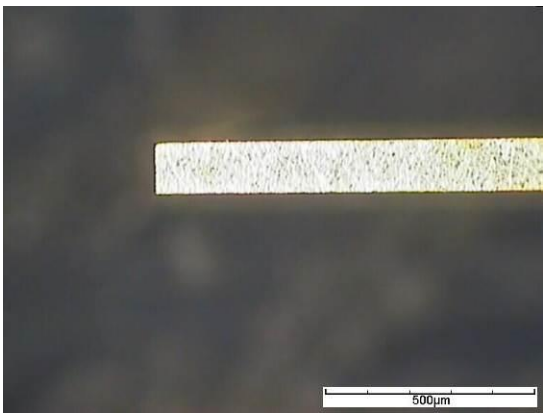


FIGURE 13: Sample D, front side view

FIGURE 14: Sample C, back side view

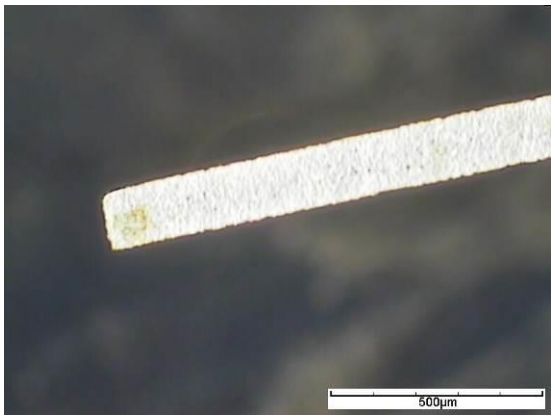


FIGURE 15: Sample D, back side view

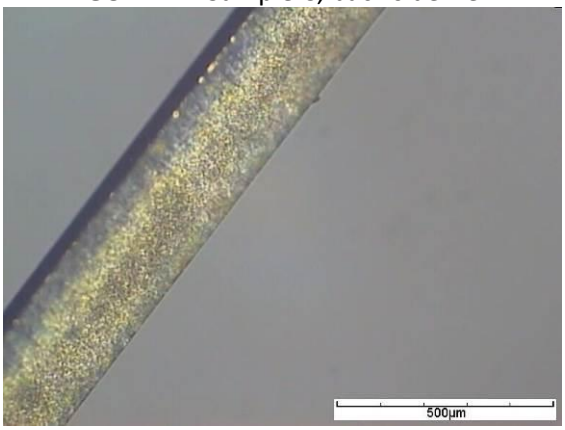


FIGURE 16: Sample C, edge view

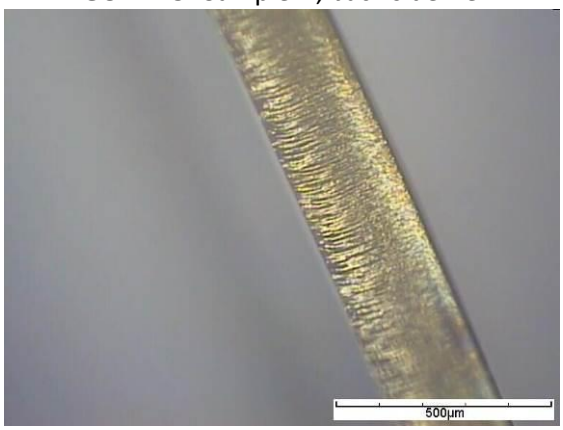


FIGURE 17: Sample D, edge view

CONCLUSION

The functional watch parts cutting was investigated on SYNOVA LCS 300.
This machine is based on the MicroJet® technology and combines the advantages of a high energy pulsed fiber 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 particle contamination, advantages that are essential for thin metals cutting with high quality.

The tests show that:

- The cutting time concerning the wheel varies from 6 to 27min according to the quality.
- The cutting time concerning the spring varies from 2min32s to 5min12s according to the quality.
- The cut induced roughnesses are lower than 0.3µm.
- The processes are stable and repeatable.

We are open to further discuss your needs regarding:

- The fixture to optimize the roughness on the outer contours.
- The cleaning.
- The final 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.