REPORT: Cutting of brush springs by Laser-MicroJet®

for Anonymous

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1. TASK

This application aimed at optimizing the cutting speed of brush springs using the Laser-MicroJet® technology.

2. TASK DESCRIPTION

SUPPLIED MATERIAL	Material	CuBe2
	Thickness	0.09 mm

The task consisted in extending the cut between the fingers in the spring. On Picture 1, we can see the piece as provided (left arm) and the piece once cut (right arm).

PICTURE 1: Original and cut piece

Release of application report			
	Project Leader		Industry BU Responsible
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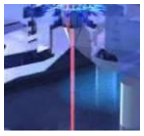
Date:	11.06.2014	Date:	12.06.2014
Visum:	FBR, SHI	Visum:	BC

3. PROCESS: INSTRUMENT & TEST PARAMETERS

For this application, the LCS150, equipped with a frequency doubled, Q-switched, Nd:YAG laser, has been selected as the best machine configuration available in the lab. In the table below, the optimised processing parameters used in the experiments are summarised:

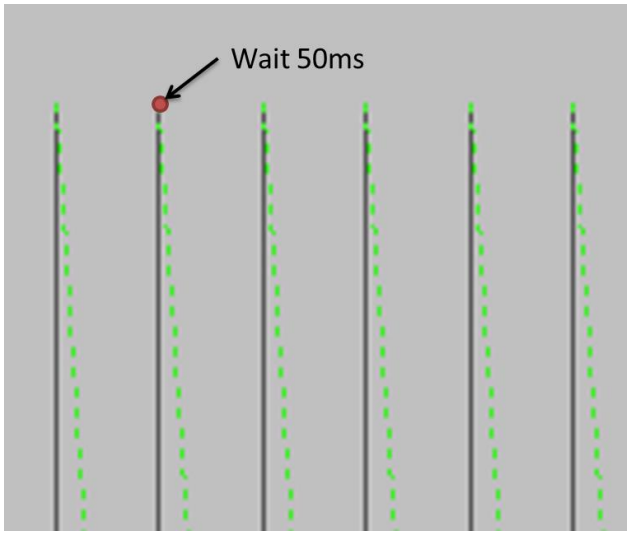
	**SYSTEM**	Machine type	LCS150	
		Fixture	Clamped	
	**MICROJET® PARAMETER**	Nozzle diameter	40	*µm*
		Kerf width	64	*µm*
		Water pressure	400	*bar*
		Working distance	12	*mm*
		Assist gas	He	
	**LASER PARAMETERS**	Laser type	L51G	
		Wavelength	532	*nm*

The laser parameters used are summarized in the table below:

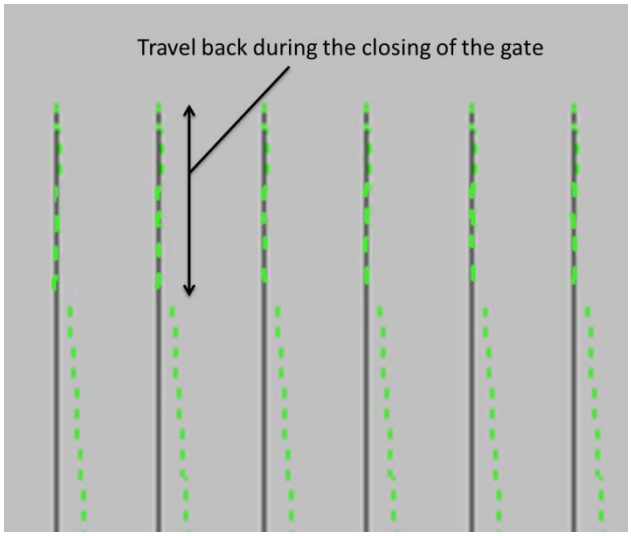
Frequency [kHz]	Power (internal) [W]	Power (in the water jet) [W]	Pulse duration [ns]
6	38	17.1	130

TABLE 1: Sets of cutting parameter used

In order to reduce the process time, the laser path has been modified with respect to previous iterations. The laser is now moving back on its path when the gate closes bringing it closer to the next opening point. Previously, the machine would wait the compulsory 50ms to close the laser gate before moving to the next position (Picture 2). It now closes the gate on the fly by traveling back along the cut line for 50ms before moving diagonally to the next finger (Picture 3). These 50ms are the inherent time to enable or stop any radiation to reach the substrate.



PICTURE 2 : Previous path of the Laser-MicroJet®



PICTURE 3 : New path of the Laser-MicroJet®

4. RESULTS

The improved path of the laser gate, made it possible to reach a process time of 2.9s per brush spring. 209 springs have been cut to be further tested by Kern-Liebers.

5. CONCLUSION

The cutting of brush springs has been performed with a SYNOVA LCS 150. 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 brush springs with high quality.

This development shows that:

- The fixation of the spring on the moving axis is optimal as it is easy and reliable
- The cutting quality is good on the front/ back side and is not affected by an increasing speed
- The spring does not vibrate during the cutting process making it completely stable
- A cutting speed of 9mm/s can be achieved allowing for an effective cutting time of 3s per spring

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.