REPORT: CNC-dressing-disc cutting by Laser MicroJet®

for attention of Anonymous

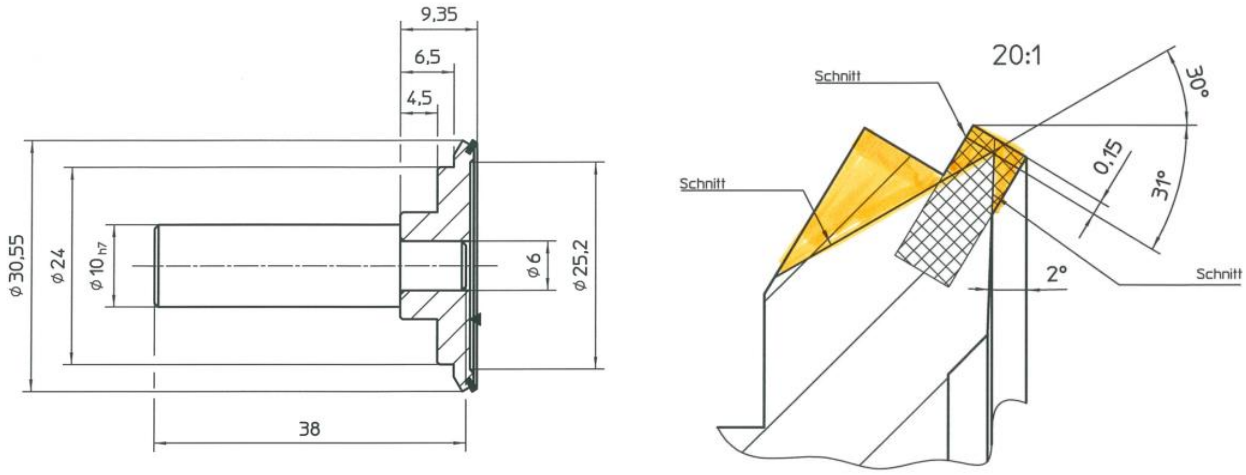
by Ronan Martin, Synova SA

TASK

The Laser MicroJet® technology has been tested for trimming dressing discs. The aim of the tests was to reach a process time of about 17min, while keeping the quality observed in the previous tests.

SAMPLE DESCRIPTION

DRESSING DISCS	Material	metal + diamond
	Diameter	25 *mm*
	Quantity	5 *pcs*



PICTURE 1: Illustration of the part and of the three cuts to perform

Release of application report			
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Date:	11.09.2015	Date:	14.09.2015
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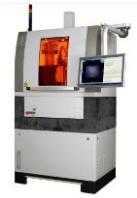
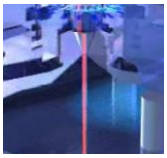
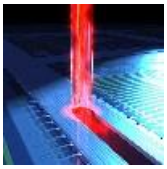
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, an LCS 150 equipped with a dual-cavity frequency-doubled Nd:YAG laser have been used as the machine configuration in our lab. This machine allows cutting diamond, most ceramics, and any kind of metal.

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

- Negligible heat damage to the material
- Excellent wall surface quality
- Limited chipping
- Advantageous process speed

The table below summarizes some of the optimized processing parameters used in the experiments.

	**SYSTEM**	Machine type Optical head type	LCS 150 compact
	**MICROJET® PARAMETERS**	Nozzle diameter	60 *µm*
		MicroJet® diameter	50 *µm*
		Water pressure	300 *bar*
		Assist gas	He
	**LASER PARAMETERS**	Laser type	L202G (one cavity only)
		Wavelength	532 *nm*
		Pulse frequency	6 *kHz*
		Internal power	40 *W*
		Power in jet	29 *W*
		Pulse width	170 *ns*
	**CUTTING PARAMETERS**	Motion speed	Cutting: 30 *mm/s* Finishing: 10 *mm/s*
		Process time for main cut	16–19 *min*
		Process time for second cut	4 *min*

For the fixation, we first tried to put the larger diameter on the top (Picture 1a), since it was easier to come close to the edge. We then switched to another configuration (Picture 1b), where the top diameter is at the bottom. In order to keep the working distance close to 15mm, we used a short nozzle nut with diaphragm.

PICTURES 1A & 1B: Sample fixation. Left: initial setup, right: final setup.

RESULTS

Preliminary tests were performed on sample 1 using the setup presented in Picture 1A, with a 50µm nozzle and different lasers parameters. These tests showed that this setup was not ideal for two reasons:

- The centering on the sample was too difficult with our machine configuration.
- The diamond inclusions are likely to create some instability at the beginning of the cut.

We therefore switched the setup shown in Pictures 1B right after these tests, using a short nozzle nut in order to keep a reasonably small working distance. We also used a 60µm nozzle, which seems to allow for a slightly faster process.

Sample 2 was used to optimize the centering procedure and run a few tests such as finishing passes, but it turned out that a simple multipass process is better regarding the quality (and the speed, obviously).

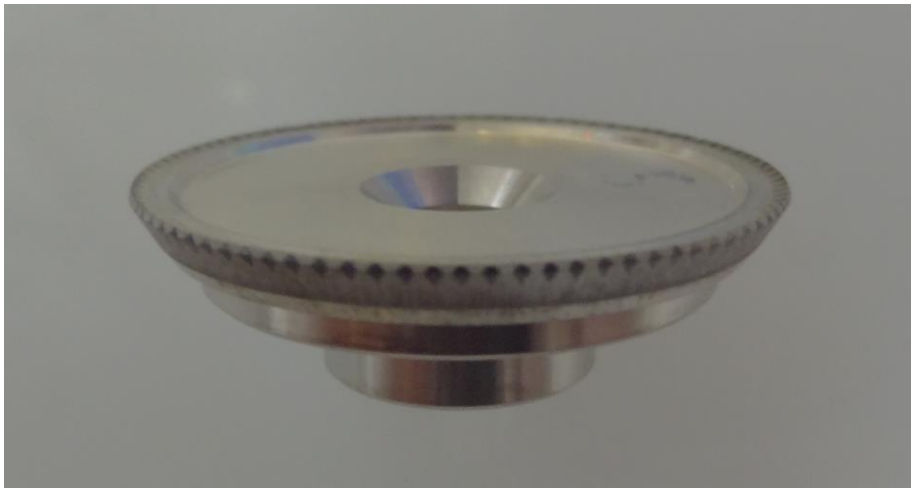
Samples 3, 4 and 5 were cut all in the same conditions, with a centering that was as good as possible, but not perfect. The geometry is therefore slightly different in each sample, and there is some variation on the process time necessary to cut the sample over the entire perimeter: 16min to 19min for the main cut.

After having performed the main cut (i.e. the one indicated at 30° on Picture 1), we performed a second cut on all the samples: the one indicated at 31° on Picture 1. This cut lasted about 4min on each sample.

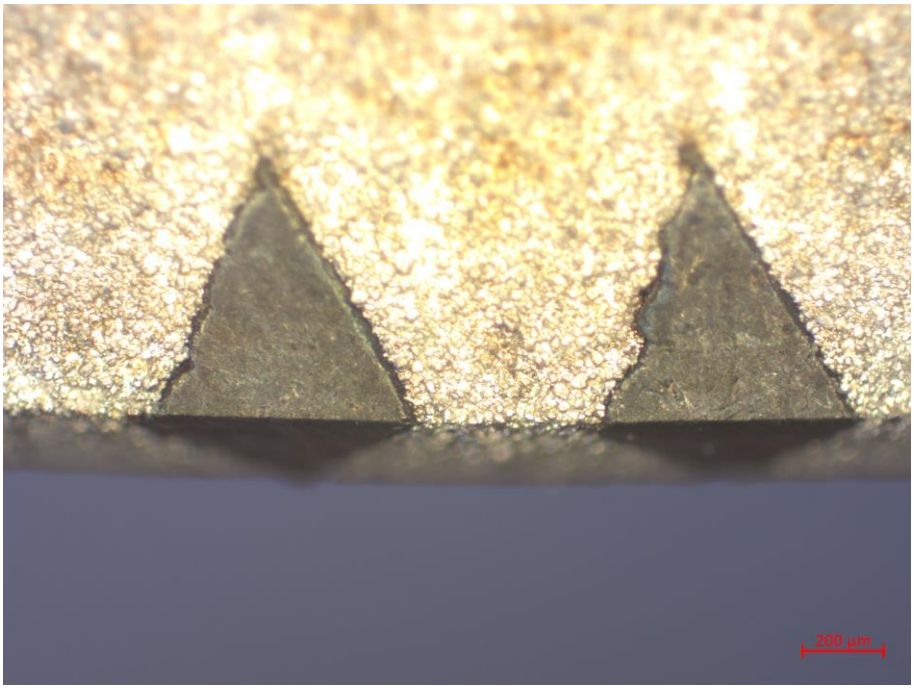
The last cut could not be performed because the available machine did not have the required rotary axis.

Please note that sample 2 and 3 present a long laser mark on one side, which is clearly due a wrong zero position used at some point during the process.

The pictures below show the excellent quality that was obtained in the last three samples. The quality seems as good as in the previous tests.



PICTURE 2: General view of a trimmed dressing disc (sample 5)



PICTURE 3: Close-up on the cut intersection in sample 5

CONCLUSION

The cutting of diamond tools was investigated on a Synova LCS 150. 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 metal and diamond with high quality.

These tests have shown that it is possible to trim the dressing discs, in about 17min for the main cut plus a few minutes for the other two cuts. Further speed optimization would be much easier on a 5-axis machine designed for this application, which would allow for a perfect centering of all the samples. The cutting quality seems as good as previously.

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