REPORT: Carbon-fiber composite cutting by Laser-MicroJet®

for TechnoCut SA; FAO: M. Julien Montavon

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TASK

The Laser-MicroJet® technology has been tested for the cutting of circles in a carbon-fiber composite plate. The main focus of the tests was to optimize the edge quality while keeping the cutting speed as high as possible.

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE	Material	carbone-fiber composite
	Dimension	~5*6 *cm*
	Thickness	400 *µm*
	Quantity	1 *pcs*

Release of application report			
	Project Leader		Responsible Application Group
Name:	Mr Stephane Delahaye	Name:	Dr Benjamin Carron
Date:	05.06.2012	Date:	05.06.2012
Visum:	STD	Visum:	MM

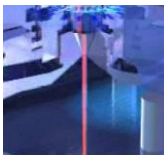
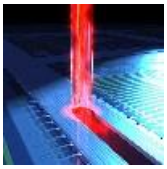
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, the LCS 150 equipped with a frequency-doubled Q-switched Nd-YAG laser has been used as the machine configuration in our lab.
It is a manually loaded clean-room compatible machine, allowing to cut, drill, groove, scribe, trench, mark, or grind different kinds of materials.

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

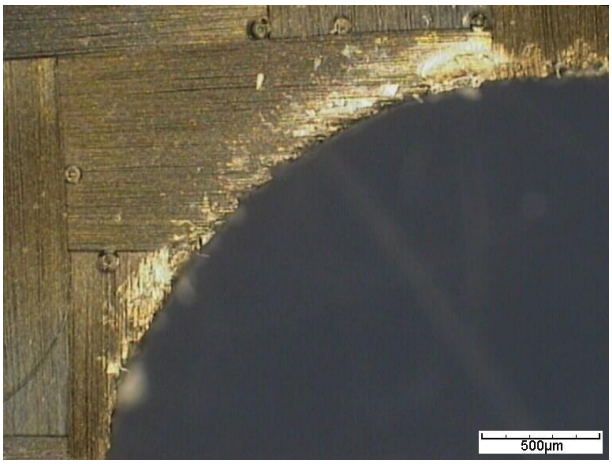
- low heat damage
- advantageous process rates
- cutting of arbitrary shapes
- parallel cut

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

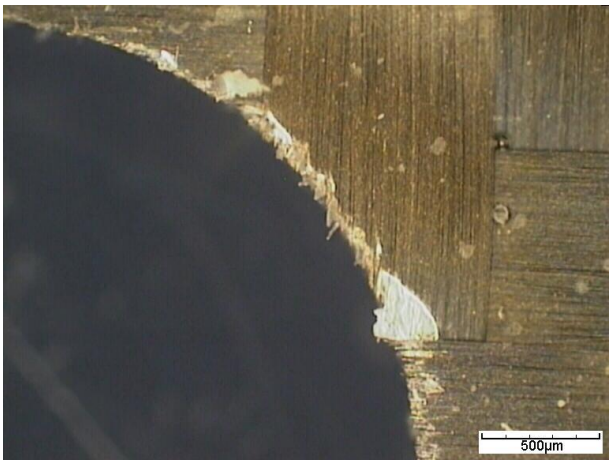
	**SYSTEM**	Machine type	LCS 150
	**MICROJET® PARAMETER**	Nozzle diameter	60 *µm*
		MicroJet® diameter	~48 *µm*
		Water pressure	300 *bar*
		Assist gas	He
	**LASER PARAMETER**	Laser type	L101G
		Wavelength	532 *nm*
		Pulse frequency	14 *kHz*
		Average power	~30 *W*
	**CUTTING PARAMETER**	Cutting speed	30 *mm/s*
		Number of passes	35
		Overall speed	~50 *mm/min*
		Fixing system	clamps

RESULTS

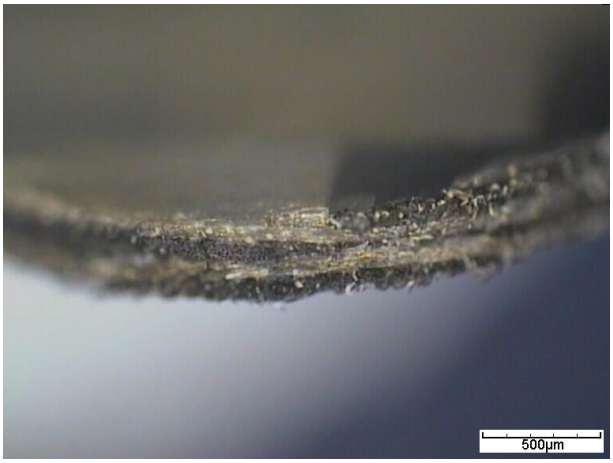
The following microscope picture give an overview on the quality obtained with the Laser-Microjet® technology.



PICTURE 1: Microscope image of the frontside (dark-field illumination)



PICTURE 2: Microscope image of the backside (dark-field illumination)



PICTURE 3: Microscope image of the cut wall (dark-field illumination)

The table below summarized Technocut SA expectations and our results:

	What are your priorities? (please put a cross)	Quantified expectations or improvements
Speed / throughput:	X	Up to 50 mm/min
Chipping/Cracks:	X	Some chipping near the edge

CONCLUSION

The cutting of thin carbon-fiber composite plate was investigated on 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 carbon-fiber composite with high quality.

These tests show that the sample looks overall clean, although the microscope pictures reveal some damage, as shown above.

Depending on your requirements, we could try in a further step to minimize the chipping and the heat damage, or to increase the cutting speed.

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