REPORT: NiBe cutting by Laser MicroJet®

for Anonymous

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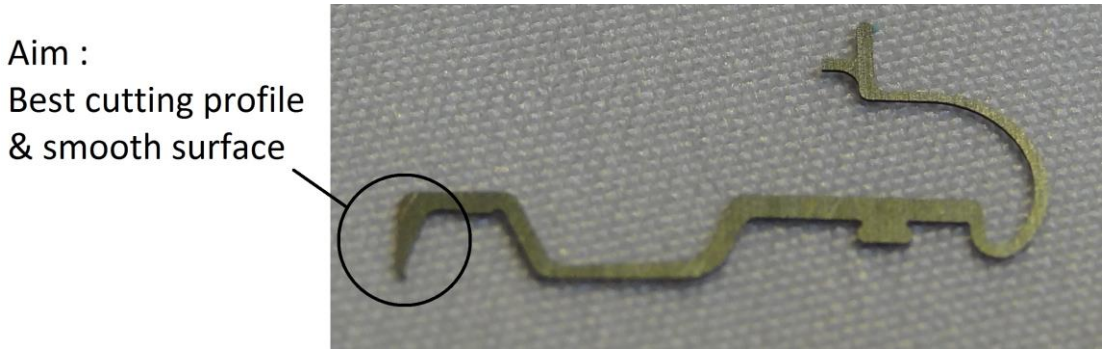
1. TASK

The Laser MicroJet® technology has been tested for cutting a specific work piece.
The aim was firstly to get an optimal roughness and secondly, to evaluate the maximal cutting speed with the Laser MicroJet® technology on NiBe samples.

2. SAMPLE DESCRIPTION

The tests were performed on different thicknesses NiBe samples, as detailed in the following tab.

SUPPLIED MATERIAL		**Group 1**	**Group 2**	**Group 3**
	Material	NiBe	NiBe	NiBe
	Thickness [µm]	100	150	500
	Quantity	6	3	1



PICTURE 1: Example of a work piece from the group 1.

Release of application report			
Project Leader		Industry BU Responsible	
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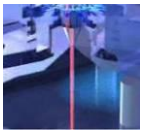
Date:	11.12.2013	Date:	12.12.2013
Visum:	FBR, SK	Visum:	BC

PICTURE 2: Macroscopic view of the samples.

3. PROCESS: INSTRUMENT & TEST PARAMETERS

For this application, an LCS300 equipped with a fiber laser working at 515 nm has been selected as the best machine configuration available in our lab.
The table below summarizes the general parameters used in the experiments.

	**SYSTEM**	Machine type	LCS300
		Fixture	Clamped
	**MICROJET® PARAMETER**	Nozzle diameter	40 *µm*
		Working distance	12 *mm*
		Assist gas	He
		Water pressure	400 *bar*
	**LASER**	Laser type	EO31G
		Wavelength	515 *nm*
		Pulse duration	8 *ns*

For this application, two laser parameters sets were used:

	P1	**P2**
Repetition rate [kHz]	50	80
Laser internal power [W]	12.3	19.6
Laser power in the water jet [W]	4.3	6.5

TABLE 1: Laser parameters used for the tests realization.

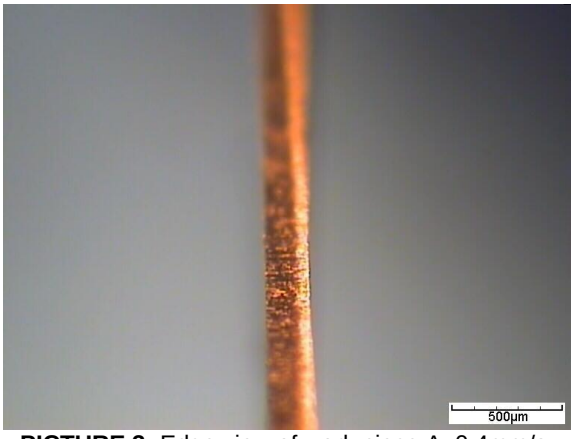
4. RESULTS

In this section, you can find a summary of the parameters used for each sample as well as the results obtained. A monopass strategy was applied for every test.

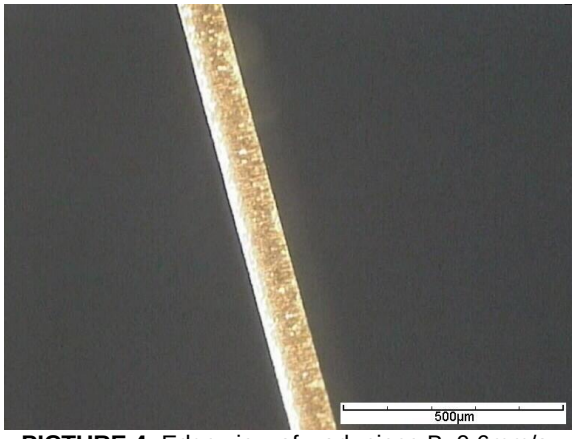
4.1. GROUP 1

.The following table gives the strategy used for the cutting of the group 1 work pieces.

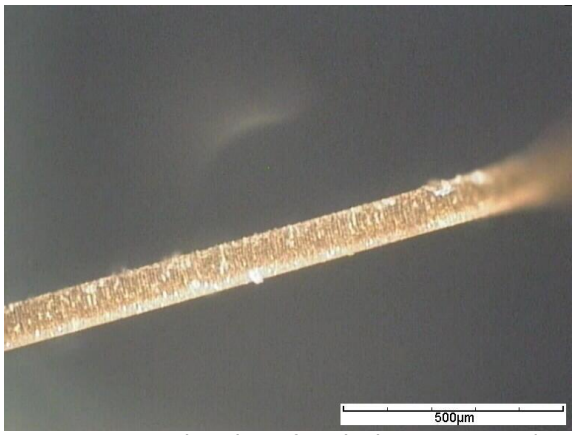
Reference	Characteristic	Picture	Laser parameters	Cutting speed [mm/s]	Process time [min'sec]
A	Best quality	3	P1	0.4	2'18
B	Best quality	4	P1	0.6	1'47
C	Highest speed	5	P1	1.4	0'48
D	Best quality	6	P2	1.2	0'55
E	Best quality	7	P2	2.0	0'37
F	Highest speed	8	P2	4.0	0'26



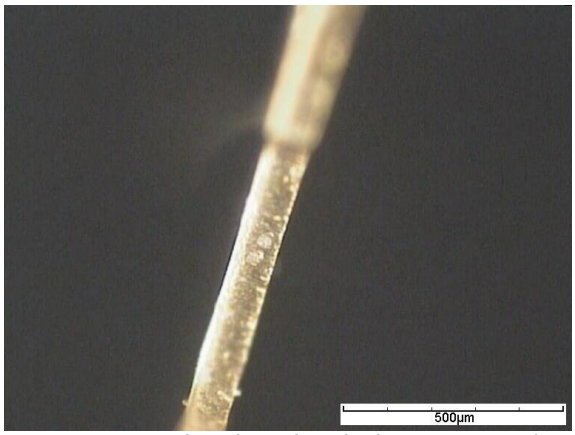
PICTURE 3: Edge view of work piece A, 0.4mm/s.



PICTURE 4: Edge view of work piece B, 0.6mm/s.



PICTURE 5: Edge view of work piece C, 1.4mm/s.



PICTURE 6: Edge view of work piece D, 1.2mm/s.

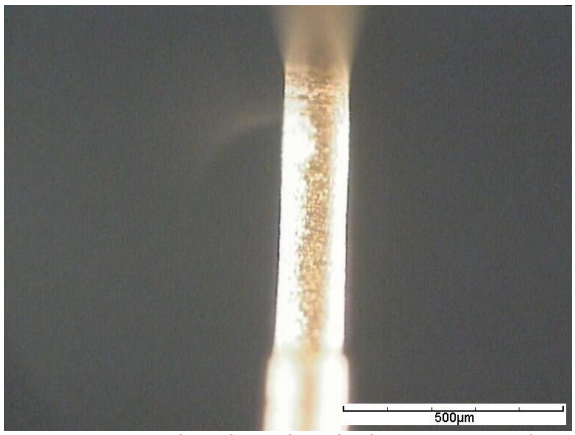
PICTURE 7: Edge view of work piece E, 2.0mm/s.

PICTURE 8: Edge view of work piece F, 4.0mm/s.

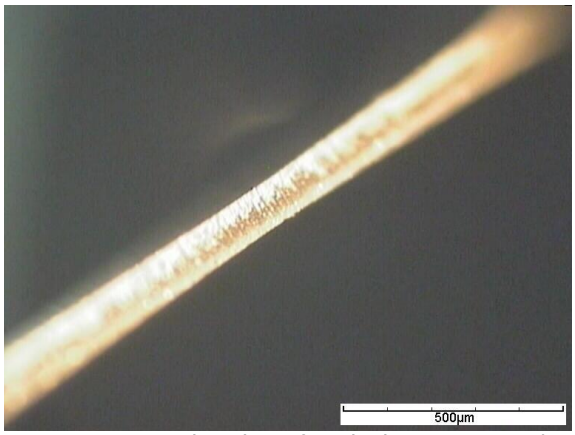
4.2. GROUP 2

.The following table gives the strategy used for the cutting of the group 2 work pieces.

Reference	Characteristic	Picture	Laser parameters	Cutting speed [mm/s]	Process time [min'sec]
G	Best quality	9	P1	0.2	4'14
H	Highest speed	10	P1	0.6	1'30
I	Best quality	11	P2	0.4	2'18



PICTURE 9: Edge view of work piece G, 0.2mm/s.



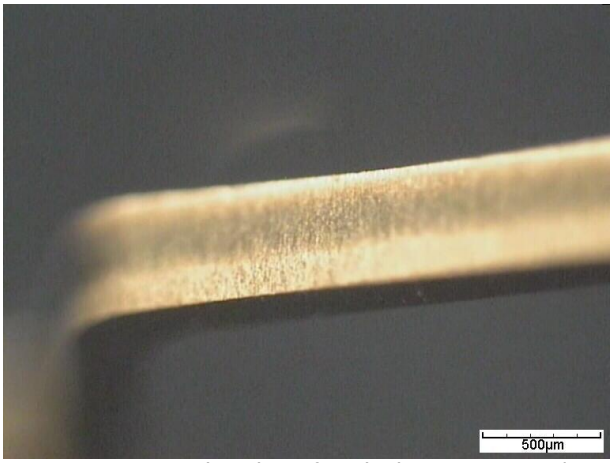
PICTURE 10: Edge view of work piece H, 0.6mm/s.

PICTURE 11: Edge view of work piece I, 0.4mm/s.

4.3. GROUP 3

.The following table gives the strategy used for the cutting of the group 3 work piece.

Reference	Characteristic	Picture	Laser parameters	Cutting speed [mm/s]	Process time [min'sec]
J	Best quality	12	P2	0.03	27'50



PICTURE 12: Edge view of work piece J, 0.03mm/s.

5. CONCLUSION

The cutting in NiBe substrates has been performed with a Synova LCS300. 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. These tests show that:

- The 515 nm fiber laser coupled with the water jet enables to reach your expectations;
- The fiber laser allows a good roughness;
- The process time can be reduced to a minimum of 26 seconds.

We are open to further discuss your needs regarding:

- The process time;
- The work piece cleaning;
- The pattern;
- The handling.

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.