REPORT: Copper and glass epoxy cutting by Laser-MicroJet®

for Anonymous

by Stéphane Delahaye; Synova SA

TASK

The Laser-MicroJet® technology has been tested for cutting glass epoxy and copper samples. The goal of this first iteration is to show the feasibility of the process and to give an overview of the Laser-MicroJet® capabilities.

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE 1	Material	Cu
	Dimension	~50*150 *mm*
	Thickness	100-120 *µm*
	Quantity	1 *pcs*

Release of application report			
Project Leader		Responsible Application Group	
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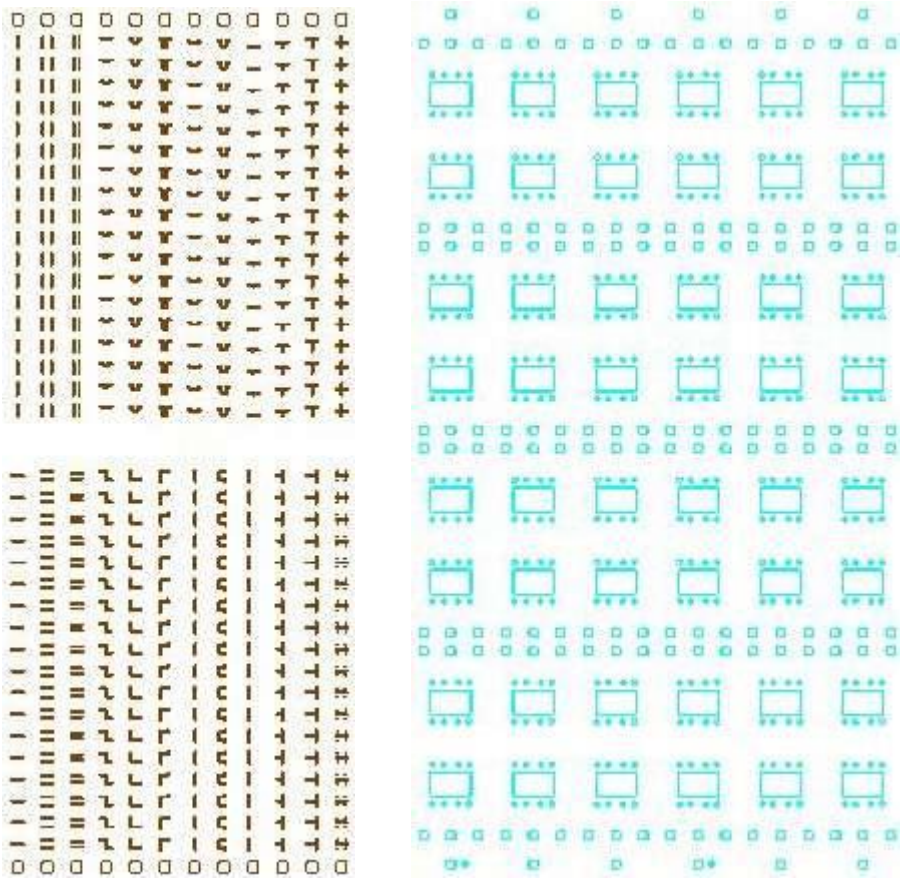
Date:	05.06.2013	Date:	05.06.2013
Visum:	SDE	Visum:	BC

SAMPLE 2	Material	Cu+Glass epoxy
	Dimension	~50*150 *mm*
	Thickness	30+100-120 *µm*
	Quantity	1 *pcs*



Picture 1: Drawings used for the cut

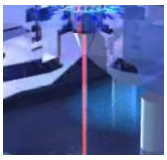
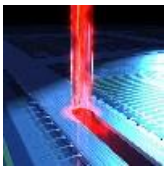
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, the LCS 300M 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 machine, allowing to cut, drill, groove, scribe, trench, mark, or grind wafers of any kind of semiconductor material.

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

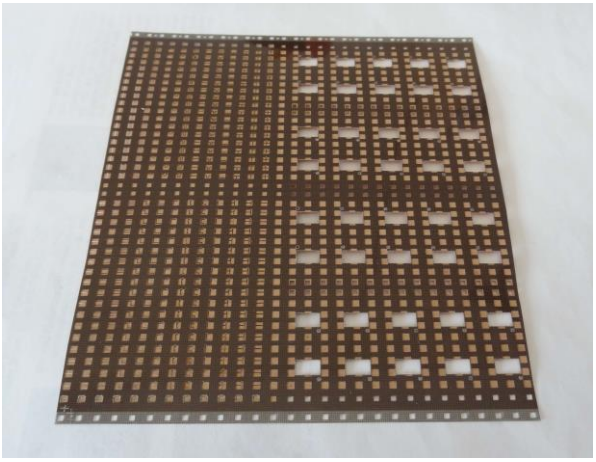
- Cutting of arbitrary shapes
- Negligible heat damage to the material
- Negligible contamination / re-deposition

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

	**SYSTEM**	Machine type	LDS 200M
	**MICROJET® PARAMETER**	Nozzle diameter	40 *µm*
		MicroJet® diameter	~32 *µm*
		Water pressure	400 *bar*
		Assist gas	He
	**LASER PARAMETER**	Laser type	L51G
		Wavelength	532 *nm*
		Pulse frequency	12 *kHz*
		Average power	~12 *W*
		Pulse width	~200 *ns*
	**CUTTING PARAMETER**	Cutting speed	4 (sample1) *mm/s* 4 (sample2)
		Number of passes	2 (sample1) 7 (sample2)
		Overall speed	~2 (sample1) *mm/s* ~0.57 (sample2)
		Process time	~29 (sample1) *min* 7 ~49 (sample2)
		Fixing system	Vacuum chuck

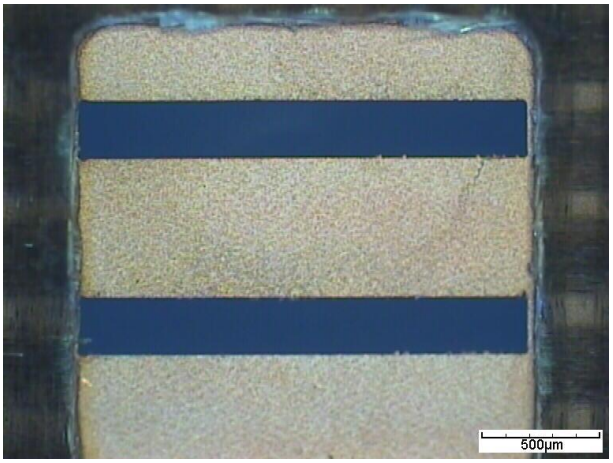
RESULTS

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

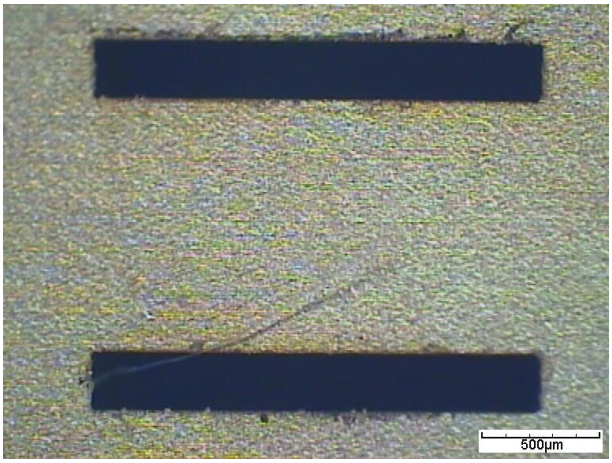


Picture 2: digital camera image of the samples (sample 1: left side/ sample 2: right side)

Sample 1

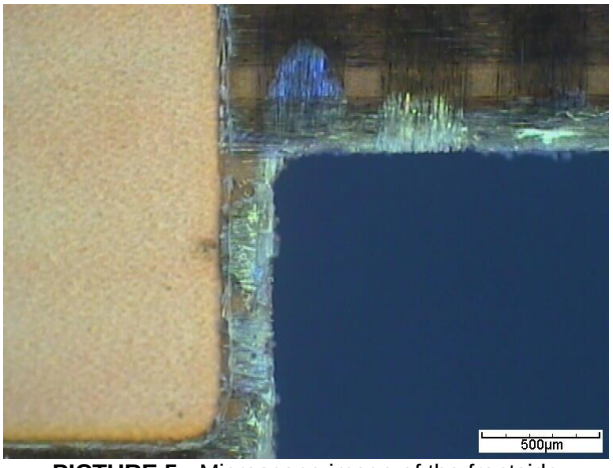


PICTURE 3: Microscope image of the frontside (dark field illumination)

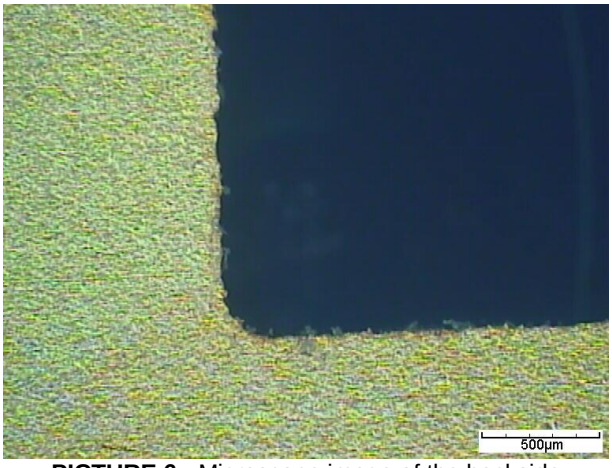


PICTURE 4: Microscope image of the backside (dark field illumination)

Sample 2



PICTURE 5: Microscope image of the frontside (dark field illumination)



PICTURE 6: Microscope image of the backside (dark field illumination)

The table below summarises Anonymous expectations and our results.

	What are your priorities? (please put a cross)	Quantified expectations or improvements
Speed / throughput:	X	2 (sample 1) and ~0.6 (sample 2) mm/s
Kerf-width:	X	~35µm
Precision:	X	A shift in the alignment is visible because the calibration done on the epoxy glass fiber area does not give a good accuracy
Burr-free:	X	Sample 1: Very good cutting

		quality Sample 2: some delamination is visible on the glass epoxy

CONCLUSION

The cutting of copper and glass epoxy was investigated on SYNOVA LCS 300M. 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 Silicon wafers with high quality.

These tests show that:

- The process is feasible
- The overall cutting quality is good except on the glass fibers
- Calibration must be done on copper area to avoid any shift in the alignment

Depending on your requirements, we could try in a further step to minimize the delamination of the glass epoxy or to increase the overall 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.