REPORT: Silicon wafer cutting by Laser-MicroJet®

for Anoymous

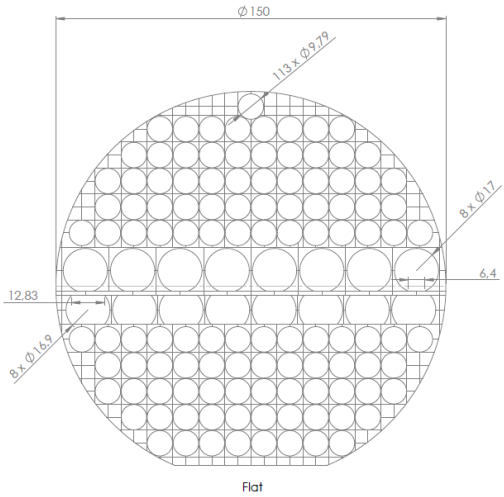
by Manuel Meizoso; Synova SA

TASK

The Laser-MicroJet® technology has been tested for cutting silicon wafers.
The aim of this second iteration was to improve the cutting quality and geometry as well as the wafer cleanliness.

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE 1	Material	Silicon
	Dimension	Ø 6 *Inch*
	Thickness	~450 *µm*
	Quantity	1 *pc*



Picture 1: Drawing representing the cutting path

Release of application report			
Responsible Job Shop		Responsible Application Group	
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Date:	05.10.2012	Date:	05.10.2012
Visum:	MM	Visum:	BC

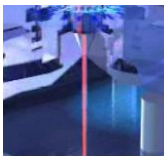
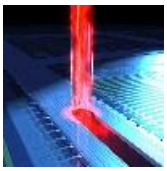
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, the LDS 200M equipped with a single cavity Nd:YAG laser has been used as the machine configuration in our lab.
It is a clean-room compatible 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
- Minimal chipping on both sides
- Negligible heat damage to the material
- Negligible contamination / re-deposition
- Excellent wall surface quality

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

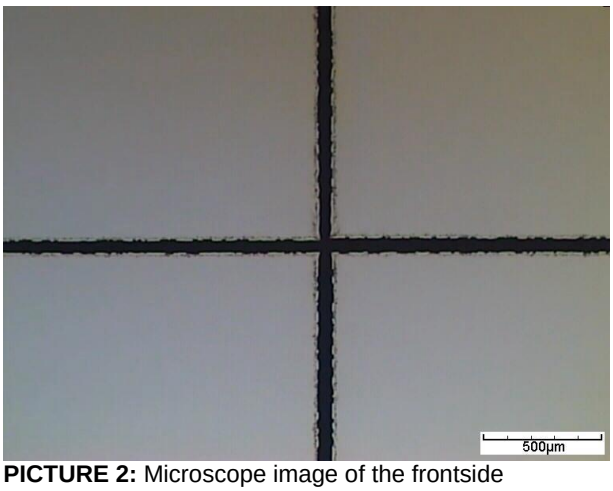
	**SYSTEM**	Machine type	LDS 200M	
	**MICROJET® PARAMETER**	Nozzle diameter	50	*µm*
		MicroJet® diameter	45	*µm*
		Water pressure	200	*bar*
		Assist gas	He	
	**LASER PARAMETER**	Laser type	L51G	
		Wavelength	532	*nm*
		Pulse frequency	22	*kHz*
		Average power	20	*W*
	**CUTTING PARAMETER**	Cutting speed	100	*mm/s*
		Number of passes	8-10 (depending on geometry)	*
		Overall speed	10-12.5	*mm/s*
		Cutting time (6" wafer)	~16**	*min*
		Tape	Type: 636	

* Lines were cut in 8 passes, small circles in 10 passes
** Pure cutting time without alignment and cleaning

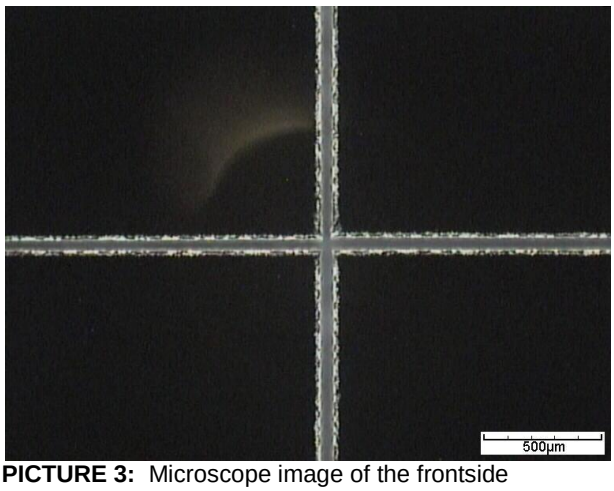
Note that the wafers have been cleaned after processing.

RESULTS

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



PICTURE 2: Microscope image of the frontside (bright field illumination)



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

CONCLUSION

The cutting of silicon wafers was investigated on SYNOVA LDS 200M. 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.

The aim is now (following your process flow) to bring the processed sample into your production line in order to expand the cut wafer and to pick the chips.

We thank you for your interest in our technology and we hope 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.