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APPLICATION REPORT

Report No: 122-8
Sample No: 2.2.1068

CONFIDENTIAL

REPORT:

Wafer Downsizing by Laser-MicroJet®

for Anonymous

by Samuel Obi, Synova SA

TASK

The Laser-MicroJet® technology has been tested for cutting 720µm thick silicon wafers into smaller discs. Two types of wafers were available; both types had been glued on alumina carrier plates by the customer. See Figure 1 below:

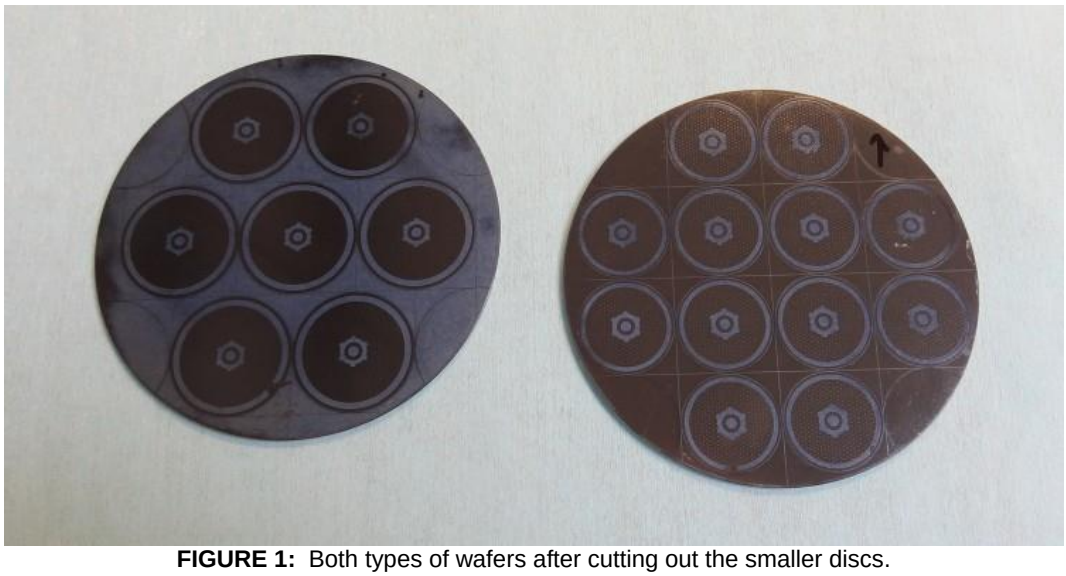

FIGURE 1: Both types of wafers after cutting out the smaller discs.

Release of application report			
Project Leader		Responsible Application Group	
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Date:	22.02.2012	Date:	22.02.2012
Visum:		Visum:	

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE 1	Material	Patterned silicon wafers	
	Carrier	Alumina plate	
	Dimension	Ø200	*mm*
	Thickness	720	*µm*
	Number of discs to cut out	12	
	Disc size	Ø23.8	*mm*
	Quantity of wafers	3	*pcs*

SAMPLE 2	Material	Patterned silicon wafers	
	Carrier	Alumina plate	
	Dimension	Ø200	*mm*
	Thickness	720	*µm*
	Number of discs to cut out	7	
	Disc size	Ø29.8	*mm*
	Quantity of wafers	2	*pcs*

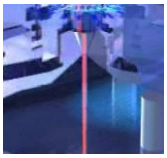
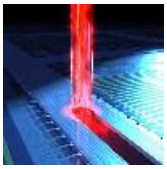
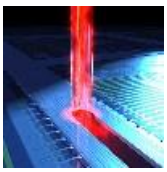
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, the LCS 300 RZW equipped with a frequency-doubled Q-switched Nd:YAG laser has been selected as the most suitable machine configuration.
This machine is based on the Laser-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 machining of silicon with high quality.
It is a manually loaded clean-room compatible machine, allowing to cut, drill, groove, scribe, trench, mark, or grind wafers of any kind of semiconductor material. Please note that Synova is also supplying customized fully automated machines capable of handling bare wafers in cassette-to-cassette operation.

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

- Advantageous process rates
- Excellent fracture strength
- Cutting of arbitrary shapes
- No chipping
- Negligible heat damage to the material
- No slag or burr formation
- No contamination or re-deposition

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

	**SYSTEM**	Machine type	LDS 200 M
	**MICROJET® PARAMETER**	Nozzle diameter	50 *µm*
		MicroJet® diameter	45 *µm*
		Water pressure	300 *bar*
		Assist gas	He
	**LASER PARAMETER**	Laser type	L101G
		Wavelength	532 *nm*
		Pulse frequency	20 *kHz*
		Average power	25 *W*
	**CUTTING PARAMETER – SAMPLE 1**	Cutting speed	120 *mm/s*
		Number of passes	30
		Process time per disc[1]	20 *sec*
		Process time per wafer[1]	280 *sec*
	**CUTTING PARAMETER – SAMPLE 2**	Cutting speed	120 *mm/s*
		Number of passes	30
		Process time per disc[1]	25 *sec*
		Process time per wafer[1]	175 *sec*

[1] Pure cutting time, not counting loading, unloading and alignment

RESULTS

The following microscope pictures give an overview on the quality obtained with the Laser-MicroJet® technology:

FIGURE 2: Microscope image of the cut (bright field imaging). The edge of the disc is sharp and clean.

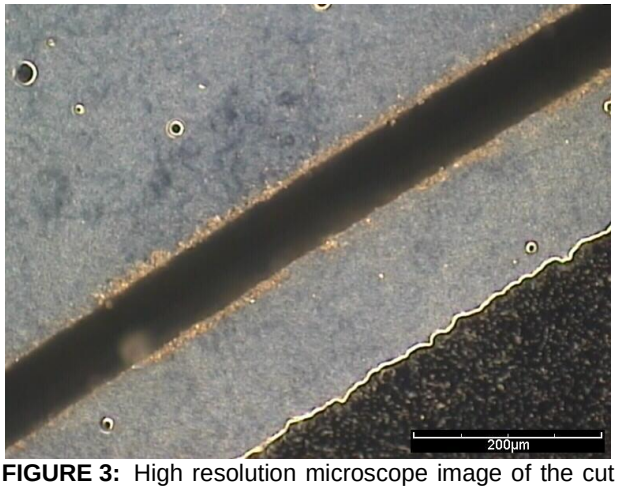


FIGURE 3: High resolution microscope image of the cut (bright field imaging).

CONCLUSION

Downsizing of diameter 100mm silicon wafers into smaller discs was investigated with the Laser-MicroJet® technology (LMJ) on the Synova LDS200M. The LMJ is ideally suited for such an application, because the ablation rates in silicon are very high, while the mechanical impact of the process is negligible. The continuously running waterjet also keeps particles from sticking to the wafer.

Our results are summarized in the table below: we achieved excellent quality standards without chipping or heat damage with very high throughput rates.

	Customer priorities	Synova results and comments
• Speed / throughput:	X	20 sec for Ø23.8mm disc 25 sec for Ø29.8mm disc
• Kerf-width:	X	Around 60µm
• Burr-free:	X	No burrs
• Depth control:	X	Cut stops at alumina plate
• Contamination/Particles:	X	No contamination
• Heat-damage free:	X	No heat damage
• Chipping/Cracks:	X	No chipping
• Edge Roughness:		Excellent edge quality
• Tolerances:	X	High tolerances
• Fracture strength:	X	Very high fracture strength

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