

 <b>SYNOVA</b> Ch. Dent-d'Oche CH-1024 Ecublens Switzerland www.synova.ch	<h1>APPLICATION REPORT</h1>	Report No: 121-6
		Sample No: 2.2.1060
		<b>CONFIDENTIAL</b>

## REPORT:                      **Wafers dicing by Laser-MicroJet®**

for                                      Anonymous

by                                        Mr Stéphane Delahaye; Synova SA

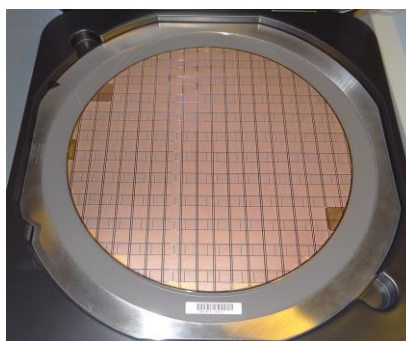
### TASK

The Laser-MicroJet® technology has been tested for the dicing of 790µm silicon wafers.

### SAMPLE DESCRIPTION AND PREPARATION

<b>SAMPLE</b>	Material	770µm Si + 20µm passivation layer
	Dimension	Ø 12 inch
	Thickness	~790 µm
	Quantity	3 pcs

3 wafers were available for cutting tests.



Release of application report			
Project Leader		Responsible Application Group	
Name:	Mr Stéphane Delahaye	Name:	D <sup>r</sup> Benjamin Carron
Date:	15/02/2012	Date:	15/02/2012
Visum:		Visum:	

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The first one was used for parameter trials and the second was split in 4 parts for the final cutting tests. The last one is kept for additional tests and further improvements.

The silicon wafers were mounted on semiconductor standard dicing frames with UV-curable tape.

## PROCESS: INSTRUMENT & TEST PARAMETERS




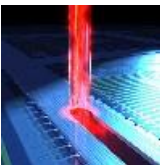
For these experiments, the LDS 200M equipped with a single cavity Nd:YAG laser has been used as the machine configuration in our lab.

It is a fully automatic cassette-to-cassette 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<sup>®</sup> technology with regards to your application are:

- Cutting of arbitrary shapes
- Minimal chipping on the frontside/ some chipping on the backside
- No heat damage to the material
- Negligible slag/burr formation
- Negligible contamination / re-deposition

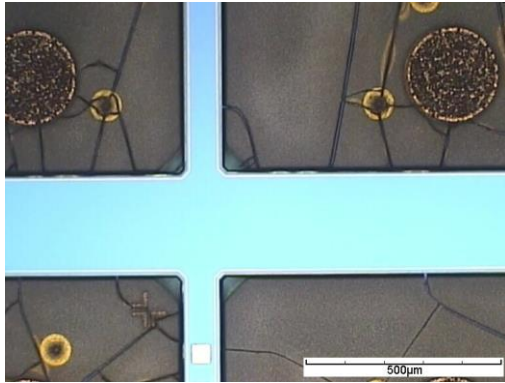
In the table below, the optimized processing parameters used in the experiments are summarized:

	<b>SYSTEM</b>	Machine type	LDS 200 M
	<b>MICROJET<sup>®</sup> PARAMETER</b>	Nozzle diameter	30 $\mu\text{m}$
		MicroJet <sup>®</sup> diameter	~24 $\mu\text{m}$
		Water pressure	450 <i>bar</i>
		Assist gas	He
	<b>LASER PARAMETER</b>	Laser type	L51G
		Wavelength	532 <i>nm</i>
		Pulse frequency	20 <i>kHz</i>
		Average power	~19.6 <i>W</i>
	<b>CUTTING PARAMETER</b>	Cutting speed	100 <i>mm/s</i>
		Number of passes	40
		Overall speed	2.5 <i>mm/s</i>
		Tape <sup>1</sup>	UV Tape: ADWILLD-628

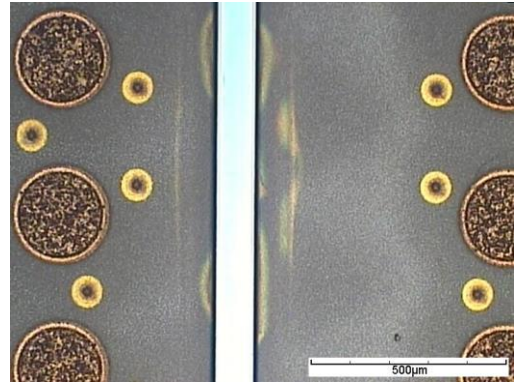
<sup>1</sup>: The UV-tape has been cured before shipping

## RESULTS

It's important to mention that when we checked the wafers before processing cracks and discolorations have been found on the passivation layer. (see pictures below)

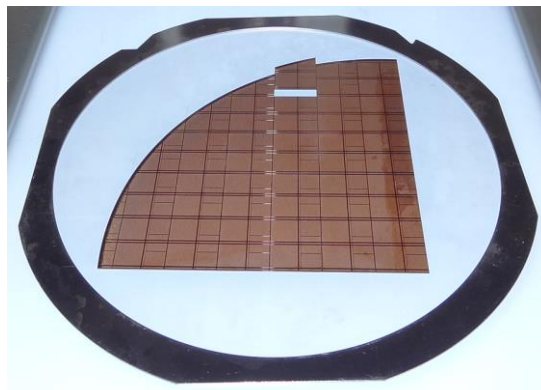


**PICTURE2:** Microscope image of the frontside (bright field illumination; top view)

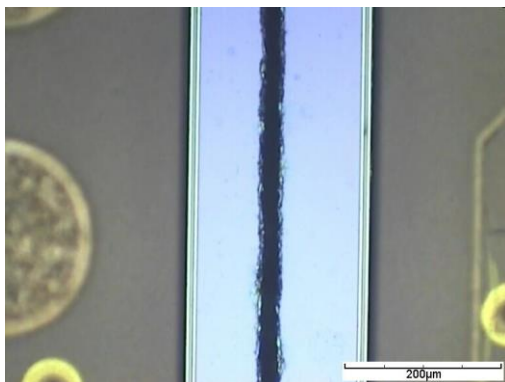


**PICTURE3:** Microscope image of the frontside (bright field illumination; top view)

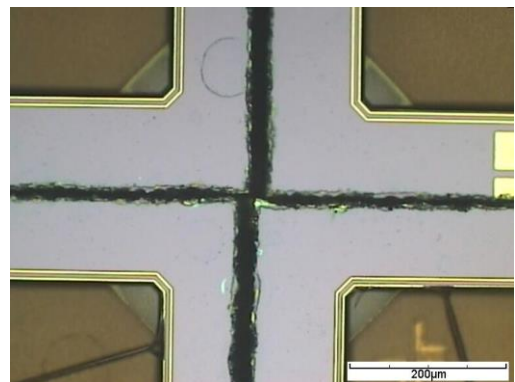
The following microscope picture give an overview on the quality obtained with the Laser-Microjet® technology.



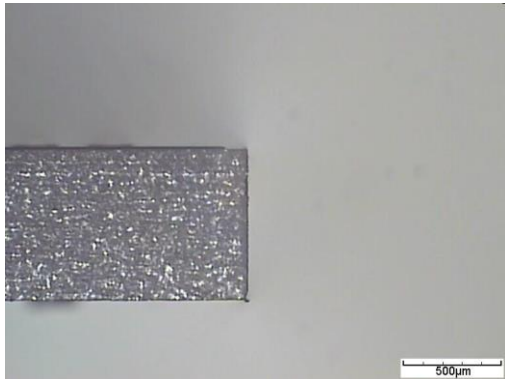
**PICTURE1:** Digital camera image of a 1/4 wafer after dicing



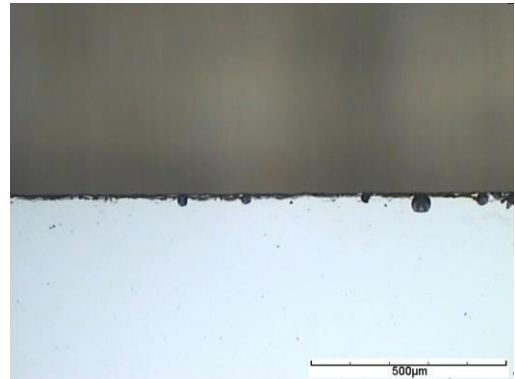
**PICTURE4 :** Microscope image of a street (bright field illumination)



**PICTURE5 :** Microscope image of an intersection (bright field illumination)



**PICTURE6** : Microscope image of the wafer edge after dicing (bright field illumination)



**PICTURE7** : Microscope image of the backside (bright 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	2.5 mm/s
Kerf/Street-width:	X	Kerf: ~29-34µm Street: ~44µm
Contamination/Particles:	X	Negligible
Heat-damage free:	X	No heat affected zone
Chipping/Cracks:	X	Minimal chipping on the front side Some chipping is observed on the back side

## CONCLUSION

The dicing of silicon wafers with passivation layer on the top was investigated on SYNOVA LDS 200 M. 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 dicing of silicon wafers with high quality.

These tests show that:

- The cutting wall quality is good and minimal chipping of the transparent layer in the street is observed on front side. Some chipping is visible on the back side
- The passivation layer on the chips looks to be fragile and defining a good cutting strategy is important to avoid any unnecessary contacts of the water jet with the surface.

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