REPORT: Wafer grooving by Laser-MicroJet®

for Anonymous

by Jerry Chera; Synova USA

TASK

The Laser-MicroJet® technology has been tested for cutting groves in multilayer silicon wafer.

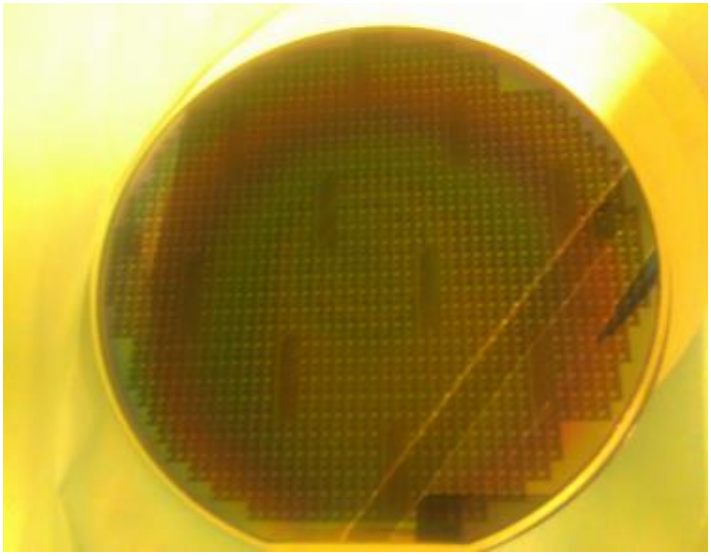
SAMPLE DESCRIPTION AND PREPARATION

SAMPLE	Material	Polyimide+Al + Oxide+CSC+Si+Backmetal
	Dimension	Dia = 150 *mm*
	Thickness	~500 *µm*
	Quantity	2 *pcs*

Detailed material description:-

• 1st layer:	Polyimide	thickness:	5 µm
• 2end layer:	Aluminium (minimal in saw street)	thickness:	4 µm (marker)
• 3rd layer:	Oxide	thickness:	5 µm
• 4th layer:	Compound Semiconductor (CSC)	thickness:	5 µm
• 5th layer:	Silicon	thickness:	480 µm
• 6th layer	Backmetal	thickness:	1 µm

Release of application report			
Project Leader		Responsible Application Group	
Name:	Jerry Chera	Name:	Dr Benjamin Carron
Date:	08.19.2013	Date:	08.21.2013
Visum:	JC	Visum:	BC



PROCESS: INSTRUMENT & TEST PARAMETERS

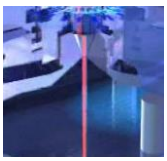
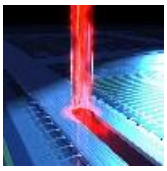
For these experiments, the LDS200 equipped with a frequency-doubled Q-switched Nd:YAG laser has been used as the machine configuration in our lab.
It is a clean-room compatible machine, allowing to cut, drill, groove, scribe, trench, mark, or grind wafers of any kind of material.

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

- Cutting of arbitrary shapes
- No chipping on front side, minimal chipping on backside
- Negligible heat damage to the material

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

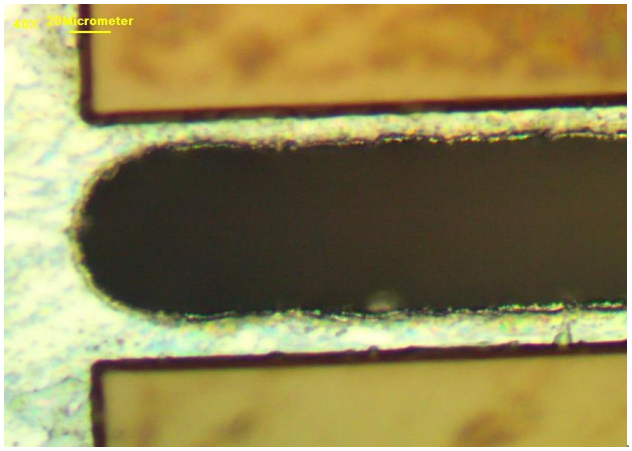
First Set of Experment With 70 Micron Nozzle

	**SYSTEM**	Machine type	LDS200
	**MICROJET® PARAMETER**	Nozzle diameter	70 *µm*
		MicroJet® diameter	55 *µm*
		Water pressure	250 *bar*
		Assist gas	He
	**LASER PARAMETER**	Laser type	LDP-200MQG
		Wavelength	532 *nm*
		Pulse frequency	40 *kHz*
		Average power	Internal power = 30 W
		Other Parmeters	SHG 24.9.9, He 1.00 Diode Current = 65%
	**CUTTING PARAMETER**	Cutting speed	150 *mm/s*
		Number of passes	2
		Process time	7 mins for verve wafer.
		Misc Info	No info available for Elvis wafer as it was cut with 50 micron nozzle.

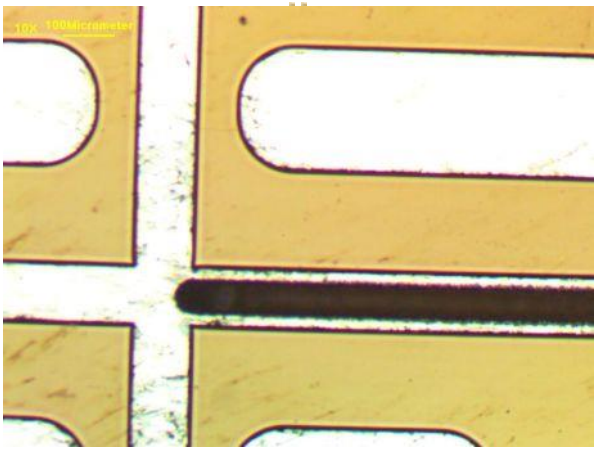
RESULTS

Edge Quality

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



Picture 1: Cut quality at 40x magnification. Pre clean.



Picture 2: Cut quality at 10x magnification. Pre clean.

CONCLUSION

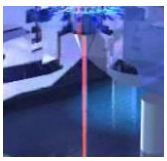
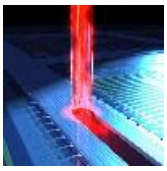
The grooving of multilayer silicon wafer was investigated on SYNOVA LDS200. This machine is based on the MicroJet® technology and combines the advantages of the high energy pulsed laser with a hair-thin water jet. While the laser is used for material ablation, the water jet is used for guiding the laser light, cooling the edges and preventing the sample from particle contamination, advantages that are essential for cutting of such kind of materials with high quality.

- The results showed a very good quality cut as shown in the pics.
- Very small HAZ (Heat Affected Zone).
- Good edge quality.

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

SECOND SET OF EXPERIMENTS WITH THE 50 MICRON NOZZLE to be followed in the next page

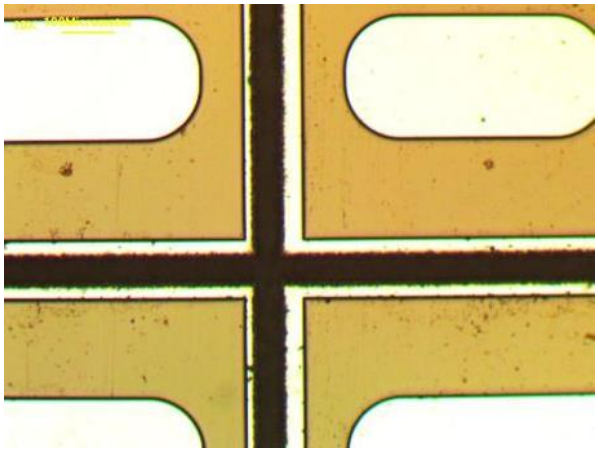
Second Set of Experment With 50 Micron Nozzle

	**SYSTEM**	Machine type	LDS200
	**MICROJET® PARAMETER**	Nozzle diameter	50 *µm*
		MicroJet® diameter	45 *µm*
		Water pressure	250 *bar*
		Assist gas	He
	**LASER PARAMETER**	Laser type	LDP-200MQG
		Wavelength	532 *nm*
		Pulse frequency	40 *kHz*
		Average power	Internal power = 19 W Pwr in waterjet = 9 W
		Other Parmeters	SHG 24.9.9, He 1.00 Diode Current = 58% Pulse Width = 700 ns
	**CUTTING PARAMETER**	Cutting speed	150 *mm/s*
		Number of passes	3
		Process time	11 mins for Verve wafer & 5 mins for Elvis wafer
		Misc Info	There are two sets of wafers with different pitch. One is called Verve and other called Elvis.

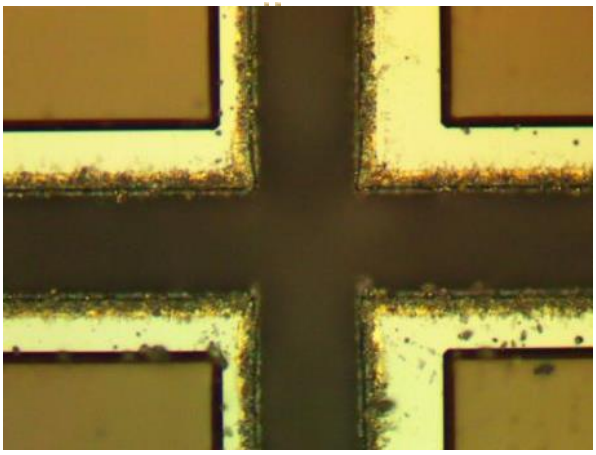
RESULTS

Edge Quality

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



Picture 3: Cut quality at 10x magnification. Pre clean.



Picture 4: Cut quality at 40x magnification. Pre clean.

CONCLUSION

The grooving of multilayer silicon wafer was investigated on SYNOVA LDS200. 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 of such kind of materials with high quality.

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