REPORT: Wafer dicing by Laser-MicroJet®

for Anonymous

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TASK

The Laser-MicroJet® technology has been tested for the dicing of Silicon wafers with mold compound on the top side and metals layer on the back side. The main goal was to demonstrate the feasibility of cutting such materials with a good surface quality and high cutting speed.

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE	Material	100µm mold compound + 100µm Silicon + 3µm TiNiAg
	Dimension	8 *Inch*
	Thickness	~200 *µm*
	Quantity	2 wafer *pcs*

2 wafers were available for cutting tests. The first one was used for parameter trials and the other was split in 4 parts for the final cutting tests. As the second wafer doesn't show any streets it makes difficult the alignment of the cut.

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

Release of application report			
Project Leader		Responsible Application Group	
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Date:	20/01/2012	Date:	20/01/2012
Visum:		Visum:	

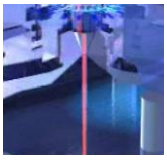
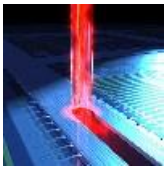
PROCESS: INSTRUMENT & TEST PARAMETERS

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 manually loaded 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:

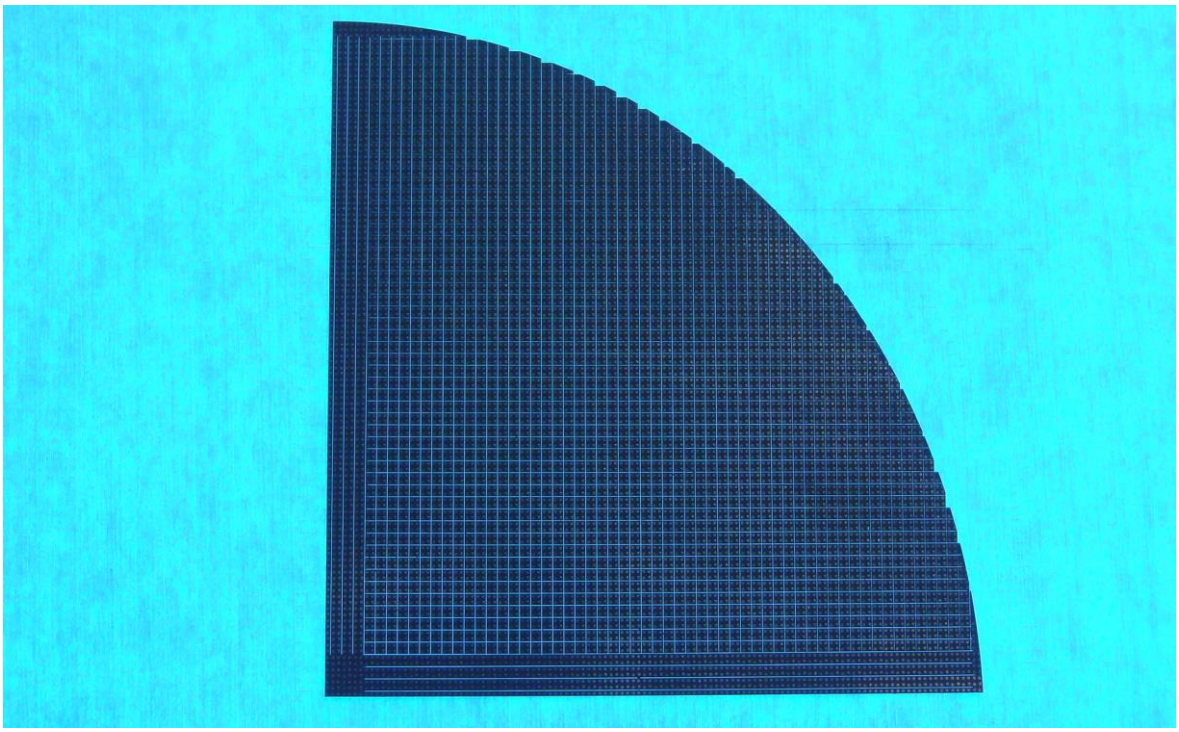
- Minimal chipping on the frontside
- No heat damage to the material
- No slag/burr formation
- Negligible contamination / re-deposition
- Advantageous process rates

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

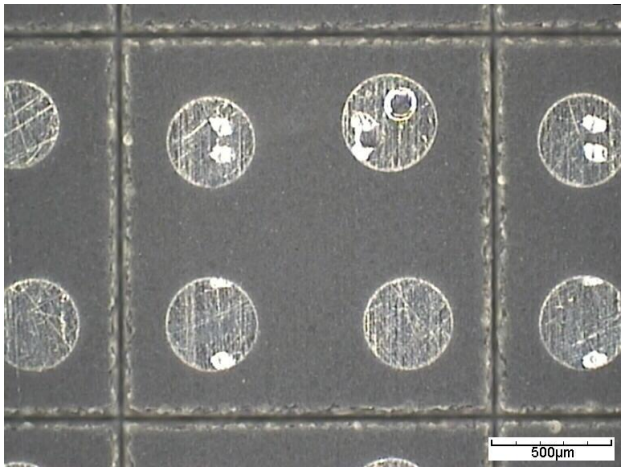
	**SYSTEM**	Machine type	LDS 200M
	**MICROJET® PARAMETER**	Nozzle diameter	30 *µm*
		MicroJet® diameter	~27 *µm*
		Water pressure	450 *Bar*
		Assist gas	He
	**LASER PARAMETER**	Laser type	L51G
		Wavelength	532 *Nm*
		Pulse frequency	20 *kHz*
		Average power	~10.6 *W*
	**CUTTING PARAMETER**	Cutting speed	300 *mm/s*
		Number of passes	Horizontal lines: 18 Vertical lines: 20
		Overall speed	15-17 *mm/s*
		Tape	UV Tape: ADWILLD-628

RESULTS

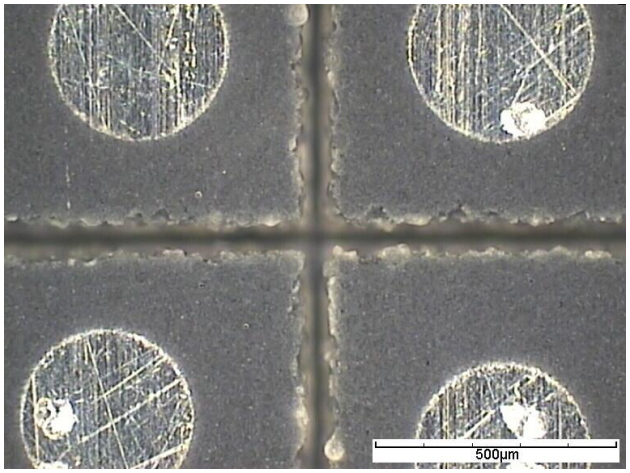
The following microscope picture give an overview on the quality obtained with the Laser-Microjet® technology.



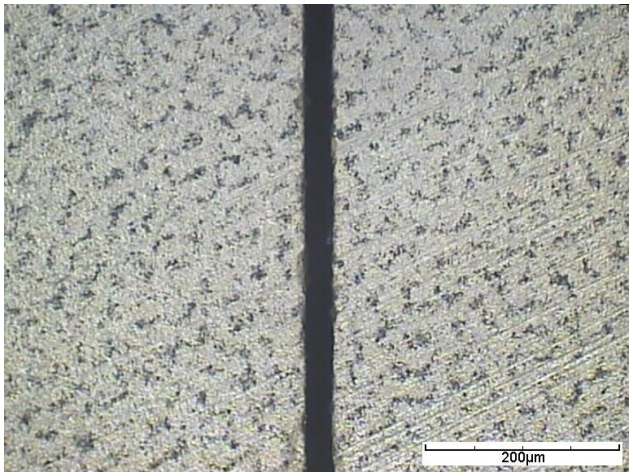
PICTURE 1: Digital camera image of the ¼ processed wafer



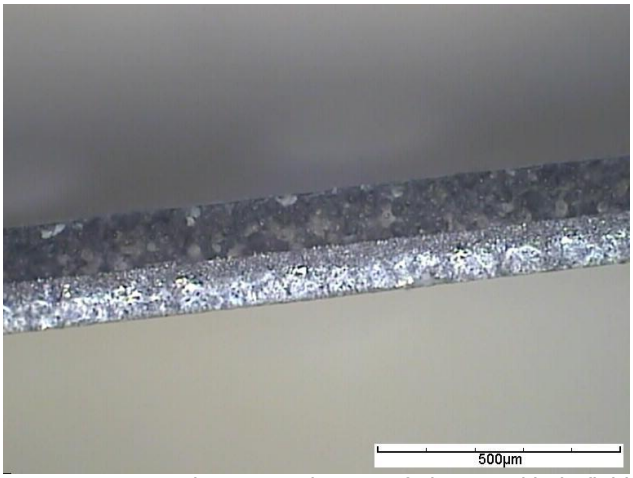
PICTURE 2: Microscope image of one chip (dark field illumination; front side view)



PICTURE 3: Microscope image of the cuts (dark field illumination; front side view). The edges are good and no heat affected zone is visible.



PICTURE 4: Microscope image of the cut (dark field illumination; back side view). No chipping is visible on the back side



PICTURE 5: Microscope image of the cut (dark field illumination; side view). The cut through the mold is regular with a straight sidewall

The table below summarizes the results.

	What are your priorities? (please put a cross)	Quantified expectations or improvements
Speed / throughput:	50 mm/s	15-17mm/s. Maybe improved with a more powerful laser, but the quality will suffer
Kerf-width:	X	~30µm on the Silicon, ~100µm on the mold compound
Burr-free:	X	No burrs observed
Contamination/Particles:	X	No contamination or particles
Heat-damage free:	X	No heat affected zone
Chipping/Cracks:	X	Minimal chipping on the frontside
Edge Roughness:	X	Good
Fracture strength:	X	Can't be measured in our lab

CONCLUSION

The dicing of silicon wafers with mold compound on the top 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 dicing of silicon wafers with high quality.

These tests show that:

- The quality of the cut is good. Some chipping is visible on the front side due to the grain observed into the mold (see picture 3).
- Speed of the cut is 15-17mm/s. This speed could certainly be increased but the quality will suffer from it.

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.