REPORT: Silicon wafer downsizing by Laser MicroJet®

for attention of Anonymous

by Ronan Martin, Synova SA

TASK

The Laser MicroJet® technology has been tested for cutting thick silicon. The aim of the tests was to minimize chipping on the backside.

SAMPLE DESCRIPTION

Forty wafers were provided: two sets of twenty wafers in two different thicknesses. We eventually had time to work on one type of wafer only. Fortunately, we chose to start with the thicker wafers, which are more prone to chipping. Like in the previous tests, we cut Ø100mm discs.

WAFERS	Material	Silicon
	Diameter	125 *mm*
	Thicknesses	1450 *µm*
	Quantity	7 *pcs.*

Release of application report			
Project Leader		Responsible Application Group	
Name:	Ronan Martin	Name:	Dr Benjamin Carron
Date:	08.02.2015	Date:	08.02.2015
Visum:	ROM	Visum:	BC

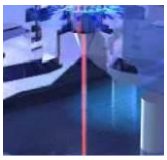
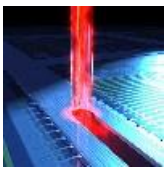
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, an LCS 150 equipped with a frequency-doubled Nd:YAG laser have been used as the machine configuration in our lab. This machine allows cutting most ceramics, and any kind of metal.

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

- Negligible heat damage to the material
- Excellent wall surface quality
- Limited chipping
- Advantageous process speed

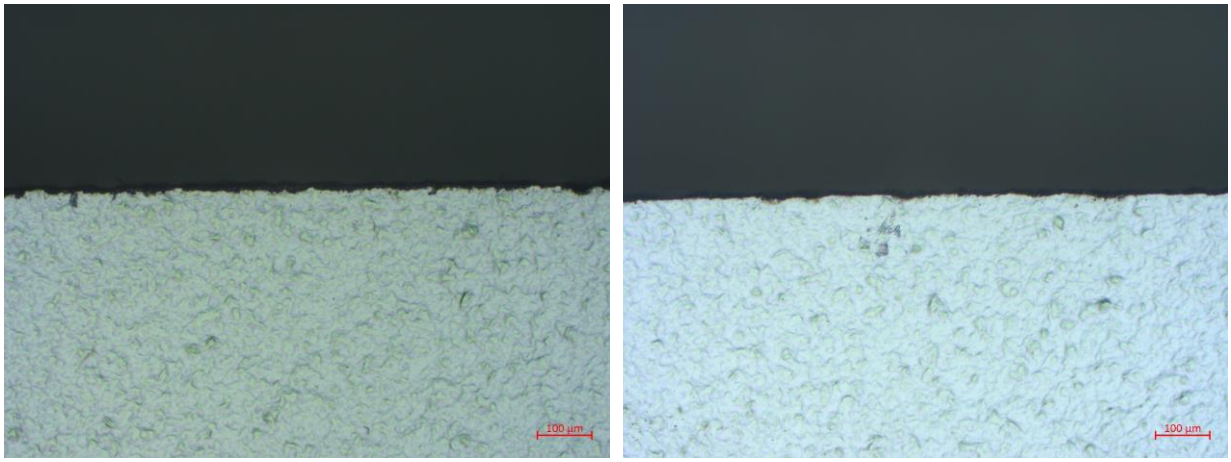
The table below summarizes the optimized processing parameters used in the experiments. Two steps were used to cut the wafers.

	**SYSTEM**	Machine type	LCS 300	
		Optical head type	Standard	
		Coupling unit type	Thin, high pressure	
		Fixture	Vacuum chuck	
	**MICROJET® PARAMETERS**	Nozzle diameter	50 *µm*	
		MicroJet® diameter	42 *µm*	
		Water pressure	350 *bar*	
		Assist gas	He, 0.9 *L/min*	
			Step 1	**Step 2**
	**LASER PARAMETERS**	Laser type	L51G	
		Wavelength	532 *nm*	
		Pulse frequency	18 *kHz*	8 *kHz*
		Internal power	26.8 *W*	29.8 *W*
		Power in jet	16.8 *W*	18.1 *W*
		Pulse width (estim.)	450 *ns*	230 *ns*
	**CUTTING PARAMETERS**	Working distance	8 *mm*	
		Motion speed	300 *mm/s*	10 *mm/s*
		Number of passes	56	1
		Cutting time	105 *s*	

RESULTS

The pictures below show the improved quality that was obtained. Like in the previous tests on such thick wafers, it was a bit more challenging to get perfectly clean front side and regular back side, but the chipping was greatly reduced.

Using the same cutting strategy on thinner wafers would lead to even better results.



PICTURES 1A & 1B : Images of the edge of a 1450µm-thick disc (left: frontside; right: backside)

CONCLUSION

The downsizing and chamfering of silicon wafers were investigated on a Synova LCS 150. This machine is based on the Laser MicroJet® technology and combines the advantages of a high-energy pulsed laser and 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 silicon with high quality.

These tests have shown that it is possible to cut wafers with virtually no chipping on both the front side and the back side.

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