REPORT: Si3N4 wafer cutting by Laser MicroJet®

for attention of Anonymous

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TASK

The Laser MicroJet® technology has been tested for determining the feasibility of cutting rectangles and ovals in 2 mm thick Si3N4 wafer covered with 40-50 µm of CVD diamond.

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE 1	Material	Si3N4 and CVD diamond	
	Dimension	~18*25	*mm*
	Thickness	~2.000 + 0.050	*mm*
	Quantity	1	*pcs*

Release of application report			
	Project Leader		Responsible Application Group
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Date:	02.02.2015	Date:	02.02.2015
Visum:	SDE	Visum:	BC

PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, a DCS 150 equipped with a frequency-doubled Q-switched Nd: YAG has been used as the machine configuration in our lab. This machine allows to cut, drill, groove, scribe, trench, mark or grind any kind of material.

The table below summarizes the optimized processing parameters used in the experiments:

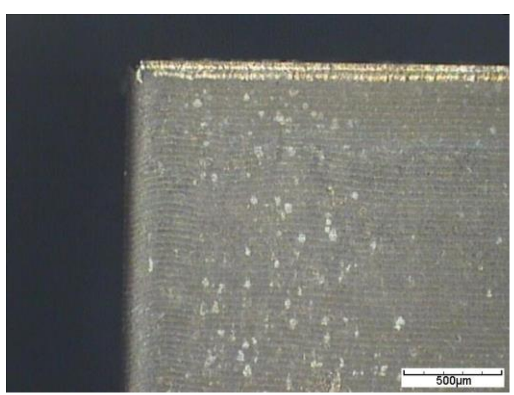
SYSTEM	Machine type	DCS 150	
	Helium flow	0.7	L/min
	Working distance	*12*	*mm*
	Laser fiber	150	*µm*
	Collimator	200	*mm*
MICROJET® PARAMETER	Nozzle diameter	40	*µm*
	MicroJet® diameter	33	*µm*
	Water pressure	350	*bar*
	Assist gas	He	
LASER PARAMETER	Laser type	L101G	
	Wavelength	532	*nm*
	Pulse frequency	6	*kHz*
	Average power	Rectangle: 10 Oval: 16	*W*
	Pulse width	<180	*ns*
CUTTING PARAMETER	Cutting speed	Rectangle: 6 and 7 Oval: 6	*mm/s*
	Number of passes	Rectangle: 80 Oval: 90	
	Fixation	Clamps	

RESULTS

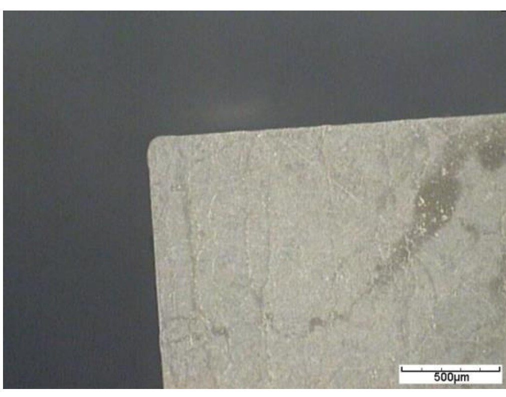
Only few trials were possible due to the small amount of material available. The cutting parameters were optimized to minimize the chipping on the frontside.
The following microscope pictures give an overview on the quality obtained with the Laser-Microjet® technology.

PICTURE 1: Microscope image of the top side of the sample.

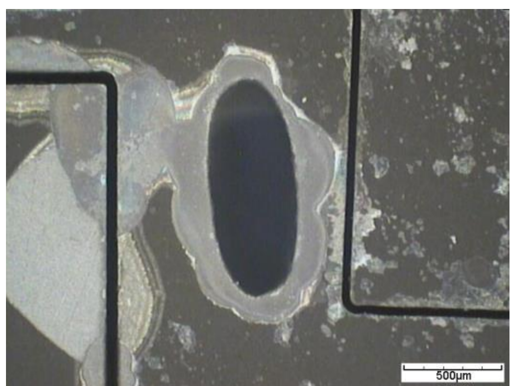
PICTURE 2: Microscope image of the top side of the sample



PICTURE 3: Microscope image of the sidewall of the sample.



PICTURE 4: Microscope image of the back side of the sample



PICTURE 5: Microscope image of the top side of the sample.

CONCLUSION

The cutting of Si3N4 wafer with CVD diamond coating on the top was investigated on a SYNOVA DCS 150. 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 cutting Si3N4 wafer with high quality.

This first iteration shows that it is feasible to cut small rectangles and ovals into this material. However some chipping is visible on the frontside and more developments are required to improve frontside quality and “oval” process stability.

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