REPORT: Silicone Covered Al_2O_3 Dicing by Laser-MicroJet®

for Anonymous

by Michael Pavius; Synova SA

TASK

The Laser-MicroJet® technology has been tested for dicing a LED sample made of Al_2O_3 covered with a silicone layer.

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE		1st layer	2nd layer
	Material	Silicone	Al_2O_3
	Thickness	100	508 *µm*
	Quantity		2 *pcs*

Release of application report			
Project Leader		Responsible Application Group	
Name:	Michaël Pavius	Name:	Dr Benjamin Carron
Date:	26.03.2012	Date:	27.03.2012
Visum:		Visum:	

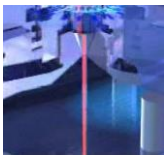
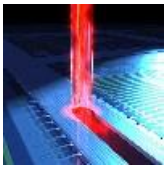
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, the LCS150 equipped with a frequency-doubled Q-switched 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 different kinds of materials.

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

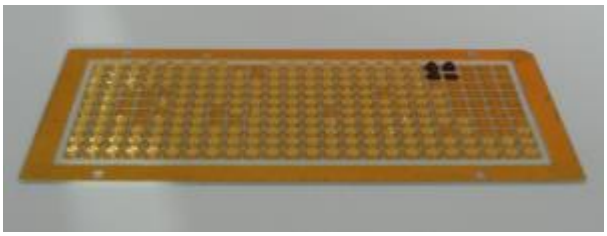
- Cutting of arbitrary shapes
- No chipping on front side, minimal chipping on backside
- Negligible heat damage to the material
- Parallel and smooth cut walls
- Negligible contamination / re-deposition

In the table below, the optimised processing parameters used in the experiments are summarised:

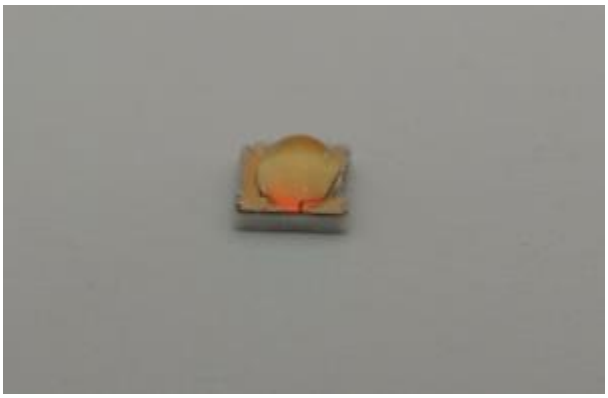
	**SYSTEM**	Machine type	LCS150
	**MICROJET® PARAMETER**	Nozzle diameter	80 *µm*
		MicroJet® diameter	66 *µm*
		Water pressure	200 *bar*
		Assist gas	He
	**LASER PARAMETER**	Laser type	L202G
		Wavelength	532 *nm*
		Pulse frequency	10 *kHz*
		Average power	2 x 50 *W*
	**CUTTING PARAMETER**	Scanning speed	10 *mm/s*
		Number of passes	12
		Overall speed	50 *mm/min*
		Fixture	clamped

RESULTS

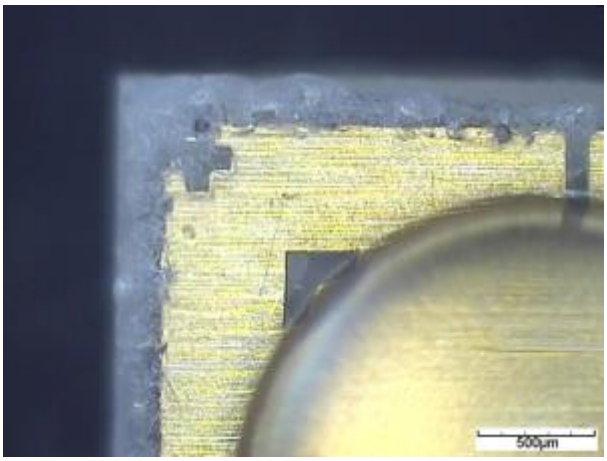
The following microscope pictures give an overview on the quality obtained with the Laser-Microjet® technology.



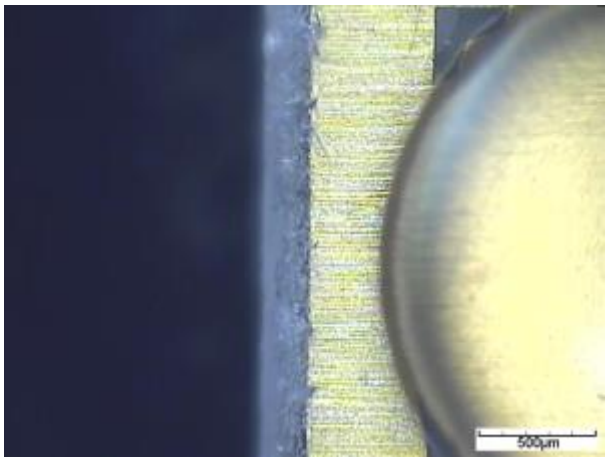
PICTURE 1: Digital picture of one complete sample (100 x 50 mm) (dark field illumination; frontside view)



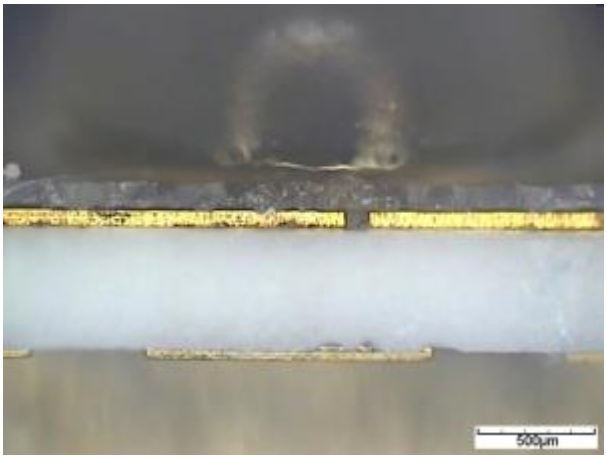
PICTURE 2: Digital picture of one cut chip (3.4 x 3.4 mm) (dark field illumination; frontside view)



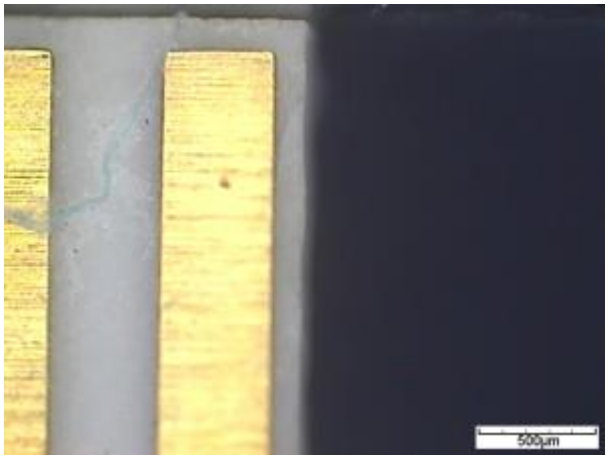
PICTURE 3: Microscope image of one cut chip (dark field illumination; frontside view)



PICTURE 4: Microscope image of one cut chip (dark field illumination; frontside view)



PICTURE 5: Microscope image of one cut chip (dark field illumination; cross-section view)



PICTURE 6: Microscope image of one cut chip (dark field illumination; backside view)

We are able to cut the Al_2O_3 layer with high quality: neither chipping nor crack can be observed. The metal layer which is all around the border is also undamaged (burr-free).

However, we are facing peeling of the silicone layer on the Al_2O_3 layer despite the different strategies we tested so far (lower water pressure, faster scanning speed, lower laser average power).

The following table summarises LGCNS's expectations and the results we obtained so far

	Customer expectations	Results
• Speed / throughput:	2	50 mm/min
• Burr-free:	1	Samples are burr-free
• Contamination/Particles:	1	No contamination
• Heat-damage free:	1	No heat affected zone
• Chipping/Cracks:	1	No cracks, no chipping of Al_2O_3. However, the silicone layer is delaminating all around the chips

CONCLUSION

The cutting of Al_2O_3 covered with a layer of silicone was investigated on SYNOVA LCS150. 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 Al_2O_3 with high quality.

We successfully cut the Al_2O_3 layer:

- Neither chipping nor cracks can be observed
- Cutting speed is currently 50 mm/min
- The metal layer which is all around the border is also undamaged
- However, the silicone layer is delaminating all around the border.

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