

REPORT: Cubic Zirconia Plate Cutting by Laser-MicroJet® – Speed Improvements

for Anonymous

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TASK

As reported in Synova Application Report 116-3, a previous series of tests showed the feasibility of cutting cubic zirconia plates with the Laser-MicroJet® technology (LMJ). Here, the goal was to improve the cutting speed and the process throughput.

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE A	Material	Cubic zirconia
	Thickness	1.60-1.65 mm



FIGURE 1: Cubic zirconia plate to be cut into small cubes.

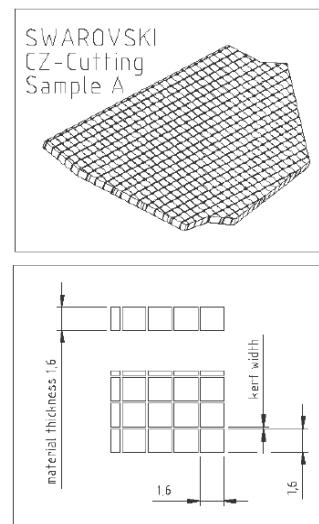





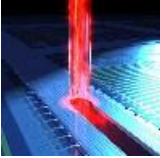
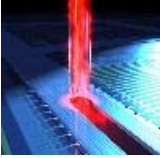
FIGURE 2: Layout of the cuts to get small cubes of 1.6 x 1.6mm.

Release of application report	
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PROCESS: INSTRUMENT & TEST PARAMETERS

In the table below, the optimised processing parameters are summarised:

	SYSTEM	Machine type	LCS300
	MICROJET[®] PARAMETER	Nozzle diameter	100 μm
		Water pressure	200 <i>bar</i>
		Assist gas	He
		Fixture	clamped
	LASER PARAMETER	Laser type	L202G
		Wavelength	532 <i>nm</i>
	CUTTING PARAMETER – FIRST CUTS	Pulse frequency	14 <i>kHz</i>
		Average power	120 <i>W</i>
		Scanning speed	60 <i>mm/s</i>
		Number of passes	50
		Overall cutting speed	1.2 <i>mm/s</i>
	CUTTING PARAMETER – CROSS CUTS	Pulse frequency	10 <i>kHz</i>
		Average power	120 <i>W</i>
		Scanning speed	60 <i>mm/s</i>
		Number of passes	70
		Overall cutting speed	0.86 <i>mm/s</i>
	SPEED RESULT	Average cutting speed	1.03 <i>mm/s</i>

First, lines were cut into the plate in one direction. The process was optimized using the “first cuts” parameters from above. This way, a comb-like structure was obtained (bars fixed at one end). The bars were then cut into cubes using the “cross cuts” parameters. These parameters were slightly different because the waterjet is disturbed at the line intersections. The efficiency is slightly lower and the lines are not completely cut through (see Figure 5 below). To obtain the final cubes, the remaining material is broken.

RESULTS

The following pictures give an overview on the quality obtained:



FIGURE 3: Cubic zirconia plate after cutting bars and cubes.



FIGURE 4: Side view of a cubic zirconia bar after the cut in the first direction.



FIGURE 5: Side view of a cubic zirconia cube after the cut in the "cross" direction. Around 15% of the total thickness is not cut through. The cube has been separated from the rest of the bar by breaking this remaining part.

CONCLUSION

Based on previous results with the Laser-MicroJet (LMJ), process tests were made with the goal of improving the overall cutting speed.

The main change was to use bigger nozzles and to apply higher power; a nozzle of **100 µm** in diameter with **120 Watt** laser power gave the best results: An overall average speed of around **1 mm/s** was obtained. Compared to the initial 0.23 mm/s and the previously reported 0.35 mm/s, this is an improvement of a **factor 3**.

With the equipment readily available in our lab, this is the range of overall cutting speed that can be obtained. We believe that even higher throughput is possible by using a more powerful laser.

We thank you again for your interest in our technology and we hope our results meet your requirements. Our sales team will contact you soon to discuss with you the further steps.