# REPORT: WCu cutting by Laser-MicroJet®

*For* Anonymous

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## TASK

The Laser-MicroJet® technology has been tested for the dicing of WCu samples. The goal was to give a first idea of the cutting speed while maintaining a good cutting quality (burrs<20 µm).

## SAMPLE DESCRIPTION AND PREPARATION

1 sample was available for the tests.

| | | | |
|---|---|---|---|
| 1st layer: | Au | thickness: | 0.5 µm |
| 2end layer: | Au/Sn | thickness: | 3-5 µm |
| 3rd layer: | Ti/Pt/Au | thickness: | 1 µm |
| 4th layer: | WCu or MoCu | thickness: | 300 µm |

Please note that the sample was mounted on semiconductor standard dicing frames with UV-curable tape.

| Release of application report | | | |
|---|---|---|---|
| Project Leader | | Responsible Application Group | |
| Name: | Mr Stéphane Delahaye | Name: | Dr Benjamin Carron |
| Date: | 05.05.2014 | Date: | 05.05.2014 |
| Visum: | SDE | Visum: | BC |

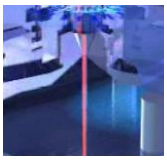
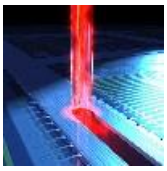
## PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, the LCS 150 machine 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 machine, allowing cutting and drilling any kind of metal piece.

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

- Cutting of arbitrary shapes
- Low heat damage to the material
- Negligible contamination / re-deposition

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

| | | | |
|---|---|---|---|
|  | **SYSTEM** | Machine type | LCS150 |
|  | **MICROJET PARAMETERS** | Nozzle diameter | 40 *µm* |
| | | MicroJet diameter | ~32 *µm* |
| | | Water pressure | 400 *bar* |
| | | Assist gas | He (0.9 *L/min*) |
|  | **LASER PARAMETERS** | Laser type | L51G |
| | | Wavelength | 532 *nm* |
| | | Frequency | 6 *kHz* |
| | | Pulse width | 120 *ns* |
| | | Power | 28 *W* |
| | | Power in jet | ~11 *W* |
|  | **CUTTING PARAMETERS** | Working distance | 12 *mm* |
| | | Motion speed | 25 *mm/s* |
| | | Pass numbers | 70 |
| | | Process speed | ~21.4 *mm/min* |
| | | Fixing system | UV Tape adwill-D611 |

Note that the sample has been UV-cured (2 min) after processing.

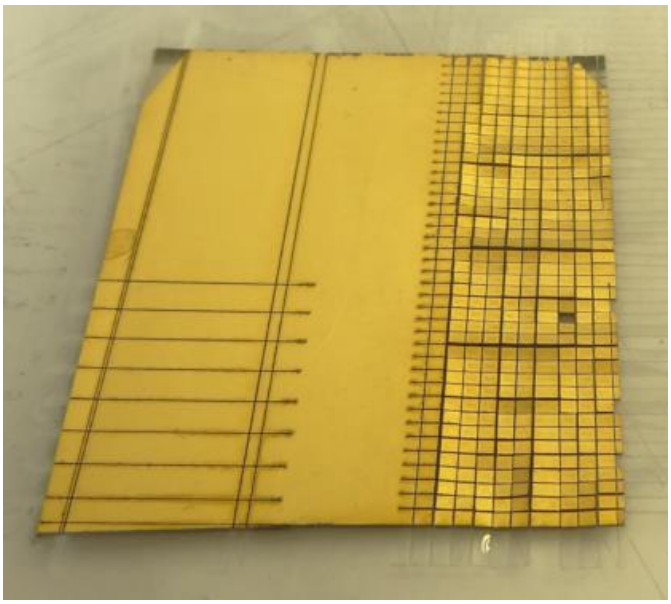
## RESULTS

As mentioned above the highest priority was to optimize the process speed while maintaining a good cutting quality A 40 *µm* nozzle was selected because it allows a good compromise between speed and cutting quality. Indeed:

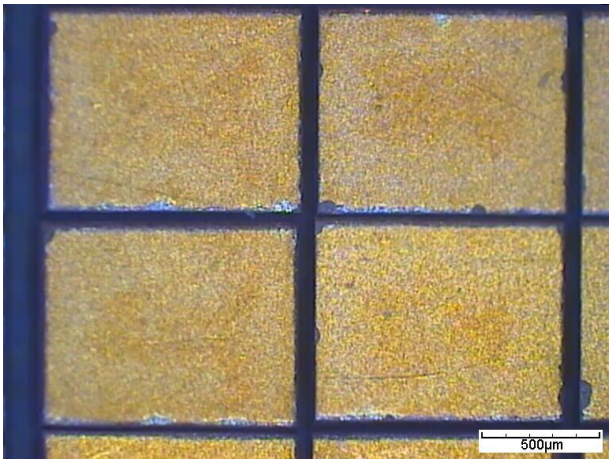
- Material removal is less efficient with a smaller nozzle size
- Higher pulse energy is possible with big nozzles

The cut is done using a multi-pass strategy. The motion speed of the Laser-MicroJet® was optimised to improve the overall cutting speed.

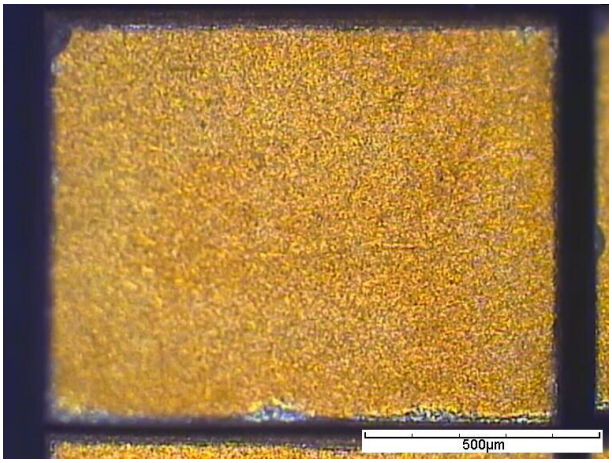
The following microscope pictures give an overview on the quality obtained with the Laser-Microjet® technology.



**PICTURE 1:** Digital camera picture of the sample




**PICTURE 2:** Microscope image of the frontside (dark field illumination)




**PICTURE 3:** Microscope image of the front side at high magnification (dark field illumination)

## CONCLUSION

The cutting of WCu samples was investigated on SYNOVA LCS 150. 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 allowing an excellent accuracy, advantages that are essential for cutting metallic samples with high quality.

These tests show that:

- Thin gold layer is very sensitive to laser parameters. Indeed high laser power is necessary to increase cutting speed but it induces burrs. A good balance must be found according to your feedback.

- Some dicing areas of the sample remained uncut. This effect was not visible on the first single lines that has been done for process optimization and is due to disturbance of the waterjet at the line intersections. This can usually be fixed by decreasing water pressure and by reducing the motion speed. More samples are necessary for further optimization.

- A new laser source (with shorter pulse width and high frequency range) will be available soon in the application lab and could be a good solution for processing such samples and reduce the burr size (currently ~50 µm).

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