Technology Transfer: Moving Ceramics from Lab to Market

Ceramics Expo USA 2026

2026-05-05

Gabriele Fischer

Booth 829



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LASER Basics

Light Amplification by Stimulated Emmission of Radion

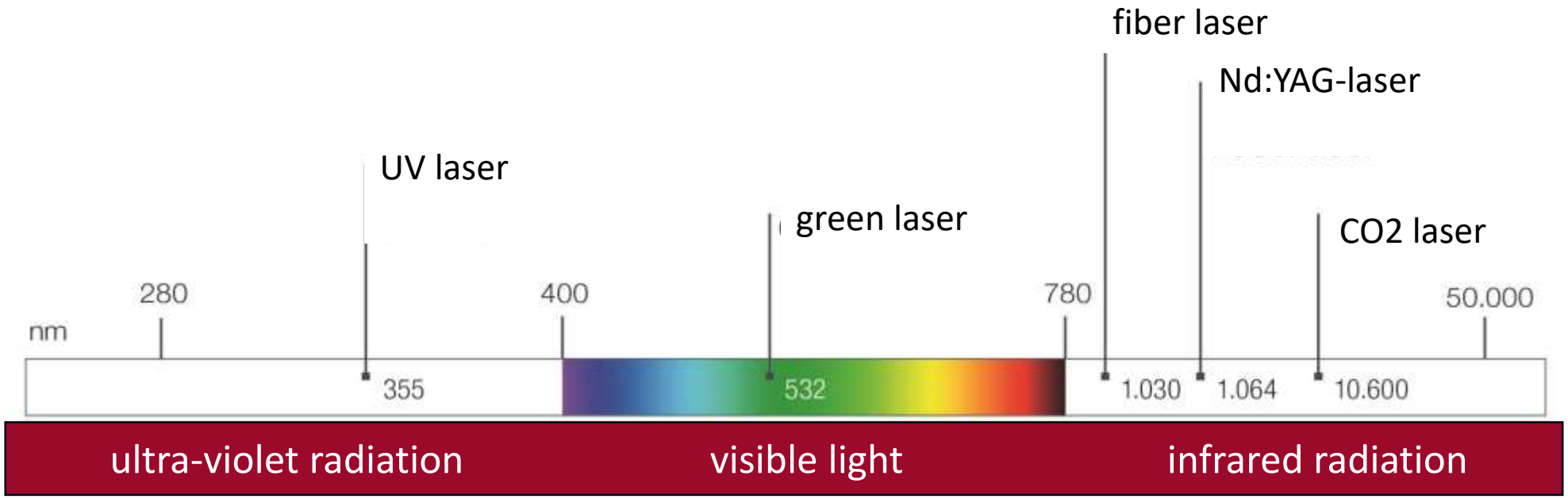


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Laser Basics

TYPICAL WAVELENGTH FOR INDUSTRIAL APPLICATIONS



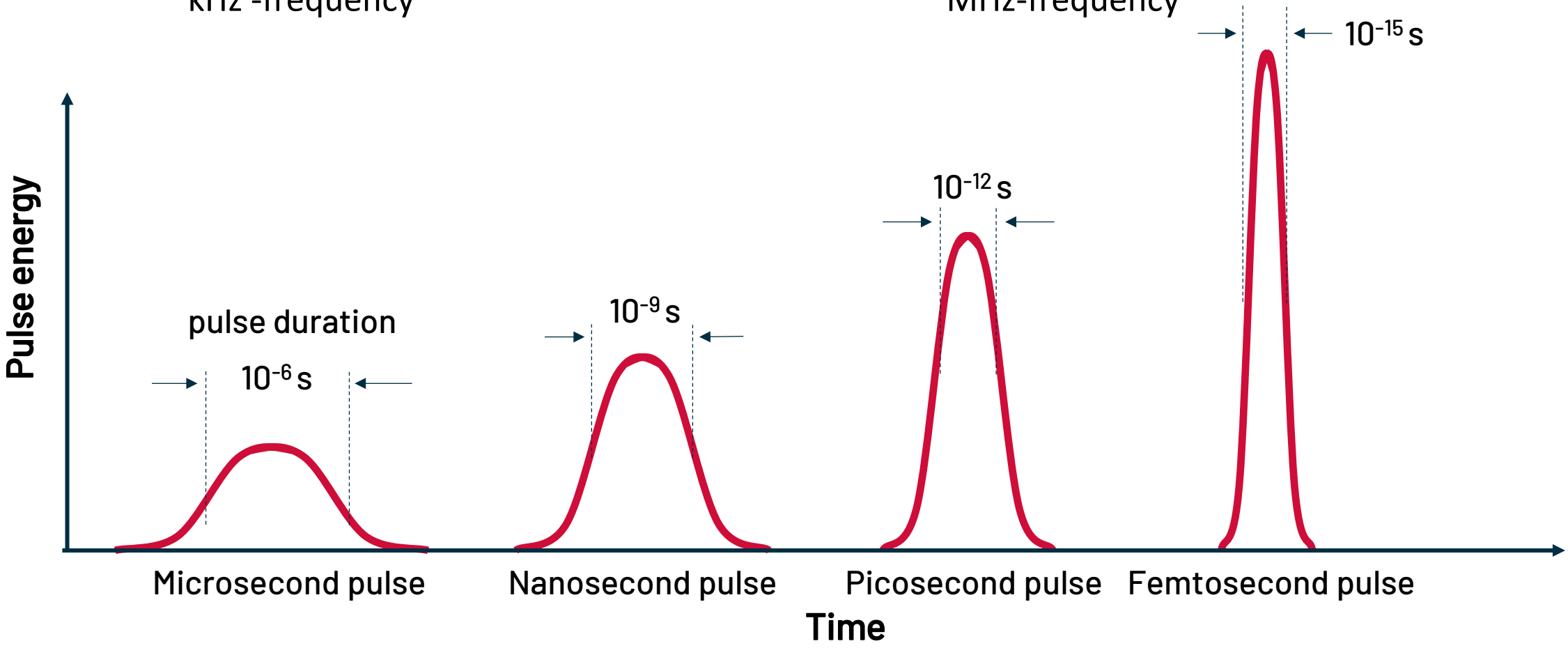
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Laser Basics

PULSE LENGTH

CO2-laser typically <2ms
kHz -frequency

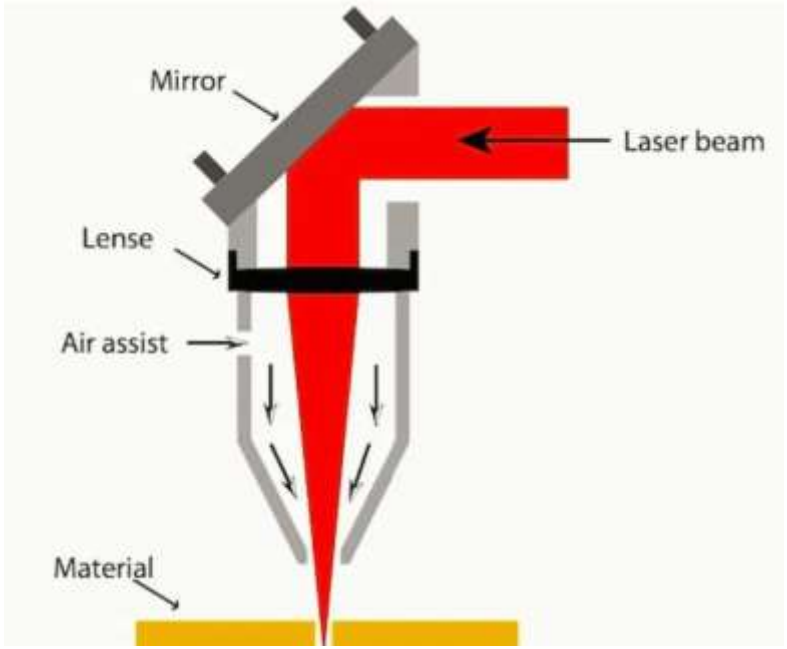
Ultra-short pulse-laser tyically <10ps
MHz-frequency

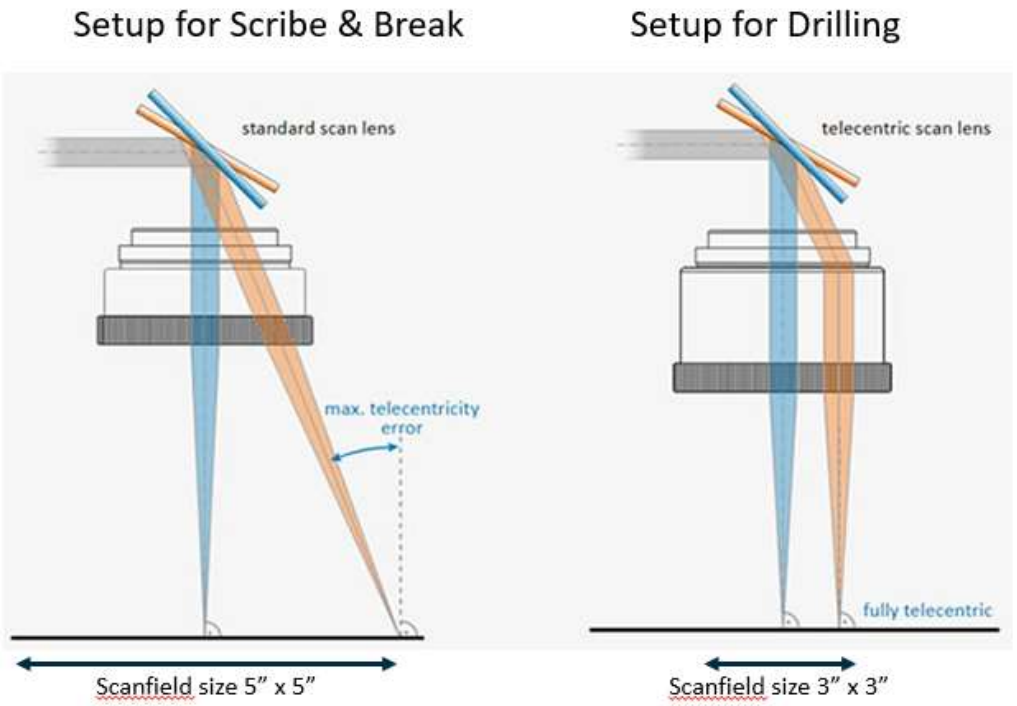


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Laser Basics
PROCESSING HEADS

CO2-laser with fix optic → Ultra-short pulse-laser with flat field lens





Laser Technology for Industrial Applications



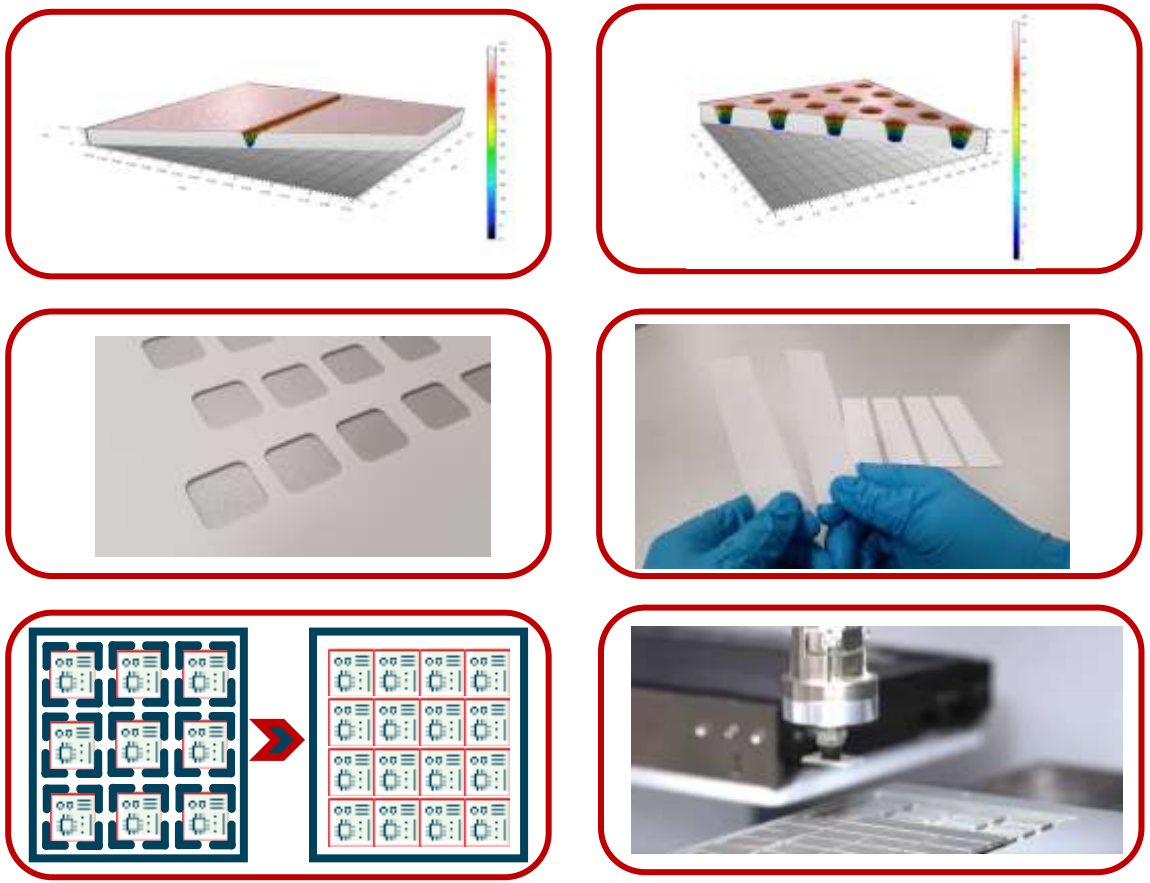
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Advantages of laser micro processing

ADVANTAGES OF LASER

1. Superior accuracy
2. No mechanical stress
3. High cleanliness
4. Process stability
5. Fast processing
6. Efficient material utilization
7. High yield
8. Flexibility in design and application
9. Low operating costs
10. Automation and integration



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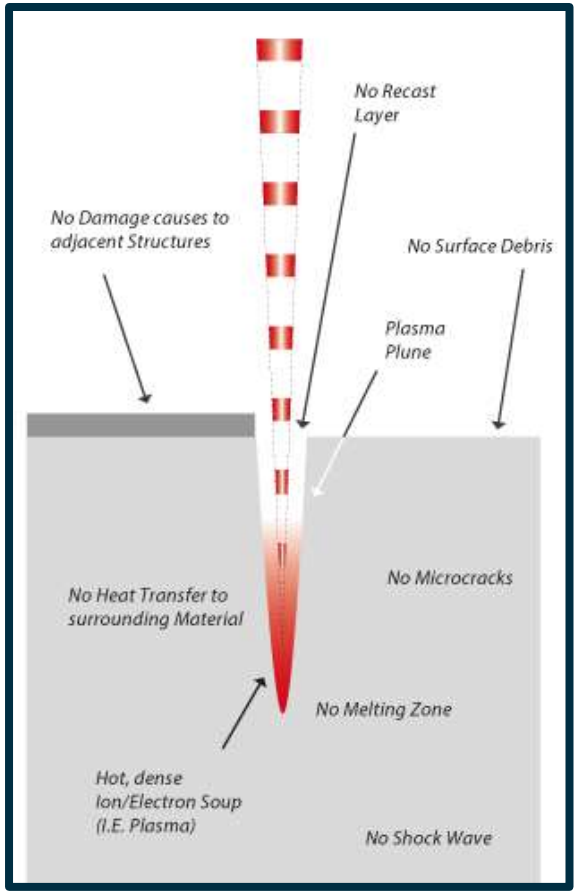
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Advantages of laser micro processing

ADVANTAGES OF USP-LASER

Advantages of ultrashort pulse laser

- Material vaporization instead of melting results in smaller HAZ and less debris
- Little to no post-processing required: Excellent surface quality reduces additional finishing steps
- Industrial USP-Lasers offer highest available power levels for efficient machining of ceramics.



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Laser cutting and structuring of ceramic substrates

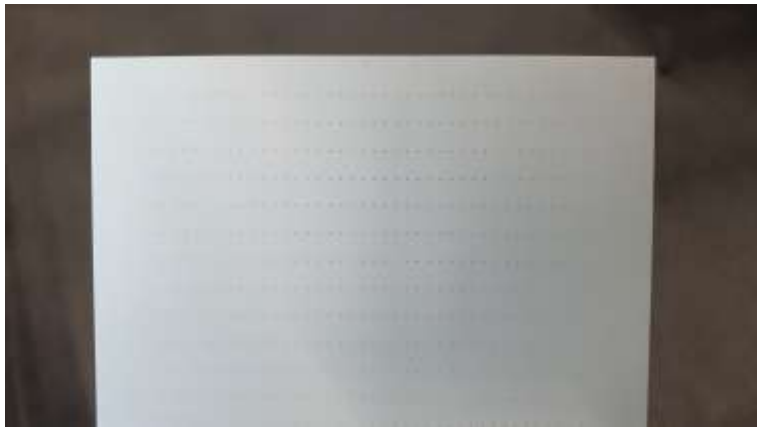


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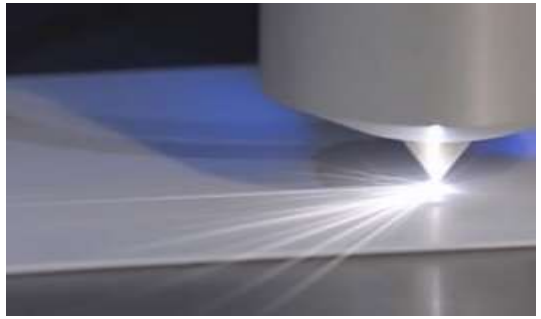
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Ceramics - Applications

DRILLING – SCRIBING - CAVITIES



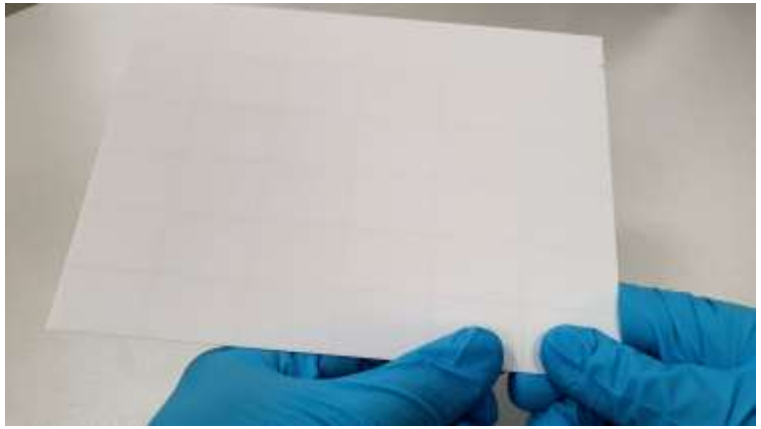
via drilling

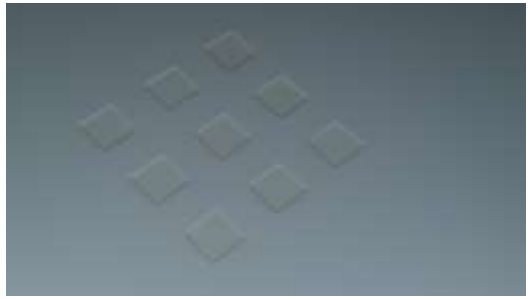


cutting



scribe & brake



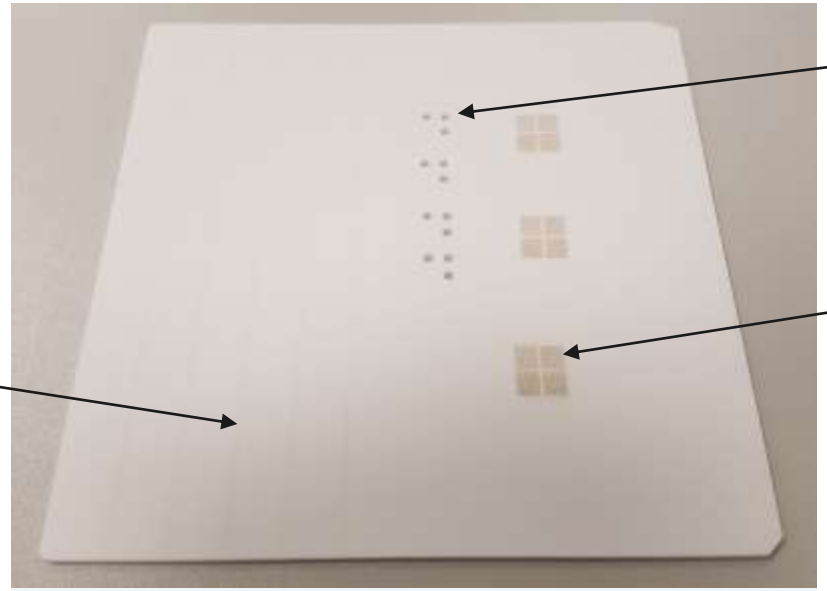


cavities
e.g. heat sink

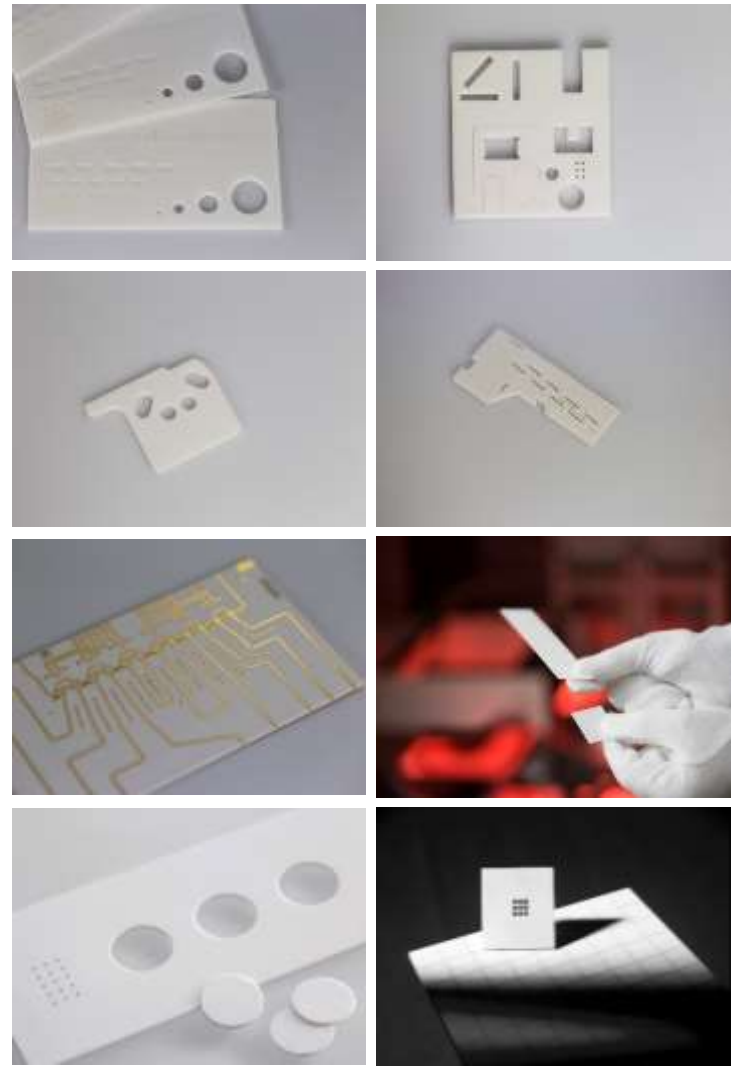
Examples

DIFFERENT MATERIAL THICKNESS CAN BE PROCESSED - USUALLY 0,25MM TO 2 MM

PS-IR 170W

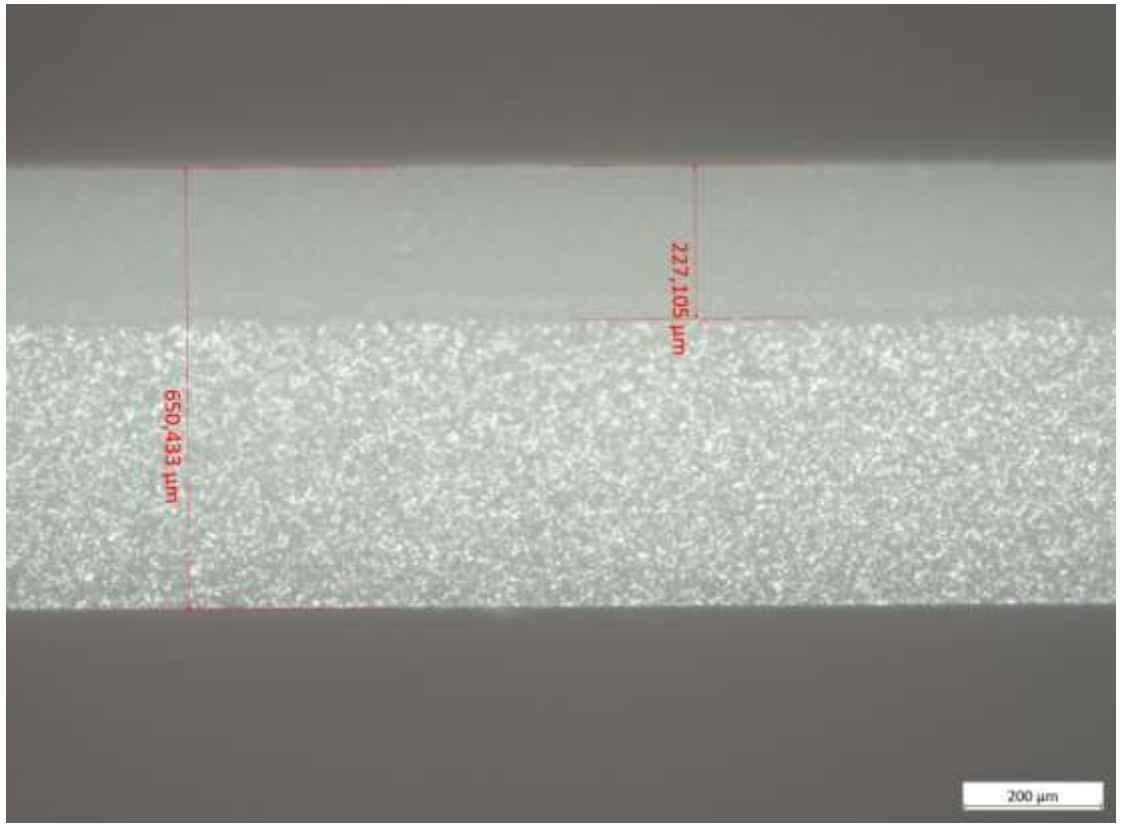


Different shapes cut/drilled by laser
(thickness = 1mm)

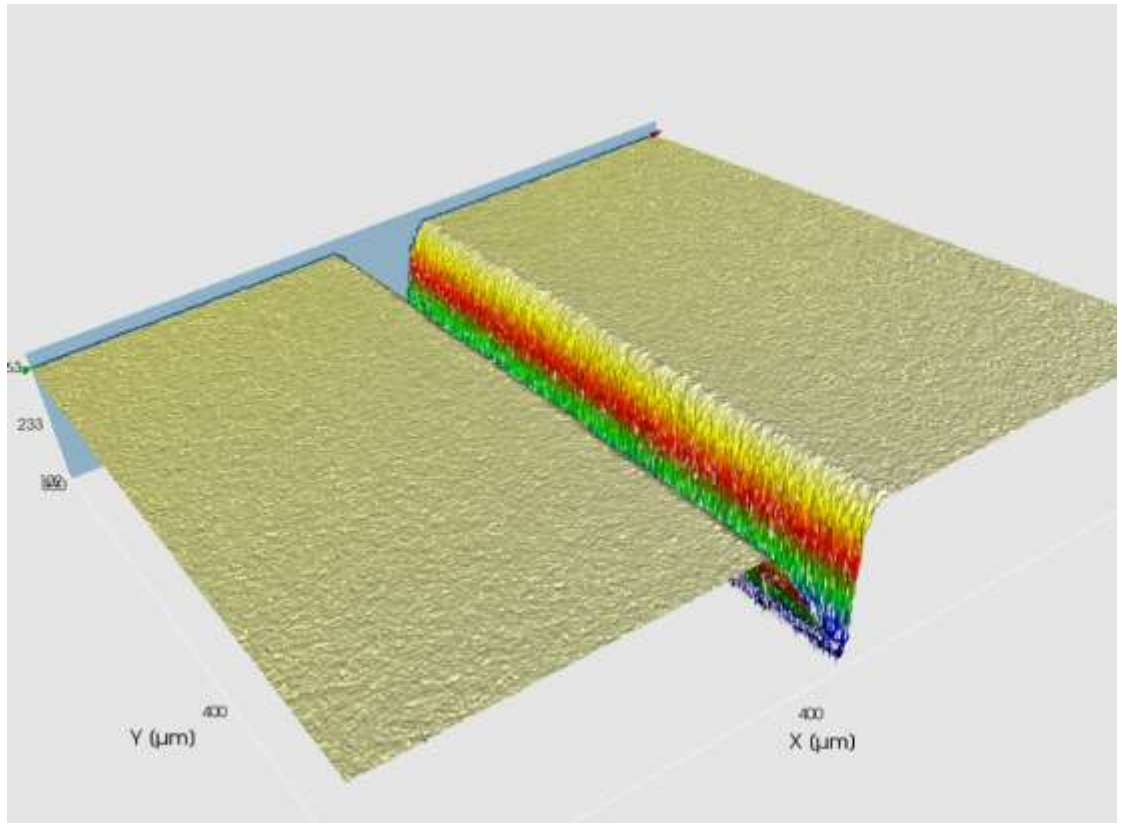


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Photonics Systems Solution with ps-IR-Laser w scanner optics



Microscope image of a laser scribe (cross section); depth of the scribe is about 230µm; thickness is about 650µm



Confocal-Microscope image of a laser scribe (V-shape); no debris at surface visible

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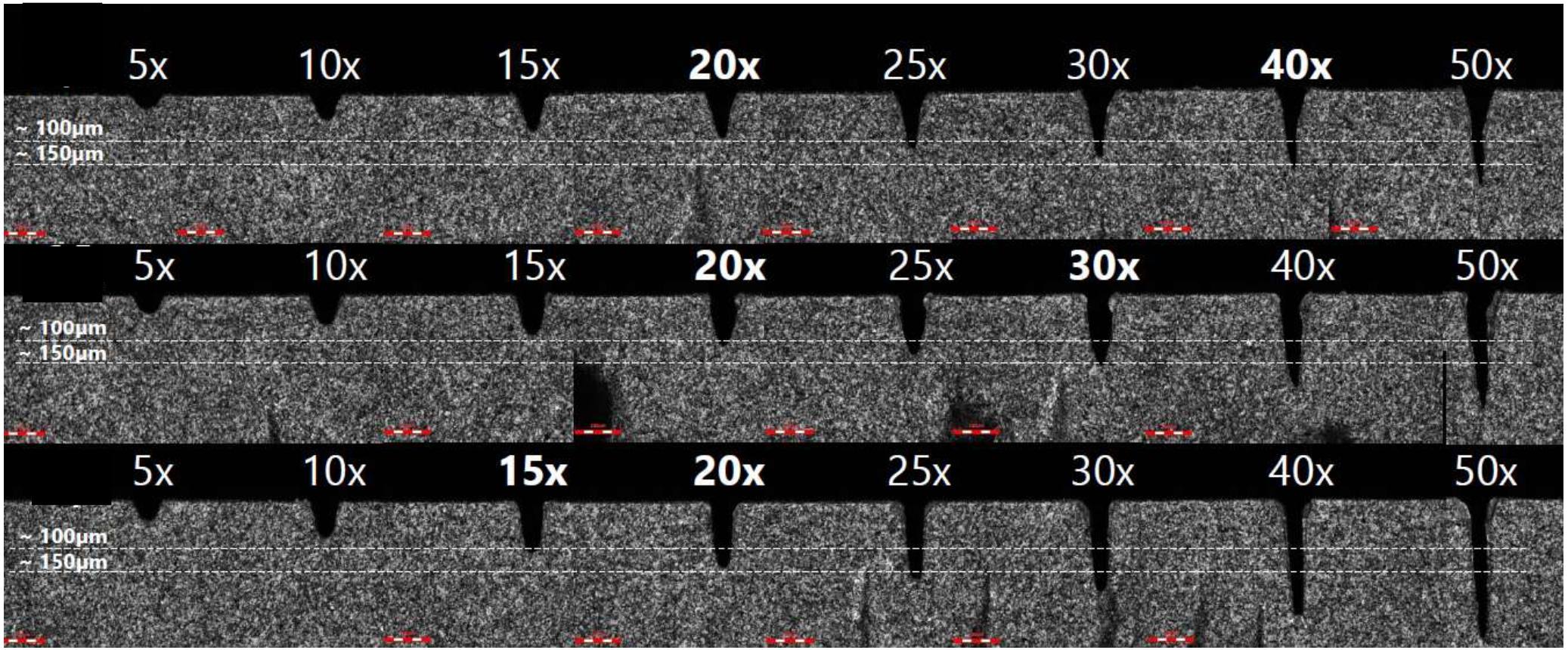
Femto-Secondlaser – new power levels available

AL_2O_3 – FIX SPEED

low power

medium power

high power

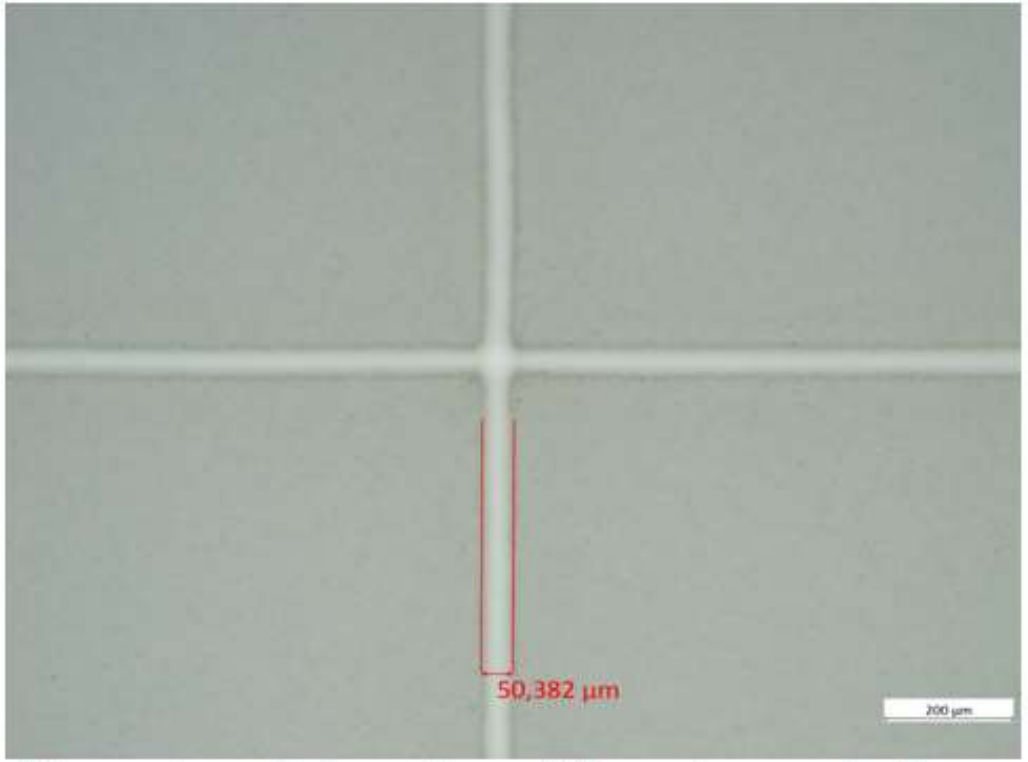


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Photonics Systems Solution with ps-IR-Laser w scanner optics



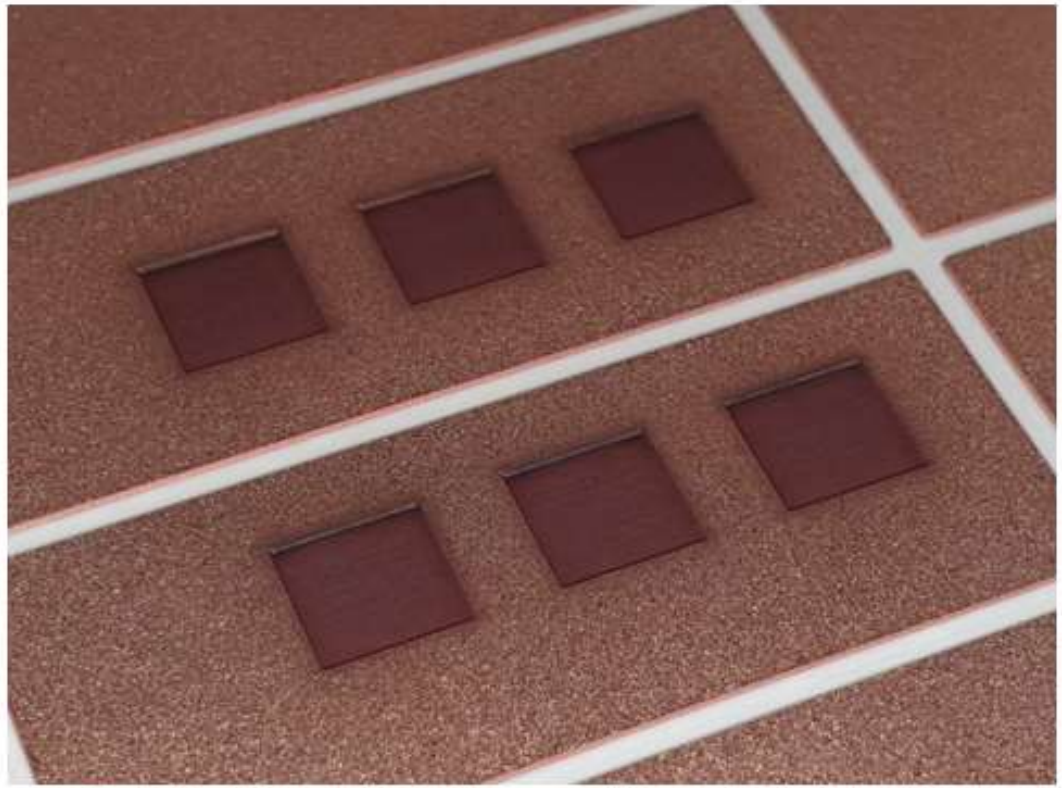
Laser scribes on a Al_2O_3 ceramic with copper



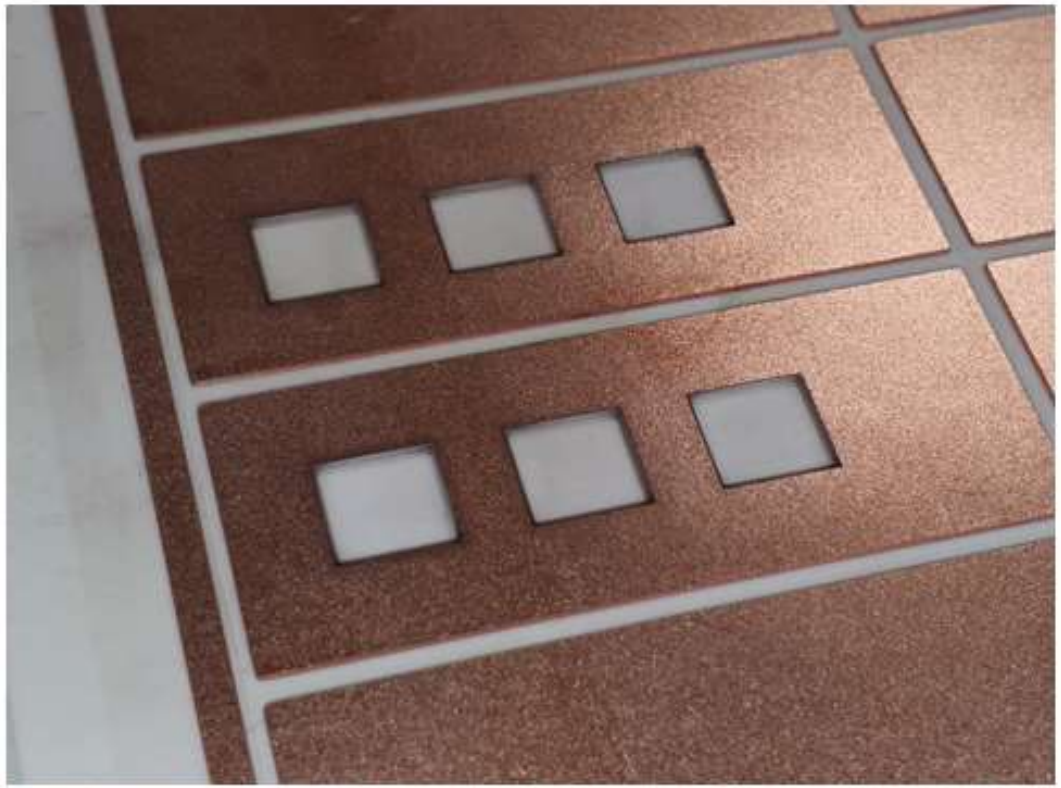
Microscope image of a laser scribe on a Al_2O_3 ceramic; very good scribe quality with a clean surface

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Photonics Systems Solution with ps-IR-Laser w scanner optics



5x5mm cavities on copper (depth is about 150µm)



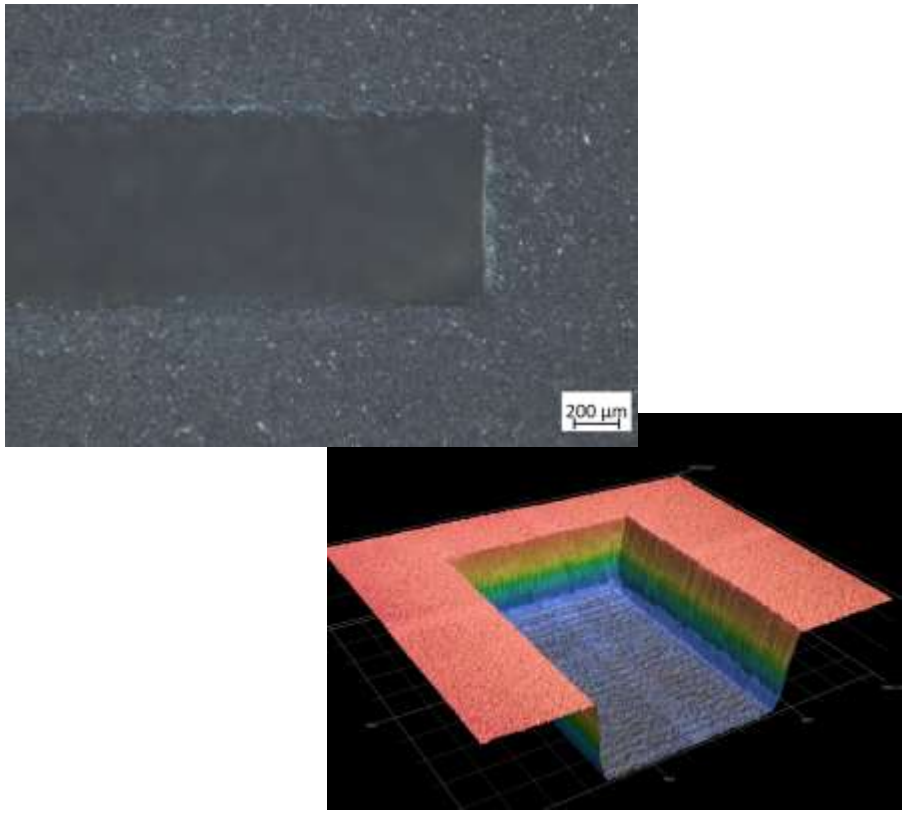
5x5mm cavities → ablated completely through copper to the ceramic (total depth is about ~450µm: ~300µm copper + ~150µm ceramic)

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C-SiC



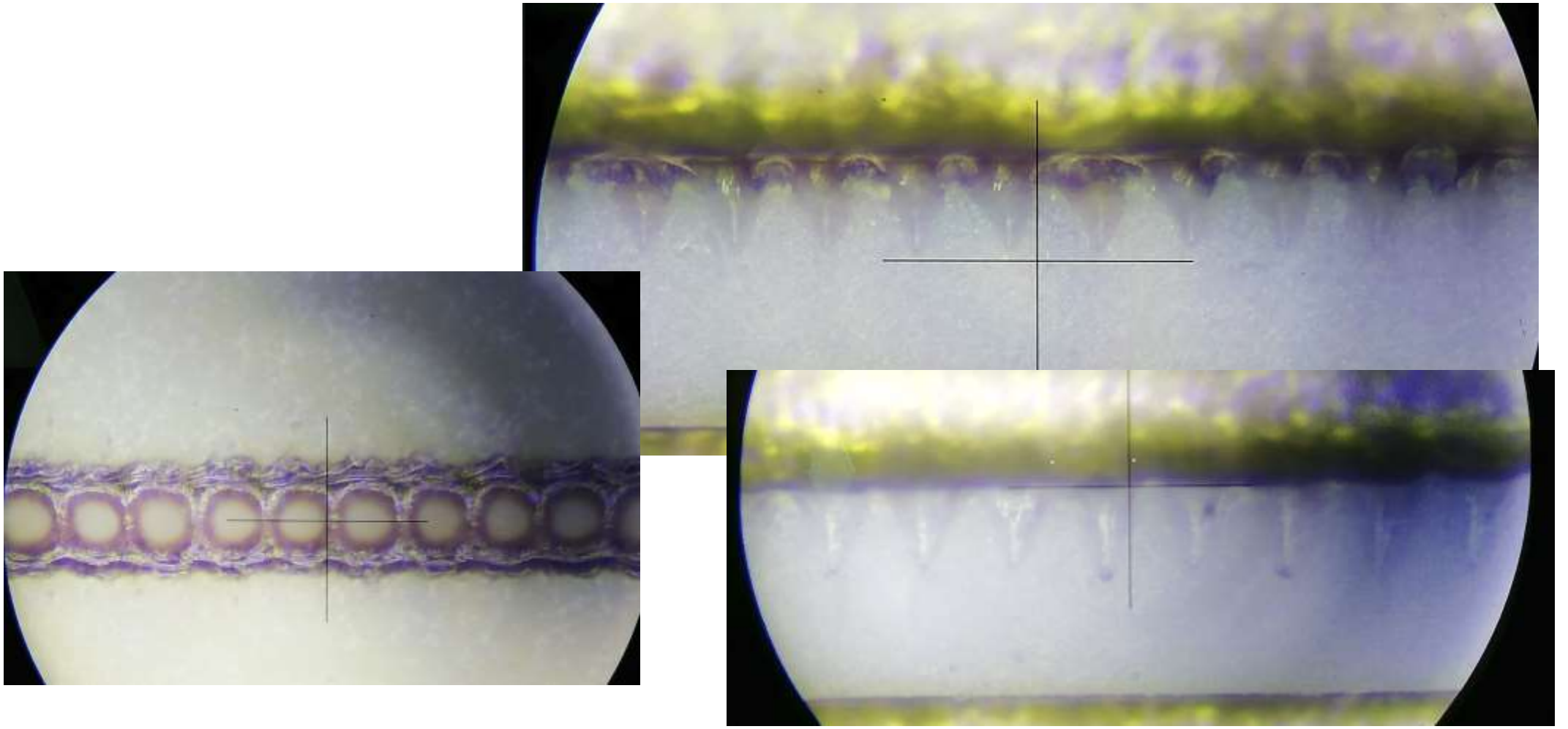


_ After Laser processing

_ Closer look at the area. The long cavity does have a length of 50mm

Photonics Systems Solution with CO2-Laser w fix optics

250W CO2-LASER FIX OPTICS



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