

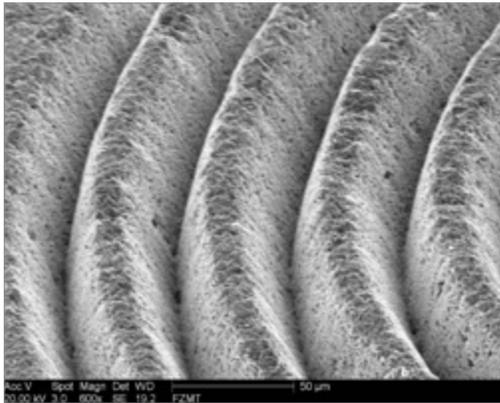
# Ultrashort-pulse Laser Structuring

Laser materials processing is of great interest for industrial applications as well as for scientific investigations. Main advantages of the laser as a manufacturing tool are the high speed at which a laser beam can be moved and, contrary to mechanical tools, laser light is not subject to wear and tear. Besides the wavelength, the pulse duration of the laser source is the main parameter influencing the nature of the laser-material coupling. Pulse durations of down to a few femtoseconds are available from state of the art laser systems. The high peak intensities

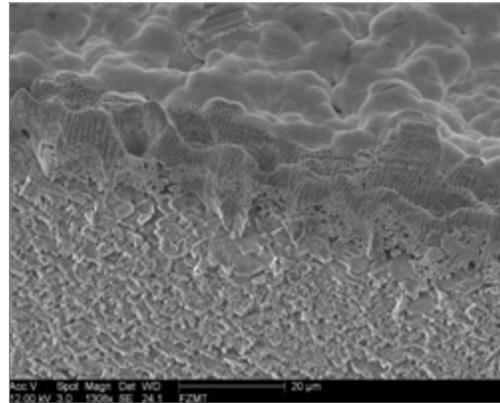
provided by ultrashort pulses initiate multiphoton absorption mechanisms, bridging a band gap much larger than the photon energy. Thus, by applying ultrashort pulses the ablation of nearly any material is possible by multiphoton absorption.

The non-thermal nature of ultrashort pulsed ablation together with the ultrafast mechanism offers well-defined ablation threshold fluences and enables laser structuring with high precision.

## Surface Structuring of AlO<sub>2</sub> Ceramics

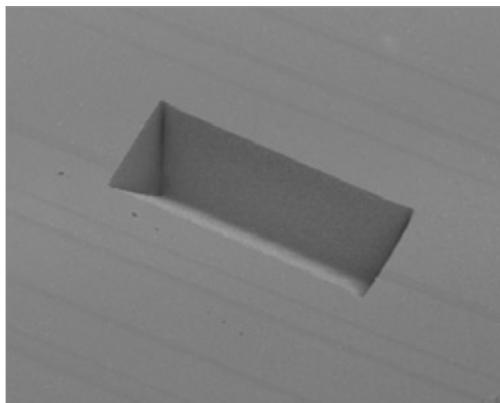


<b>MATERIAL</b>	<b>LASER</b>	$\tau = 350$ fs
Ceramic Al <sub>2</sub> O <sub>3</sub>	Spirit®	$\lambda = 1040$ nm



Lasercut Al<sub>2</sub>O<sub>3</sub> ceramics with goldcoating on the top surface

## Surface Structuring and Cutting of Dielectrics and Semiconductors



<b>MATERIAL</b>	<b>LASER</b>	$\tau = 350$ fs
Borosilicate glass	Spirit	$\lambda = 1040$ nm

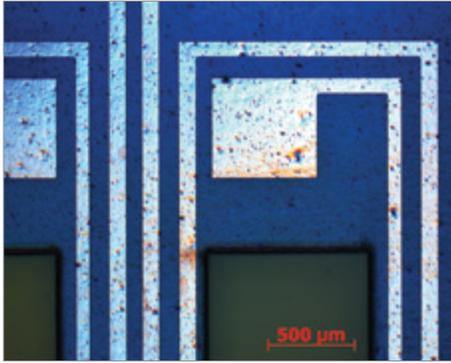


<b>MATERIAL</b>	<b>LASER</b>	$\tau = 350$ fs
3C-SiC	Spirit	$\lambda = 1040$ nm

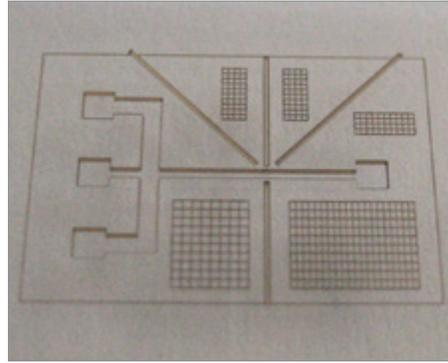
# Ultrashort-pulse Laser Structuring



## Cutting and Structuring of Polymers (Sensors and Microfluidic Devices)

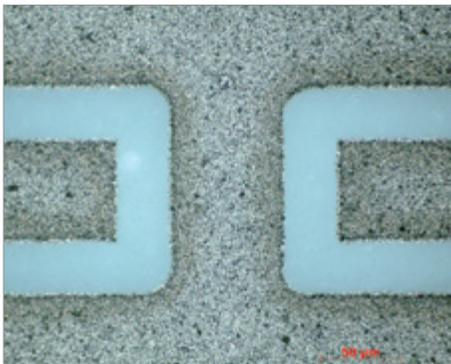


**MATERIAL** Polymersensor  
**LASER** Spirit  
 $\tau = 350$  fs  
 $\lambda = 1040$  nm

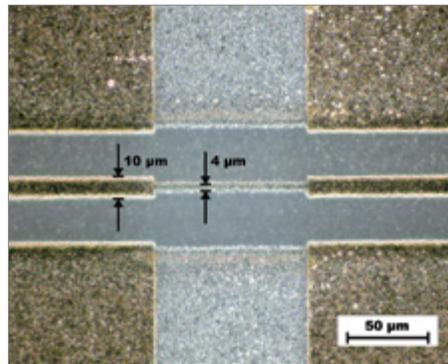


**MATERIAL** SU-8 on glass  
**LASER** Spirit  
 $\tau = 350$  fs  
 $\lambda = 520$  nm

## Thin Film Ablation (for Automotive Sensor)



**MATERIAL** Silver on ceramics  
**LASER** Spirit  
 $\tau = 350$  fs  
 $\lambda = 1040$  nm

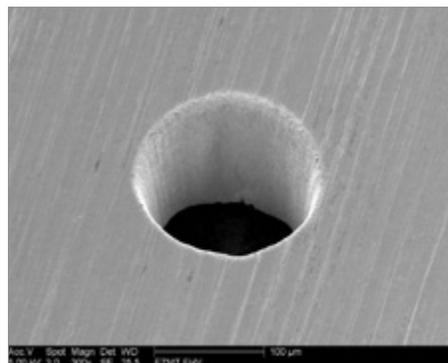


**MATERIAL** Au/Ag on ceramics  
**LASER** Spirit  
 $\tau = 350$  fs  
 $\lambda = 1040$  nm

## Cutting and Drilling of Metals



**MATERIAL** Amorphous metal  
**LASER** Spirit  
 $\tau = 350$  fs  
 $\lambda = 1040$  nm



**MATERIAL** Steel  
**LASER** Spirit ps  
 $\tau = 12$  ps  
 $\lambda = 1064$  nm

Images Courtesy Research Center for Microtechnology | Contact Dr. Sandra Zoppel | sandra.zoppel@fhv.at | www.en.fhv.at/res/rcmt



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