

Abstract

Laser based material processing for medical and biotechnology applications

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At the Medical Laser Center Lübeck, various laser systems with wavelength ranging from deep UV to infrared are available for micro material processing. Excimer Lasers are a versatile tool in many material processing applications. Due to their short attenuation length in many materials, the applied energy is absorbed near the surface. This leads to a process called ‘cold ablation’ which allows material processing on a sub-micrometer scale in axial direction, with minimal unwanted thermal effects. This could be interesting for post processing of surfaces of objects made in 3D printing. Polymers, ceramics and biological tissue are examples of materials processed with excimer lasers. We mainly use processes like drilling, milling or selective ablation in the fabrication of microfluidic devices and modification of polymer membranes [1].

Ultra-short pulse lasers operate in a range of pico- to femtoseconds pulse duration. This type of laser allows high resolution structuring of nearly every material at high speed rates. Currently we are using USP Laser for generating so called Laser-induced periodic surface structures (LIPSS). Upon irradiation with ultra-short pulses, nano-structures with adaptable characteristics begin to form on the surface. With the right parameter set these structures can act as ‘light traps’, letting the surface appear blackened with high contrast or modify the material for better cell adhesion.

Among others, applications are blackmarking on surgical instruments or generation of functional surfaces for e.g. cell- and biological applications. Nanosecond Microchip Laser can be an effective, low cost alternative to ultra-short pulse lasers for processes like cutting or marking. Using ns-Lasers, we developed processes for visible markings inside transparent materials, achieved through optical breakdown and label microscopic slides with alpha numeric symbols and 2D codes [2].

AUTHOR'S STATEMENT

Conflict of interest: Authors state no conflict of interest. Informed consent: Informed consent has been obtained from all individuals included in this study.

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