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Surfaces using simultaneous Dual-
IR and XUV Pulses

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eak extreme ultraviolet (XUV) beam
ading to very strong radiation-matter
teraction bringing dramatic increase
the surface processing speed. As an
ample, we present results on surface
nostructuring of amorphous carbon
d poly(methyl methacrylate) (PMMA).
ır method utilizes modification of
aterials optical properties by highly
ergetic XUV photons generated via
gh-order harmonics generation (HHG)
d creation of nanostructures on the
rfaces of the materials by resuming IR
mtosecond laser pulses.

3D Photofabrication by Femtosecond Laser Pulses and its Applications in Biomedicine

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Multiphoton absorption of femtosecond laser pulses can trigger chemical reactions inducinghighly localised modifications within the sample. Nonlinear nature of such light-material interaction allows true 3D processing and realisation of structures with submicrometer spatial resolution. By moving the laser focus in 3D the material is modified along the trace. This way direct laser recording of complex 3D patterns into the volume of photoreactive material is possible.

In case of two-photon polymerization (2PP) technique this chemical reaction results in the cross-linking of the material. Photonic crystals, microoptical elements, data storage, and biomedical devices are just a few examples of applications of the 2PP technique. The ability to produce true 3D structures with high precision and reproducibility is particularly appealing for the field of regenerative medicine and tissue engineering for the fabrication of scaffolds. The primary function of the scaffold structure is to provide a micro- and nano-structured 3D environment for the cells to migrate and to proliferate in. The specific properties of the scaffold have to resemble natural cell environment, providing appropriate geometry and instructive cues needed to maintain cell phenotype and behaviour. Once the cells of the engineered tissue have built their own connective matrix, the scaffold becomes redundant. Therefore, biomaterials that are bioresorbable and biodegradable on a similar timescale as the production of the extra-cellular matrix of the engineered tissue are preferred. In comparison to other technologies currently applied for the fabrication of scaffolds, the advantage of 2PP technique is a combination of unprecedented resolution, high reproducibility, and the ability to generate true 3D structures directly from CAD input. In addition femtosecond laser can be used for selective biofuntionalisation of the scaffold by photografting of relevant biomolecules, providing additional means for controlling cell adhesion and migration.

In this contribution, our recent advances on development and laser microstructuring of novel biophotopolymers are presented. Such important issues as biocompatibility and structurability of applied materials will be discussed. The presentation is supported by numerous examples.