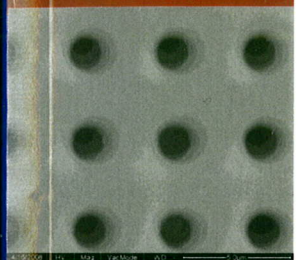
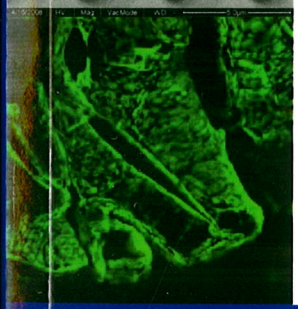
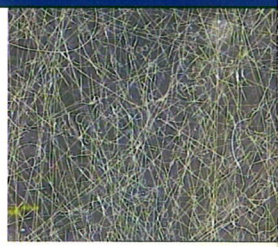
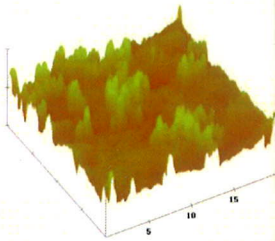
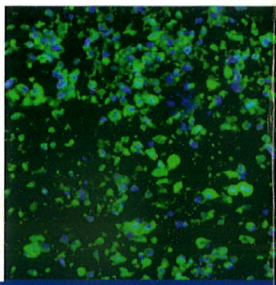
BIOFUTURE 2011:

YOUNG EUROPEAN BIOMATERIAL SCIENTISTS DESIGNING A VIEW FOR THE FUTURE

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3D Photoinduced Laser ropatterning of Polymers for Biomedical Applications

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INTRODUCTION

Natural cell environment is a complex 3D arrangement with characteristic features at multiple length scales, complemented with a variety of biomolecules inducing chemical stimuli.[1] In an attempt to approach this natural complexity, many *in vitro* studies of cell behavior and tissue formation in 3D use scaffolds.[2-4] Herein, a technology capable of creating high-resolution 3D scaffolds from photopolymers in accordance to a defined design is presented.

MATERIALS AND METHODS

Two-photon polymerization (2PP) is a method based on localized photopolymerization/cross-linking of the material, induced by femtosecond laser pulses. High resolution of the 2PP enables fabrication of 3D structures, which contain features at several length scales, in a single step. Very similar principle is also used for selective functionalization of the scaffold by photografting. Multiphoton grafting allows to tailor local chemical properties of the scaffold surface or a 3D matrix, by space-resolved docking of molecules. High selectivity and spatial resolution are among the main advantages of laser photografting.

RESULTS AND DISCUSSION

The essential requirements imposed on material/photoinitiator for application in scaffolds include good material structureability by 2PP, minimal cytotoxicity, and biodegradation behavior appropriate for a specific tissue engineering application. A number of novel biodegradable photopolymer formulations with different properties have been developed and tested for fabrication of 3D scaffolds by 2PP.[5-7] Comparative analysis of suitability of presented materials for 2PP microfabrication and the subsequent cell-culture studies for various tissue engineering applications is performed. Finally the results on 3D functionalization of polymeric materials by means of laser-induced photografting, and its potential for providing space-resolved biochemical signaling are discussed.

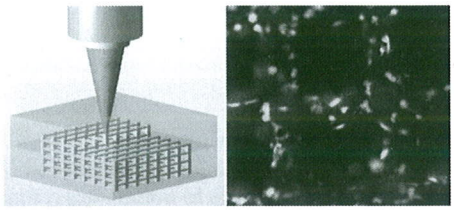

Figure 3 Schematic principle of 2PP-microfabrication of scaffolds by direct laser writing and a fluorescence image of a 2PP scaffolds seeded with MSC's.[5]

CONCLUSIONS

In this contribution, our recent advances on development and microstructuring of novel biophotopolymers and 3D photografting are presented. It is shown that femtosecond laser is a universal tool allowing to engineer complex 3D scaffolds and to carry out localized functionalization via photoinduced molecule immobilization.

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