PHYSICAL AND TECHNOLOGICAL SCIENCES

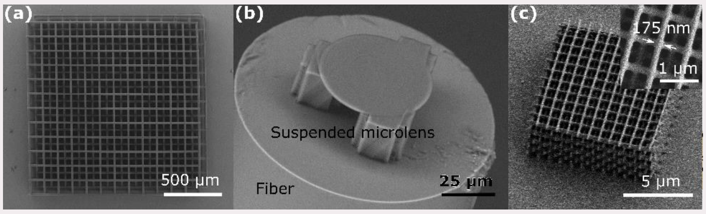
Laser Nanophotonics Group

Vilnius University

Keywords: ultrafast laser 3D nanolithography, multiphoton processing, nanophotonics, microoptics, biomedicine, biomaterials, light-matter interaction, optical 3D printing, 4D printing

Research group activities

- Mechanisms of ultrafast laser 3D nano-processing of of organic, inorganic and hybrid materials;
- Optical 3D µ-printing of functional prototypes;
- Creation and characterization of novel nanophotonic, microoptical, biomedical, microfluidic, micromechanic, and other integrated devices;
- Hybridization of meso-scale and multi-material laser processing technologies (from nano- to macro-architectures, additive with subtractive, monolith structures of composite materials, etc);
- Characterization of optical, photonic, and chemical properties of 3D printed micro-objects.



3D structures realized via ultrafast laser 3D nanolithography:
(a) a millimetre sized microporous biomedical scaffold,
(b) a microoptical component integrated directly onto a facet of a single mode fiber,
(c) a woodpile nano-lattice geometry photonic crystal.

Proposal

Long term or project based collaboration with academia and industry towards development of ultrafast direct laser writing (DLW) process and its application for creation of novel 3D micro-/nano-architectured functional devices.

Feasibility studies or small scale batch production are available via open access facility “NAGLIS”.

Meet our team

Leading researcher: Dr. Mangirdas Malinauskas, h-index – 29.

Staff:
Dr. Martynas Peckus
Dr. Sima Rekštytė
Dr. Vytautas Purlys
Mr. Arūnas Čiburys

PhD students:

D. Gailevičius,
T. Tičkūnas,
L. Jonušauskas,
S. Varapnickas,
G. Kontenis,
D. Mackevičiūtė (industrial with Femtika Ltd.),
E. Skliutas.

Research outcomes

5 book Chapters, 4 review papers, > 150 research papers, > 2300 citations.

M. Malinauskas et al., Ultrafast laser processing of materials: from science to industry, Light: Sci. Appl. 5, e16133 (2016). [a hot paper in CA-WOS list]

S. Rekstyte et al., Nanoscale Precision of 3D Polymerization via Polarization Control, Adv. Opt. Mater. 4(8), 1209-1214 (2016).

J. Maciulaitis et al., Preclinical study of SZ2080 material 3D microstructured scaffolds for cartilage tissue engineering made by femtosecond direct laser writing lithography, Biofabrication 7, 015015 (2015).

L. Maigyte et al., Flat lensing in visible frequency range by woodpile photonic crystals, Opt. Lett. 38(14), 2376-2378 (2013).

T. Tickunas et al., Combination of additive and subtractive laser 3D microprocessing in hybrid glass/polymer microsystems for chemical sensing applications, Opt. Express 25(21), 26280 (2017).

International scientific collaboration:

Swinburne University of Technology (Prof. S. Juodkazis), Universitat Politècnica de Catalunya (Prof. K. Staliunas), Foundation for Research and Technology - Hellas (Dr. M. Farsari), University of Bordeaux (Dr. E. Brasselet), Shizuoka University (Prof. V. Mizeikis), Laser Zentrum Hannover (Prof. B.N. Chichkov), University of Sheffield (Dr. F. Claeyssens), Belarusian State University (Prof. S. Kostjuk), Tokyo Institute of Technology (Prof. J. Morikawa).

Cooperation with industry:

A spin-off company Femtika, continuous collaboration with Light Conversion, Workshop of Photonics, Ekspla, Prodentum, 3D Creative, BioLabas, AmeraLabs.

Ongoing projects

Laser Nanophotonics Group's laboratories are continuously supported by National (Lithuanian Research Council: currently 3 running projects), European (H2020 LaserLab Europe and InterReg EcoLab-Net) as well as Worldwide (NATO Science for Peace program and US AMRDEC) funding schemes.

Resources

- Automated setups of ultrafast lasers synchronized with linear stages and galvo-scanners for spatio-temporal selective light-matter interaction (DLW setup with widely tunable exposure conditions);
- Tabletop optical 3D printers, spatial light modulators for beam shaping, UV light sources;
- Chemistry laboratory for sample pre-/post-exposure preparation, development, vacuuming, spin-coating and/or heating;
- Access to and expertise in scanning electron microscopy and optical profilometry inspections;
- Custom optical setups for characterization of nanophotonic, microoptical and microfluidic components.

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