PHYSICAL AND TECHNOLOGICAL SCIENCES

Laser Matter Interaction Group

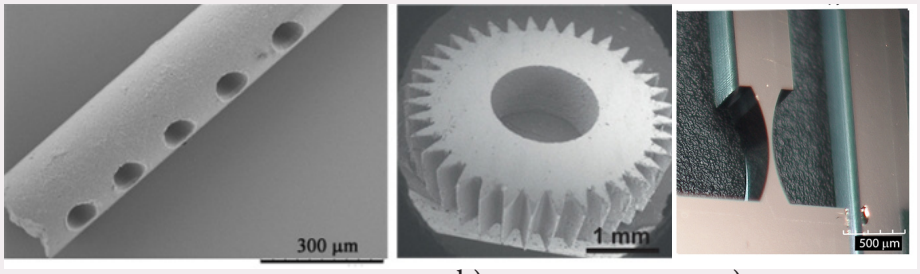
Keywords: ultrafast laser micromachining, laser induced breakdown spectroscopy (LIBS), optical parametrical interactions, supercontinuum in PCF, vector vortex beams, terahertz spectroscopy

Vilnius University

Research group activities

Laser Matter Interaction Group is engaged in the following activities:

- The development of novel methods for microfabrication of transparent and metallic materials with Lithuanian-made femtosecond laser systems;
- Volumetric modification of transparent materials via femtosecond laser pulses; waveguide and other photonic device integration in glasses;
- The application of Laser induced breakdown spectroscopy (LIBS) for monitoring of femtosecond laser micromachining;
- Development and optimization of Synchronously Pumped Optical Parametric Oscillators (SPOPO) by femtosecond pulses;
- Research on supercontinuum generation in photonic crystal fibers; nonlinear optics, vortex beam generation;
- Research on ultrafast coherent spectroscopy in terahertz range.



Femtosecond micro-processing of transparent materials and dielectrics: a) micro-holes drilled in thermally sensitive ceramics; b) cogwheel cut from 1-mm thick glass; c) precise cutting of glass using laser assisted chemical etching.

Proposal

Long term or project based collaboration with academia and industry towards development of ultrafast laser machining and advanced nonlinear applications.

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

Meet our team

Leading researcher: Prof. Valdas Sirutkaitis

Staff:
Dr. Domas Paipulas, Dr. Julius Vengelis, Dr. Ona Balachninaitė, Dr. Eugenijus Gaižauskas, Prof. Valerijus Smilgevičius, Dr. Viktorija Tamulienė, Dr. Vygandas Jarutis, Dr. Aidas Matijošius, Dr. (HP) Virgilijus Vaičaitis, Dr. Rimantas Grigonis

PhD students:
Simas Butkus, Ieva Pipinytė, Lina Mažulė, Maksym Ivanov.

Research outcomes

The group released over 200 research papers, that were cited more than 1700 times. The most important publications are:

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).

S. Butkus et al., Rapid microfabrication of transparent materials using filamented femtosecond laser pulses, Appl. Phys. A., 114(1), 81-90 (2014).

M. Gecevičius et al., Towards the generation of broadband optical vortices: extending the spectral range of a q-plate by polarization-selective filtering, JOSA B, V.1, p. 190 (2018).

V. Vaičaitis et al., Influence of laser-preformed plasma on THz wave generation in air by bichromatic laser pulses, Laser physics, 28, art. no 095402 (2018).

J. Vengelis et al., Characteristics of optical parametric oscillator synchronously pumped by Yb:KGW laser and based on periodically poled potassium titanyl phosphate crystal, Opt. Comm. 410, 774—781 (2018).

J. Skruibis et al., Multiple-pulse laser-induced breakdown spectroscopy for monitoring the femtosecond laser micromachining process of glass", Optics and Laser Technology 111, 295-302 (2019).

International scientific collaboration:

Shizuoka University (Prof. V. Mizeikis); Galatea Lab., EPFL (Prof. Y. Bellouard); Tartu University (Dr. V. Nagirnyj); Latvia University (Prof. R. Ferber); Linköping University (Dr. C. Ponseca); Leibniz University of Hannover (Prof. U. Morgner); Max Born Institute (Dr. I. Babushkin); University of Southampton (Dr. M. Beresna); University of Gothenburg (Prof. D. Hanstorp); Brno University of Technology (Prof. J. Kaiser); Cairo University (Dr. A. Galmed), University of Patras (Prof. S. Couris); University of Technology in Braunschweig (Prof. A. Dietzel).

Cooperation with industry:

Continuous collaboration with Lithuanian laser companies Light Conversion, Eksma Optics, Altechna R&D Ltd.

Participation in projects supported by:

Lithuanian Research Council, Lithuanian Agency for Science, Innovations and Technology and H2020 Laserlab-Europe 4 project.

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);
- Femtosecond Yb:KGW and Ti:sapphire laser systems;
- Chemistry laboratory for sample preparation, development, spin-coating and vacuuming;
- Access to and expertise in scanning electron microscopy and optical profilometry inspections;
- Setups for characterization of nanophotonic, microoptical and microfluidic components;
- Custom optical setup for femtosecond LIBS measurements.

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