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SUPERLASERS FOR THE REAL WORLD

TEAMING FOR SUCCESS

Poster Presentation

Third Annual HiLASE Workshop

October 14 – 17, 2018, Dolní Břežany, 15:30 – 17:30

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Science & Technology Facilities Council

EUROPEAN UNION
European Structural and Investment Funds
Operational Programme Research, Development and Education

MINISTRY OF EDUCATION, YOUTH AND SPORTS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 739573 (HiLASE CoE)

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Poster 1

Evaluation of laser scanning strategies for surface micro-texturing at high speed

Denys Moskal, Jiri Martan, Martin Kucera
University of West Bohemia - New Technologies - Research Centre

Summary: Different laser scanning strategies of surface micro-texturing can result different precision and processing times. Results of comparison between two scanning strategies for laser surface texturing (LST) are presented in this contribution. Classic hatch and shifted LST in burst regime strategies are compared. Precision and maximal acceptable speed are evaluated for both mentioned strategies for galvanoscan system. Physical principles for achieving of high quality of LST at possible higher speeds are discussed. Influence of positive heat accumulation and of incubation effects is presented as a possible reason of differences in LST quality.

Poster 2

Femtosecond laser shock peening without sacrificial and confining overlay to obtain superhydrophobic and durable corrosion resistant surface

Uroš Trdan, Tomokazu Sano, Damjan Klobčar, Yuji Sano, Janez Grum, Roman Šturm
Faculty of Mechanical Engineering, University of Ljubljana

Summary: 3 highlights of the research: 1.) First report of femtosecond laser shock peening (fLSP) without sacrificial and confining medium on the corrosion behaviour of AA2024-T3. 2.) After fLSP superhydrophobic state with reduced corrosion activity and long-term stability is achieved. 3.) With fLSPed sample reduction in pitting and complete eradication of IGC attack in aggressive chloride environment.

Poster 3

Characterization of a chirped volume bragg grating compressor in a high-power laser system

Denisa Štěpánková, Ondřej Novák, Jiří Mužík, Lukáš Roškot, Michal Chyla, Martin Smrž, Michal Jelínek, Vadim Smirnov, Leonid Glebov, Akira Endo, Tomáš Mocek
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Summary: We present a study of chirped volume Bragg grating (CVBG) compressor in a high-power laser system up to 258 W incident power. In this work an extensive analysis of the compressed beam characteristics including diffraction efficiency, autocorrelation of pulses, beam profiles, etc. has been studied. Thermal lensing and its effect on decreasing beam quality is also discussed.

Poster 4

Silicon Brewster plate wavelength separator for a mid-IR optical parametric source

Bianka Csanaková, Ondřej Novák, Martin Smrž, Michal Vyvlečka, Jaroslav Huynh, Akira Endo, Tomáš Mocek
HiLASE Centre, Institute of Physics of the CAS, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic

Summary: We propose a four-plate, high-power compatible silicon Brewster plate polarizer, intended for the signal and idler beam separation of a 1.4 – 3.5 μm mid-IR optical parametric source. Its contrast and its tolerance to angular misalignment, transmission of the p-wave is studied, taking into account the different powers of the signal and idler beam.

Poster 5

Picosecond pulse driven supercontinuum as a seed for a wavelength tunable mid-IR parametric source

Lukáš Roškot, Ondřej Novák, Bianka Csanaková, Michal Vyvlečka, Martin Smrž, Michal Jelínek, Akira Endo, Tomáš Mocek
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Summary: The mid-IR optical parametric amplifier requires stable seed pulses, which can be realized by supercontinuum generation. The supercontinuum outperforms the stability of the driving picosecond pulses and covers wavelength range from 0.5 μm to more than 1.7 μm. Near-IR part of the supercontinuum was successfully amplified.

Poster 6

Cryogenic 2 micron lasers based on Tm:YLF crystal

Fangxin Yue, **Venkatesan Jambunathan**, Samuel Paul David, Jürgen Reiter, Jörg Körner, Diethardt Klöpfel, Joachim Hein,Malte C. Kaluza, Antonio Lucianetti, and Tomas Mocek
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Summary: We present the spectroscopy and diode pumped laser operation of Tm:YLF crystal at cryogenic temperatures.

Poster 7

Wavefront correction with photo-controlled deformable mirror

Jan Pilar [1], Stefano Bonora [2], Simon Hutchinson [1], Antonio Lucianetti [1] and Tomas Mocek [1]
1) HiLASE Centre, Institute of Physics of the CAS, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic
2) IFN-CNR, Via Trasea 7, 35131, Padova, Italy

Summary: As the demand for high quality wavefront correction drives the integration of increasing number of actuators into single deformable mirrors, the computational demand on the driving logic increases. Adaptive optics systems for atmospheric turbulence compensation need temporal bandwidths in the order of hundreds Hz to kHz. Conventional systems using deformable mirrors accounting thousands of actuators running at kHz repetition rates need administrating processor frequencies in the order of GHz. To allow for integration of higher number of actuators and reach higher quality of wavefront correction, an alternative approach is needed. Here, a method for generation of driving signal virtually independent on the number of actuators and capable of high speed operation.

Poster 8

High-power Faraday Isolators

David Vojna, O. Slezák, R. Yasuhara, H. Furuse, A. Lucianetti, T.Mocek and M. Čech
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Summary: The desired performance of a high-power Faraday may be achieved via: 1) an extensive research of novel magneto-active materials and 2) optimization of the FI design process incorporating, for instance,

design of optical compensation FI layouts, magnetic field design or design of effective cooling system using numerical modelling.

Poster 9

Ceramic Broadband Materials For HAPP Lasers at HiLASE

Samuel Paul David, Fangxin Yue, Venkatesan Jambunathan, Antonio Lucianetti, Tomas Mocek
HiLASE Centre, Institute of Physics of the CAS, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic

Summary: We present the synthesis and photoluminescence study of mixed garnets towards the development of high average and peak power (HAPP) lasers. By introducing an extra cation (Ga3+) in the regular YAG lattice, we achieved significant broadening in its emission band at cryogenic temperatures.

Poster 10

Investigation of large-area femtosecond laser-induced periodic surface nanostructuring of metals

Marek Stehlík[1], J. Sládek[1], M. Gedvilas[2], I. Mirza[1], A.V. Bulgakov[1], N.M. Bulgakova[1], G. Račiukaitis[2]
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2) Center for Physical Sciences and Technology, Savanoriu Ave. 231, LT-02300 Vilnius, Lithuania

Summary: A systematic study of the formation of laser-induced periodic surface structures (LIPSS) on Ti and Mo surfaces by IR fs-laser pulses has been performed. The evolution, morphology, bifurcation, and effects of the initial surface roughness in large-area LIPSS fabrication are discussed.

Poster 11

Numerical Modeling of Energy Relaxation in Molybdenum Thin Films on Soda-lime Glass upon Irradiation by Picosecond Laser Pulses

Kryštof Hlinomaz, Y. Levy, T.J.-Y. Derrien, N.M. Bulgakova
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Summary: An advanced numerical code for simulations of irradiation of thin metal films by ultrashort laser pulses was developed and applied for the case of thin Mo films deposited on soda-lime glass. The simulation results are in good agreement with experimental data.

Poster 12

Modeling of optical response of metals to ultrafast laser irradiation: Comparison with experiment

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2) The Institute of Optics, University of Rochester, Rochester, NY, USA
3) School of Science, Chongqing University of Posts and Telecommunications, Chongqing, China
4) The Guo China-US Joint Laboratory, Changchun, China

Summary: The existing models of the optical response of metals are overviewed with critical assessment of their applicability to the conditions of high-power-laser excitation (HPLE), based on direct comparison with experimental data and numerical modeling for gold and zinc.

Poster 13

Large beam effect on surface structuring of Si with ultrashort laser pulses

Chiara Liberatore, J. Hrabovsky, I. Mirza, Y. Levy, T.J.-Y. Derrien, J. Sladek, Jiri Beranek, A.V. Bulgakov, N.M. Bulgakova
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Summary: The questions on the role of surface dimension and roughness in the laser-induced periodic surface structure (LIPSS) formation are addressed. It is found that surface defects (scratches, protrusions, dips) behave like nanoantennas directing radiation according to their shapes.

Poster 14

Theoretical and experimental study of laser crystallization of thin amorphous layers of silicon under continuous an pulsed irradiation

Jiří Beránek[1], O. Aktas[2], S. MacFarquhar[2], Y. Franz[2], S. Mailis[2], N.M. Bulgakova[1], A.C. Peacock[2]
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2) ORC, University of Southampton, University Road, Southampton,SO17 1BJ, United Kingdom

Summary: The aim of this work is to crystallize 1–2 μm wide stripes of a-Si selectively etched from initial uniform layer of 400 nm thickness deposited on SiO2. We are developing a model to understand thermodynamic processes taking place during melting of material and solidification of crystals.

Poster 15

Periodic surface structuring of fused silica and ULE glass using femtosecond laser pulses

Juraj Sládek[1], M. Stehlík[1], M. Gedvilas[2], I. Mirza[1], N.M. Bulgakova[1], G. Račiukaitis[2]
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Summary: A systematic study of the LIPSS produced on fused silica and ULE glasses by IR fs-laser pulses has been performed. For both glasses, ranges of parameters for creation of coarse LIPSS were found with local regions with both perpendicular and parallel LIPSS orientation.