Invited speaker

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Next generation high average power lasers and technologies at the HiLASE facility

Abstract

HiLASE is a technological infrastructure in the field of application-oriented laser research and development, up and running since 2016. We develop the next generation of high power diode pumped solid state lasers (DPSSL), while at the same time, exploit these unique light sources for a wide range of hi-tech industrial and scientific applications. PERLA is an in-house developed thin-disk laser platform generating 1-ps pulses with an average power of up to 500 W at 1030 nm, exceptional beam quality (M2 < 1,1), power stability (RMS < 0,5%), and offering extension of wavelength range from Mid-IR to DUV [1]. Thanks to the unique combination of PERLA laser with a novel diffractive optical element, we have achieved the world record in the speed (1909 cm^2/min) production of laser-induced periodic nanostructures on stainless steel surface [2]. BIVOJ is the world's first DPSSL delivering 1 kW average power in 10 ns pulses since 2016, based on cryogenic gas-cooled, multi-slab ceramic Yb:YAG amplifier technology. In 2021, we reported 146 J operation of the system at 10 Hz repetition rate with excellent power stability and a very good beam profile [3]. This was achieved by using an optimized dielectric coating compatible with high-energy & high repetition rate operation. BIVOJ laser has been used for a variety of applications in the aerospace, automotive, power engineering, marine industries [4], etc. Unique laser systems deployed at the HiLASE facility are available for external users [5] for scientific experiments via Open Access program (free of charge) as well as for commercial and/or collaborative research in the areas of customized laser development, laser induced damage, laser shock peening, laser micro/nanoprocessing and functionalization of materials and surfaces.

References

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[3] M. Divoky et al., "150 J DPSSL operating at 1.5 kW level," Opt. Lett. 46, 5771-5773 (2021).
[4] J. Kaufman et al., "The effect of laser shock peening with and without protective coating on intergranular corrosion of sensitized AA5083," Corros. Sci. 194, 109925 (2022).
[5] https://www.hilase.cz/en/we-offer/

About the Author

Tomas Mocek (born 1970) received his Ph.D. in Physics from the Korea Advanced Institute of Science and Technology (KAIST), South Korea in 2000, and in Applied Physics from the Czech Technical University in Prague, Czech Republic in 2001. Since 2011, he serves as the Head of HiLASE Centre at the Institute of Physics of the Czech Academy of Sciences. His research expertise includes development of high-average power diode-pumped solid state lasers for hi-tech applications, EUV generation, high-order harmonic generation, mid-IR generation, laser induced periodic surface structures, laser acceleration of particles, dense plasma diagnostics, optical-field ionization, X-ray lasers, and spectroscopy of laser plasma. His research activity is documented by 199 papers published in international peer-reviewed journals with impact factor which acquired over 4.000 citations, H-index of 32, and 5 patents. He was awarded by the "Prize of Josef Hlávka" for talented young researchers by the Foundation "Nadání Josefa, Marie a Zdeňky Hlávkových" in 2000, the "Otto Wichterle Award" for young scientists by the Czech Academy of Sciences in 2005, the "Outstanding Editor of Chinese Laser Press" in 2019, and the "Personality of the project Visionaries" by CzechInno in 2021. He has been Principal Investigator and/or Coordinator of numerous research and development projects with total cumulative budget of about 80 mil. EUR.