Editorial

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The ultrafast laser is gearing up to become a tool for high-precision mass production – opportunities and challenges

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With the average output power of ultrafast lasers just entering into the multi kW level, the usage of these lasers is currently leaving the classical micro processing labs and conquering large-scale manufacturing applications. Having lasers available that offer both high peak intensities and high average powers allows to combine the benefits of high-precision materials processing and high productivity at the same time. We will therefore soon see more and more laser-based high-precision material processing performed on large-scale production machines that at a first sight look very similar to those we are used to apply for the classical macro applications such as cutting and welding.

But of course there are still many challenges to be solved in order to pave the way for a widespread application of ultrafast lasers with kW average output powers in the manufacturing industry. Some of the fundamental phenomena of the interaction of ultrashort laser pulses with the different kinds of material such as benefits from pulse bursts, including bursts with short interburst pulse separation (GHz mode), or shielding effects appearing at high repetition rates are still the subject of scientific investigations. Others, like the effect of heat accumulation, are well understood but in the meantime require suitable processing strategies to avoid having a detrimental impact on the processing quality.

The present topical issue on 'Ultrafast Laser Matter Interaction' of *Advanced Optical Technology* highlights some of these important aspects and gives a good idea of the present state of the technology. It covers contributions ranging from the physics of the fundamental interaction phenomena all the way to specific applications.

We wish you inspiring reading!

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Thomas Graf was born in Switzerland in 1966. He received his MSc in Physics in 1993 and his PhD degree in 1996 both from the University of Bern. After 15 months of research at Strathclyde University in Glasgow (UK) he was appointed head of the High-Power Lasers Group at the Institute of Applied Physics at the University of Bern in April 1999 where he was awarded the venia docendi in 2001 and appointed Assistant Professor in April 2002. In June 2004 he was appointed university Professor and Director of the Institut für Strahlwerkzeuge (IFSW) at the University of Stuttgart (D). At the IFSW Prof. Graf is engaged in high-power laser systems, laser system engineering and laser applications in manufacturing. At the University of Stuttgart Prof. Graf was Vice Dean of the faculty of Engineering Design, Production Engineering and Automotive Engineering from October 2010 to February 2013 and has been Vice Rector for Knowledge and Technology Transfer since February 2013. From 2001 to 2007 Prof. Graf served as a board member of the Swiss Society for Optics and Microscopy (SSOM), from 2008 to 2012 he was a board member of the European Optical Society (EOS), he is a board member of Photonics BW e.V., serving since 2016 as its chair, and is a member of the German Wissenschaftliche Gesellschaft Lasertechnik e.V., WLT (Scientific Society for Laser Technology), and since 2013 he has been a member of its board as vice president of Engineering Sciences.

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