

SLT 2016: Highlighting Numerous Breakthroughs

Ultrafast laser materials processing asks for novel approaches to system engineering

The ever-growing needs of industrial materials processing continue to initiate exciting progress in the field of laser technology, which in return opens up more and more new prospects in a wide range of highly productive applications for manufacturing. In this context, the latest progress in the field of ultrafast laser sources and the significant advances in the understanding of the fundamentals of laser-matter interactions now lead to the conclusion that new approaches are needed in system technology in order to be able to exploit the foreseeable laser powers in manufacturing applications with respect to high productivity and quality.

Ultrafast lasers with pulse durations in the order of ps that provide average output powers in the kW range have already been set-up in various research labs and will certainly become commercially available before long. The availability of these lasers for scientific investigations on materials processing has raised the awareness concerning the limitations imposed by effects such as heat accumulation and led to a deeper understanding on the processing strategies required to be able to combine high quality with high productivity. It turns out that the bottleneck today results neither from the available laser power nor from the current knowledge on materials processing – it is the system technology. To scale the productivity with the now foreseeable powers of ultrafast lasers and to open up new fields of applications, laser-based machines will have to become about 100 times faster and roughly 10 times more precise, with all the corresponding implications that this has on beam control, beam delivery, integration, safety, measurement, and control engineering. System engineering therefore is a many-sided discipline that will attract a lot of interesting research in the near future.

Of course, the trend towards novel materials and material combination is still a significant focus, especially for laser-based welding and is complemented by the current revival of the field of additive manufacturing.

The ninth international Stuttgart Laser Technology Forum (SLT 2016) will highlight numerous breakthroughs along the above lines. In the field of laser systems the presentations include the latest developments especially on power and energy scaling of ultrafast lasers and on high-brightness cw systems. Further sessions are devoted to beam shaping, beam delivery (especially for ultrashort laser pulses) and non-linear frequency conversion. Following the above considerations, the sessions on applications will highlight system technology for ultrafast laser applications, processing of dielectric materials, solutions for lightweight production, additive manufacturing, the fundamentals of materials processing with ultrafast lasers, the optimization of processes at high average powers and much more.

The mission of the SLT is to address laser technologies for materials processing in a fundamentally scientific and yet comprehensible manner. You find some presentations as corresponding articles in this issue of Laser Technik Journal. I wish you inspiring reading!



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