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➢ Andrés-Fabián LASAGNI - FRAUNHOFER IWS

BIOGRAPHY:
Prof. Andrés Fabián Lasagni, MSc. in Chemical Engineering & PhD in Materials Science, is full professor at Technische Universität Dresden, in Germany. He has over 15 years of experience in the field of laser processing, especially for micro/nano fabrication of structured surfaces. He is author or co-author of 202 publications in scientific journals and has been awarded with several international prizes including the Materials Science and Technology Prize 2017 from the Federation of European Materials Societies (FEMS), the Green Photonics Award 2015 from the International Society for Optics and Photonics (SPIE) and the Masing-Gedächtnispreis 2012 from the German Society for Materials Science (DGM) between others.

TITLE: Direct Laser Interference Patterning: new possibilities for surface functionalization at high throughputs

ABSTRACT:
A wide range of products can be improved through the use of micro- and nanostructures that significantly influence the physical properties of their surfaces. Such topographies can be utilized to functionalize surfaces and adjust different properties such friction, wear, light management, biocompatibility or others depending on the specific requirements for a certain application. However, these micro- and nanostructures will have an impact on industrial applications only if they can be produced at high throughputs with low fabrication costs and a new processing method called direct laser interference patterning (DLIP) meets both needs.
Starting from a simple concept, transferring the shape of an interference pattern directly to the surface of a material, the DLIP technology has been continuously developed in the last 20 years. From lamp pumped to high power diode-pumped lasers, DLIP permits today to achieve impressive processing speeds, even close to 1 m²/min. Furthermore, DLIP can be also used to treat cylinders or sleeves imprint tolls for roll-to-roll hot or UV embossing methods and thus allowing throughputs over 10 m²/min.
This talk describes recently advances performed in the field of interference patterning, showing the potential of the DLIP technology for being transferred in industrial applications. Several examples will be introduced, including the structuring of thin metallic films and bulk materials using nano and picosecond laser systems, as well as introducing different optical setups and industrial systems which have been newly developed.

➢ Malte KUMKAR – TRUMPF

BIOGRAPHY:
Malte Kumkar received his diploma in physics at the University Hannover in 1988, worked at the Festkoerper-Laser-Institut Berlin GmbH and received his PhD from the Technical University Berlin in 1994. He developed laser engraving systems at MDC Max Daetwyler AG (Switzerland) and lasers for materials processing at HAAS-Laser GmbH (Germany). As managing director of the JTOE GmbH + Co. (Germany) he started the development of fiber laser modules for TRUMPF and JENOPTIK in 2007. Since 2011 he is responsible for the advanced application development at TRUMPF Laser- und Systemtechnik GmbH (Germany).

TITLE: Advanced in-situ diagnostics for development of transparent materials processing

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ABSTRACT:
Laser machining of transparent materials by nonlinear induced absorption is already well established. For throughput scaling, process optimization and development of new applications, a thorough understanding of the underlying mechanisms of laser matter interaction is required. In-situ diagnostics are well known for advancing insight, but are typically not applied at parameters relevant for industrial processing.
A novel pump-probe system offers flexible pulse duration, burst options and repetition rates up to 2 MHz, combined with pulse on demand functionality. Probe pulses of 200 fs duration and a basically unlimited delay enables analyzing effects with high resolution even on extended time scales. The system is integrated into an experimental processing setup including beam shaping modules, allowing pump-probe technology to be applied at parameters used for processing in the same setup.
We highlight some fundamental effects of multi pulse exposure observable already without sample translation. This is exemplified by illustrating phenomena to be considered for percussion drilling, melt generation inside of bulk material and inscription of elongated modifications for cutting applications.
The impact of accumulation on beam propagation and absorption becomes apparent. Pump-probe polarization microscopy gives insight into the transient buildup of thermally induced stress and pressure waves, responsible for crack initiation and development. The influence of aberrations on the inscription of elongated profiles is observed by pump-probe imaging, supporting beam shaping concepts with integrated aberration correction. Observing the influence of pulse duration and bursts further demonstrates the benefits gained by in-situ diagnostics applied in the development of processing by ultrashort laser pulses.

➢ Patrice PEYRE – PIMM-ENSAM

BIOGRAPHIE:
Patrice Peyre est directeur de Recherche CNRS au laboratoire PIMM (UMR 8006 Arts et Métiers – CNRS – CNAM). Il travaille sur la transformation des matériaux par procédés laser depuis plus de 20 ans avec des thématiques spécifiques comme : le renforcement des surfaces par choc-laser, l'assemblage laser de matériaux hétérogènes (Fe/Al, Ti/Al) et depuis 2007, sur la fabrication additive par fusion laser de poudre (procédés LMD et LBM).

TITRE : **Étude de l'interaction laser-poudre-zone fondue en fabrication additive lit de poudre. Application à l'élaboration de matériaux denses**

Patrice Peyre, Valérie Gunenthiram, Matthieu Schneider, Morgan Dal, Frédéric Coste, Rémy Fabbro
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RESUMÉ :
La capacité d'élaborer des pièces métalliques denses en fabrication additive passe par une maîtrise de l'interaction énergie-matière, que ce soit au niveau de son absorption par des surfaces complexes comme des lits de poudre, ou au niveau des différentes instabilités (balling, éjections métalliques) susceptibles d'être formées, et limitant l'aptitude à la densification du métal fondu.
A travers différentes recherches récentes, et en se focalisant sur les procédés de fusion laser de lit de poudre (Laser Beam Melting), la présentation se propose de passer en revue les différents enjeux et verrous scientifiques à maîtriser afin d'assurer une fabrication stable et des microstructures optimisées. Plus généralement, à travers des expériences instrumentées sur machine LBM et sur banc prototype, l'objectif est de pouvoir comprendre ce qui qualifie un matériau métallique ou une source d'énergie donné(e) pour la fabrication additive par LBM, et quel est le lien entre les nombreux paramètres du procédé (Puissance, vitesse, diamètre de faisceau, écart vecteur …) et les propriétés de la matière consolidée. Différentes perspectives de développement pour les procédés LBM seront également évoquées.

➢ OLIVER SUTTMANN - LASER ZENTRUM HANNOVER

BIOGRAPHY:
Oliver Suttmann studied Mechanical Engineering at the universities of Rostock and Hannover. After receiving his PhD in 2013, he took over responsibility for the Production & Systems Department at LZH. His current work concentrates on material processing of heat sensitive materials, such as Fiber reinforced plastics, glass, metals and thin film systems. Decreasing and controlling the thermal load on the processed components is in every case the key to success and can be realized using short and ultrashort pulsed lasers, adapted wavelengths and beam shapes in combination with processing and monitoring strategies. Under consideration of these aspects, he and his team work on different processes such as ablation, cutting, drilling, and welding as well as additive manufacturing ranging from fundamental studies to industrial implementation.

TITLE: **Welding of fused silica using CO2-Lasers towards Additive Manufacturing**

Authors: Leonhard Pohl, Philipp von Witzendorff*, Achim Heinrich**, Jörg Zander**, Oliver Suttmann (a)*, Stefan Kaierle**
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ABSTRACT:
Fused silica is used within medical products when high chemical inertness and transparency is required. Complex three-dimensional fused silica parts, as for example artificial kidneys, are produced via manual welding processes by heating the fused silica with a gas flame. In this study, a CO2 Laser is used as the energy source to heat the fused silica enabling welding and additive manufacturing. A fused silica fiber was supplied as additional material to bridge gaps within welding process and to build simple arbitrary components by additive manufacturing. The fiber is conveyed through a self-developed feeding system. A laser head focusses the laser radiation in order to melt the fiber. A three axis systems is used to move the feeding system and laser head. The laser welding process of fused silica has been examined numerically and experimentally. The introduced simulation tool forecasted the principle process window where greater laser spot diameters are favourable for higher weld penetration without overheating. Based on the numerical simulation, a process window for welding 2 mm thick fused silica was identified. By adapting the process parameters, the system is capable of performing additive manufacturing of fused silica which allows for the creation of arbitrary 3D fused silica structures. Both methods are envisioned to replace conventional manual glass manufacturing processes within the production of complex hollow glass structures which are present in the medical sector.

➢ Olivier HAUPT – COHERENT

BIOGRAPHY:
Oliver Haupt graduated in precision mechanics, University of Applied Science, Kiel. Worked at Laser Zentrum Hannover and finished his PhD in mechanical engineering at University of Hannover in 2009. He was product line manager for short pulsed and scientific lasers at Coherent in Hannover from 2011. Today he is product line manager for Coherent Excimer laser systems and LLO systems in Göttingen/Germany focused on Flex OLED applications.

TITLE: **UV lasers driving the flexibility of micro electronic devices**

Oliver Haupt, Ralph Delmdahl
Coherent LaserSystems GmbH&Co.KG
Dr.-Ing. Oliver Haupt

ABSTRACT:
Over the past years, there have been many innovations in displays for TV and mobile devices which today are characterized by very high resolution with increasing sizes. Right now flexible OLED displays are experiencing a boom and are creating a wave in the market. Other display technologies, such as LCD, OLED and the emerging µLED's are under development and on the way to mass production.
UV lasers are the perfect choice to detach functional foils, µLED devices or single µLED´s from ridged wafers or panel type carriers. Laser processing has always been a key technology in achieving breakthrough developments in microelectronics devices. The combination of modern excimer lasers, being the most capable in the UV laser landscape, with large-field projection optics bridges the long-standing gap between "fast processing" and "precise processing" due to an unprecedented effective illumination footprint, some 10,000 times larger than the achievable resolution.

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