SCHOOL OF ENGINEERING
INSTITUTE OF MICROENGINEERING

SELECTED TOPICS IN ADVANCED MANUFACTURING

THURSDAY, MAY 23rd 2019

BC 420

Program

14h15 : Introduction
14h20 : *Laser Induced Forward Transfer (LIFT) of Functional Materials*
Thomas Lippert, Paul Scherrer Institute
15h00 : *Additive Optics design and Manufacturing Technology for Fast, Flexible and Cost-effective fabrication of Custom Optics*
Marco de Visser, co-founder, Luximprint
Suresh Christopher, Physionary
15h40 : *3D printing by Direct Laser Writing*
Andrew Dalebrook, Nanoscribe
16h20 : Networking apero
17h00 : End

PAUL SCHERRER INSTITUT

PSI

Abstract

Laser Induced Forward Transfer (LIFT) of Functional Materials

Functional materials with certain dimensions in liquid or solid form are often required for a range of applications and may be even needed on or in devices. A range of different techniques has been developed to deposit materials (or to structure after deposition) with micron-size dimensions. All applied methods have strengths and weaknesses; therefore a range of techniques has been developed. In approach a laser is applied to transfer the thin films with a well-defined geometry from a target onto a receiver, which may even have a structure on its own, e.g. an electrode structure for sensors. The transfer of thin films with defined geometries using lasers has been first reported in 1969, and became known in 1986 under the name of laser-induced forward transfer (LIFT), but also several other names have been used for fundamentally very similar processes, such as LAT, LITI, MAPLE-DW etc. One of the further developments of the LIFT process has been the application of laser light absorbing layers between the substrate and the layer to be transferred. These absorbing layers, also named dynamic release layers (DRL) or sacrificial layers, protect the transfer layer from the laser, which may cause thermal or photochemical reactions, and allow therefore the transfer at lower laser fluences and also of sensitive materials. A large number of sensitive materials, e.g. bio-materials and polymers, has been transferred by this approach in liquid or solid form.

I will summarize the different LIFT approaches, give insights in the transfer mechanisms and show examples of the LIFT transfer of functional materials, including the transfer onto devices, with a focus on sensors.

Thomas Lippert is since 2013 adjunct professor at the *Laboratory of Inorganic Chemistry* at ETH Zurich, where he got also his habilitation in 2002. He was/is since 2002 head of the *Materials* research group in the *Energy and Environment Division* at the Paul Scherrer Institut (since 07/2016 as *Thin Films and Interfaces* group in the *Research with Neutrons and Muons Division*). Thomas is also PI at International Institute of Carbon-Neutral Energy Research (I^2CNER) at Kyushu University, Japan. Thomas Lippert studied Chemistry at the University of Bayreuth, Germany, where he received his PhD in Physical Chemistry in 1993. He went then as a Postdoctoral Fellow to the National Institute of Materials and Chemical Research (NIMC) in Tsukuba, Japan. After Japan he moved in 1995 to Los Alamos National Laboratory, USA, where he also became a Technical Staff Member. In 1999 Thomas Lippert went as Senior Scientist to the Paul Scherrer Institut, Switzerland. Thomas Lippert has published > 330 papers, delivered > 140 invited talks, organized >10 international conferences, has been a reviewer for over 20 international funding agencies, and numerous journals. Thomas is the Editor in Chief of Applied Physics A-Material Science & Processing and was the President of E-MRS (from 2014-2015).

LUXIMPRINT

physionary

Abstract

Additive Optics Design and Manufacturing Technology for Fast, Flexible and Cost-Effective Fabrication of Custom Optics

Additive manufacturing of custom LED optics is a future proof methodology of rapid prototyping optical components using digital 3D printing technologies. The seminar on 'Custom Optics Design meets Additive Optics Fabrication Technology teaches practical lessons on how to design for Luximprint additive optics manufacturing by using state-of-the-art 'target-to-source' optics design software from Physionary, aiming to overcome the challenges in todays' industrial engineering landscape.

A combination of those two emerging technologies is extremely powerful, as the intelligent piece of design software incorporates and considers the optical 3D printing platform capabilities when generating a design for manufacture. Product developers, on the one hand, can now benefit from the 'printing-on-demand' of custom optics, with no costly commitments to tooling and inventory, while designers and specifiers can get uncompromised solutions, meeting the exact quantities and needs for their custom project.

Marco de Visser - a Dutch self-proclaimed 3D Printing, Optics and Lighting enthusiast.

Marco holds the position of Director of Marketing & Sales and is co-founder of Luximprint, Editor-in-Chief for 3DPrinting.Lighting and Inspiration.Lighting and actively involved with the global lighting, optics and maker movements.

Suresh Christopher - Physionary

Business development/Project manager, back ground in research and development, passionate about helping the clients to put the light here they want using the in-house developed target to source optical software.

Abstract

3D Microprinting by Direct Laser Writing

Modern additive manufacturing requires tools with extraordinary precision. Since 2008, Nanoscribe has been the market leader in 3D microprinting with its Photonic Professional series. Today over one thousand users operate nearly two hundred 3D printers. The community continues to push the boundaries of fields spanning optics, microrobotics, biology, metamaterials and many more. In this talk, we will present an overview of the technology along with a suite of current applications.

Dr. Andrew Dalebrook grew up and studied chemistry in New Zealand, culminating in a PhD at the University of Auckland in 2012. The same year he moved to Lausanne and took a post-doctoral position at EPFL in Gábor Laurenczy's group, working on catalytic systems for hydrogen production. Since 2018 he is employed as a field service engineer at Nanoscribe, near Karlsruhe, Germany.