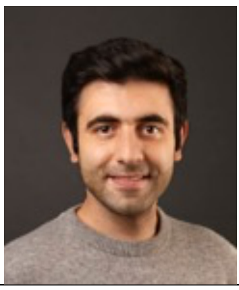
Mini-workshop
in the frame of MICRO-413 “Advanced Additive Manufacturing Technologies”

Date: June 2nd, 2022
Time: 14h15 – 17h00, with networking aperitif
Place: EPFL Lausanne, room BC 420 https://plan.epfl.ch/?room==BC%20420

Schedule (each talk 15 min + 5 min Q&A)

Time	**Speaker & affiliation**	**Title**
14h15	ChM & JB (EPFL)	Workshop opening
14h20	Navid Sohrabi (CSEM)	4D Printing of Shape Memory Compliant Mechanisms for Space Applications
14h40	Patrick Galliker (Scrona)	NanoDrip Printing: A 3D printing technology with the power to reinvent semiconductor and display production
15h00	Taavet Kangur (EPFL/U-Oregon)	Developing Melt Electrowriting on an Open Source Fused Filament System
Break		
15h30	Theophane Besson (Heidelberg Instruments)	Direct laser lithography for industrial applications and its challenges (MLA300)
15h45	Jonas Wiedemann (Multiphoton Optics)	Multiphoton lithography
16h00	Damien Loterie (Readily3D)	Volumetric 3D printing
16h20	Dominic Ernst (regenHU)	3D Bioprinting for Next-Gen Therapeutical Solutions
16h40	Sébastien Lani (SIPBB)	Metal laser powder bed fusion : From R&D to the industry
17h00	Networking apero	

Speakers’ info and abstracts (where available)

Title	**4D Printing of Shape Memory Compliant Mechanisms for Space Applications**
Presenter 	Navid SOHRABI
Affiliation	CSEM S.A. Neuchatel
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Abstract	Compliant mechanisms can achieve macroscopic linear and rotary motion without friction, wear, and backlash. In recent years, the advent of Additive Manufacturing (AM) enabled new topologies for compliant mechanisms that were too complex to manufacture using traditional subtractive manufacturing methods. Today, at CSEM, we tackle the challenge of the development of AM process for the next generation of compliant mechanisms with shape memory behavior. The advantages of using shape memory alloys such as NiTi are numerous: (i) actuation without micro-vibration, (ii) simplified assembly, and (iii) simplified control of electronics. In this work, we show the development of a full-chain laser powder-bed fusion (LPBF) process starting from powder selection, process, and post-process optimization for NiTi actuators with actuation strain up to 4% and austenite start temperature above 50°C. Combined with shape memory training techniques, two-way shape memory effect was achieved to demonstrate shape memory actuation using a Large Angle Flexural Pivot demonstrator in collaboration with ALMATECH. Applications of such mechanisms could be found in flip mirrors, high-accuracy pointing mechanisms, and louver windows.
Speaker Bio	Dr. Navid Sohrabi received his Master's degree in Materials Science and Engineering from the University of Tehran (Iran) in 2016, where he was recognized as the top-ranked student. In 2017, he was admitted to the doctoral program of Advanced Manufacturing at EPFL. Navid joined the laboratory of thermo-mechanical metallurgy (LMTM) as a Ph.D. student to investigate laser powder-bed fusion (LPBF) of metallic alloys with enhanced microstructure and properties under the supervision of Prof. Roland Logé. He graduated in September 2021 and received the best Ph.D. thesis award 2021 by the journal of Metals. Then, he joined the Swiss Center for Electronics and Microtechnology SA (CSEM) as a post-doctoral researcher, and he is working on alloy development using powder metallurgy and additive manufacturing of metallic alloys.

Title	**NanoDrip Printing: A 3D printing technology with the power to reinvent semiconductor and display production**
Presenter 	Patrick Galliker
Affiliation	Scrona; https://www.scrona.com/
Email	patrick.galliker@scrona.com

Abstract	Over the last decades inkjet printing has substantially improved, for example by adapting microfabrication technology in the production of the most recent inkjet printheads. However, the further enhancement of the inkjet printhead architecture is becoming physically limited and therefore increasingly expensive. The goal of making inkjet printheads higher resolved and use them as additive manufacturing tools in printed electronics and related fields has therefore been restricted. To make inkjet printing compatible with high-resolution 3D printing not incremental innovation in needed but actual distruption, a complete change of paradigm. Electrohydrodynamic printing, the basis of Scrona's NanoDrip printing, creates the force required to eject droplets directly inside the ink, at the nozzle exit where the force is actually needed. All problems related to creating a force inside the printhead itself and transmitting it to the nozzle exit inside a viscous medium are thereby eliminated. This leads to nothing less than the potential of increasing both the printing resolution and ink viscosity more than a hundredfold.
Speaker Bio	Patrick Galliker is CEO and co-founder of the ETH spin-off company Scrona. Patrick studied Nanosciences at University of Basel and subsequently got his PhD at the laboratory of Prof. Dimos Poulikakos at ETH Zürich. In parallel to his PhD studies Patrick enrolled for a Master in Advanced Studies in Management, Technology and Economics at ETH Zürich as well. For his company Scrona Patrick has already raised more than 10 Million Swiss Francs in funding and multiple recognitions, including a Guinness World Record for the smaller inkjet printed color image.

Title	**Developing Melt Electrowriting on an Open Source Fused Filament System**
Presenter 	Taavet Kangur
Affiliation	EPFL / U-Oregon
Email	taavet.kangur@epfl.ch
Abstract	Melt Electrowriting (MEW) is a novel additive manufacturing technology mainly used in the tissue engineering and regenerative manufacturing (TERM) domain. The price of systems capable of MEW is expensive and require fine tuning in order to produce quality results.

	This project's aim is to make a system capable of producing quality fibers and scaffolds by MEW on an open-source FFF platform to drastically reduce the entry price in the field of MEW and at the same time enabling new materials to be MEW for applications outside TERM. The final system will be open source.
Speaker Bio	2014- 2019: Bachelor in Microtechnology at EPFL 2019-2022: Master in Robotics at EPFL (Master project done at the University of Oregon in collaboration with LAPD, LMIS1 and the Dalton Lab)

Title	**Direct laser lithography for industrial applications and its challenges (MLA300)**
Presenter 	Theophane Besson
Affiliation	Heidelberg-Instruments
Email	theophane.besson@heidelberg-instruments.com
Abstract	Heidelberg Instruments became a key player in the R&D and university laser lithography space by bringing the MLA150 to market, a versatile and easy to use alternative to mask aligners. Offering an industrial version of the MLA150 in the enterprise segment presented many challenges that led to the development of the MLA300 and a change in the way systems are built: • More throughput: The system must be competitive with steppers and mask aligners • Better uptime and automation: Yield is key. All lithographic steps need automatic high accuracy alignment and as few issues as possible • Compliance and conformity • MES integration: substrates are recognized and exposed directly from the MES and dies/sensors are saved in the database. • Versatile conversion setup: integration with the MES (logging and labeling) and the metrology in the production lines (distortion compensation for 3d integration) In this presentation, we want to present the MLA300, show some of the challenges encountered and the solutions that were developed.
Speaker Bio	Born in Martigny, Valais, Switzerland 2008-2013: Bachelor and Master of Science in Micro- and Nanotechnologies at EPFL (Master project done at the LMIS1)

	2014-2018: First application engineer for the MLA150 product and gestion of the first system at CMi 2018-2020: Development and installation of the first MLA300, the industrial version of the MLA150 2020-now: Head development engineer of the MLA300

Title	**Multiphoton Lithography**
Presenter	Jonas Wiedemann
Affiliation	Multiphoton Optics
Email	jonas.wiedenmann@multiphoton.de
Abstract	Multiphoton Lithography enables high precision freeform 3D printing below the optical diffraction. In this talk, I will cover the physical principles, describe a typical workflow, and present some of its many applications.
Speaker Bio	Jonas Wiedenmann joined Multiphoton Optics GmbH in February 2019 and is currently the Head of Development. He holds a Master of Physics degree in Optoelectronics and Laser from the Heriot-Watt University in Scotland and a M. Sc. degree in Physics from the University of Wuerzburg, Germany. From 2014-2019 he was as a research assistant at the Chair of Prof. Molenkamp, where he worked on the fabrication and analysis of II-VI semiconductors superconductor hybrids nanostructures with potential application in the field of topological quantum computation. He received his PhD in 2018.

Title	**Metal laser powder bed fusion : From R&D to the industry**
Presenter 	Sébastien Lani
Affiliation	Switzerland Innovation Park Biel/Bienne https://www.sipbb.ch/en/
Email	sebastien.lani@sipbb.ch
Abstract	Metal laser powder fusion (LPBF) is one of the most mature 3D printing technologies. It consists of selectively melting a layer of metal particles and to repeat the operation until the component is manufactured. For a long time, it has been limited to prototyping but is now used also in production. Applications are very broad, from space rocket engines to dental implants. Different examples will be presented and the reason of their success. In addition, some SIPBB's activities will be presented.

Speaker Bio	Sébastien Lani has a PhD from University Paris XI in microengineering. He has more than 10 years in leading R&D innovation projects (industrial mandate, CTI/innosuisse, EU and ESA) up to the transfer to the industry. His expertise is covering design, precision manufacturing, chemistry, additive manufacturing and mechanical testing. He is the author of various patents and publications.

Title	**3D Bioprinting for Next-Gen Therapeutical Solutions**
Presenter 	Dominic Ernst
Affiliation	regenHU
Email	Dominic.Ernst@regenhu.com
Abstract	3D bioprinting leverages many novel exciting technologies, including advanced liquid handling, high precision extrusion, additive manufacturing processes and highly sophisticated instrument control techniques to provide new solutions for the current and future challenges in tissue engineering, drug discovery and testing, as well as personalized medicine. Discover this fascinating technology and its applications and get to know the market pioneering and leading bioprinting platform of the world-renowned Swiss company REGENHU.
Speaker Bio	Dominic Ernst, Technology & Innovation Manager at REGENHU, is passionate for cutting-edge technology and seeks to bring new solutions, that serve our global and ambitious user base to push the borders of their research for the next revolution in medicine. Dominic earned his Master of Sciences in Engineering from the Bern University of Applied Sciences in 2009, specializing in optics for production technologies and continued education in product management. Since then, he has contributed to a large range of technological and business developments in different industries, starting in optical design for spectrometers for OCT in medical imaging for 5 years, followed by 2 years of software development in sheet metal industry. Having gained experience in customer driven product development processes, Dominic has now been actively contributing for 6 years to REGENHU's continuous growth in different roles, from development engineer, project manager for international technology projects, product manager and currently as technology & innovation manager.

	Dominic lives in Bern, is happily married for 5 years and is proud father of 2 little boys.

Title	**Volumetric 3D printing**
Presenter	Damien Loterie
Affiliation	Readily3D https://readily3d.com/
Email	paul@readily3d.com
Abstract	In this talk, we discuss the opportunities of volumetric 3D printing and the process of commercializing a new technology as a startup." Bio: "Damien graduated from EPFL in 2017 with a PhD in microengineering. His expertise in light shaping through complex media put him on the track of developing Readily3D's algorithm for volumetric 3D printing. He is now the CEO of Readily3D and works on establishing business partnerships to foster the commercialization of volumetric 3D printing.
Speaker Bio	