Capacity Build-Up & Technologies Platform Activities @ Empa

Annual Review Meeting, January 29th 2020
Microcity of EPFL Neuchâtel

Pierangelo Gröning
Advanced Manufacturing

R&D Focus Areas @ Empa

3D-Printing
- Selective Laser Melting (SLM)
- Laser Direct Metal Deposition (LDMD)

Vacuum Deposition
- Sample
- Ar or Ar/N2 plasma
- Target 1
- Target 2

LiGA (Lithographie, Galvanoformung, Abformung)
(Lithography, Electroplating, Molding)

High precision printing
- Pre treat
- Curing
- Source & drain
- Semiconductor
- Dielectric layer
- Gate
- PET film
- Printer#1
- Printer#2
- Printer#3
- Printer#4
- PET film
Coating Competence Center

Infrastructure

INGENIA S3p™
(High-Power Impulse Magnetron Sputtering)

High precision modular sheet printing system C600

Hard coatings
- Automotiv
- Energy
- Medtec
- ....

UHV Sputter Cluster CT200

Multilayer coatings
- Thin film solar cells
- Thin film solid state batteries
- ....

Multilayer printing
- Thin film solar cells
- Thin film solid state batteries
- Supercaps
- Printable electronics
- ....
Coating Competence Center

Aerosol Printer

Strategic collaboration with the company

1. Atomizer
2. Mist transport-conditioning channel
3. Deposition head

$N_2$ is the typical (inert) processing gas

Contact person:
Dr. Jakob Heier (jakob.heier@empa.ch)
Laser Scriber

Printing Carbon-based Mesoscopic Perovskite Solar Cells

Cross section of interconnected stripe-shaped cells indicating the laser scribing steps P1, P2 and P3, the bus bar current collector. The green layer shows the FTO and the gray layer indicates compact TiO$_2$.

Nanosecond pulsed UV laser ablation setup
Selective Laser Melting (SLS) Systems

- Building volume: 300 x 300 x 300 mm³
- Laser Power: 400W

Contact person:
Dr. Christian Leinenbach (christian.leinenbach@empa.ch)

SISMA / mysint 100 (SLM)

- Laser System: Fiber
- Building volume: Circular dia. 100 x 100 height (mm)
- Maximum laser power: 200 W (CW); 1070 nm
- Laser spot diameter: 30 - 55 μm
- Layer thickness: Std. 20-40 μm
- Productivity: Max 5 cm³/h (Stainless steel)

With an adaptor for 30 x 30 (mm)
**Laser Direct Metal-Deposition (LDMD)**

**BeAM Mobile 1.0 Machine**

Strategic collaboration with the company

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**Micropowder**

Volumetric powder feeder

**Nanopowder**

Dense phase convey system, pulsed powder feeder

Contact person:

Dr. Marc Leparoux

(marc.leparoux@empa.ch)
Laser Direct Metal-Deposition (LDMD)

*BeAM Mobile 1.0 Machine*

- Ti + n-Al₂O₃ powder
- Ti powder
- n-Al₂O₃ powder
Modular R&D Platform for 3D Metal-Printing

Select Laser Melting (SLM)  
Laser Direct Metal Deposition (LDM)  
Laser Wire Deposition  
Electron Beam Melting (EBM)

Modular R&D 3D Metal-Printing Platform
Combines 3D Printing Techniques and Scanning Electron Microscopy
Will be installed in July-September 2020

Contact person:
Prof. Patrik Hoffmann (patrik.hoffmann@empa.ch)
Thank you for your kind attention.