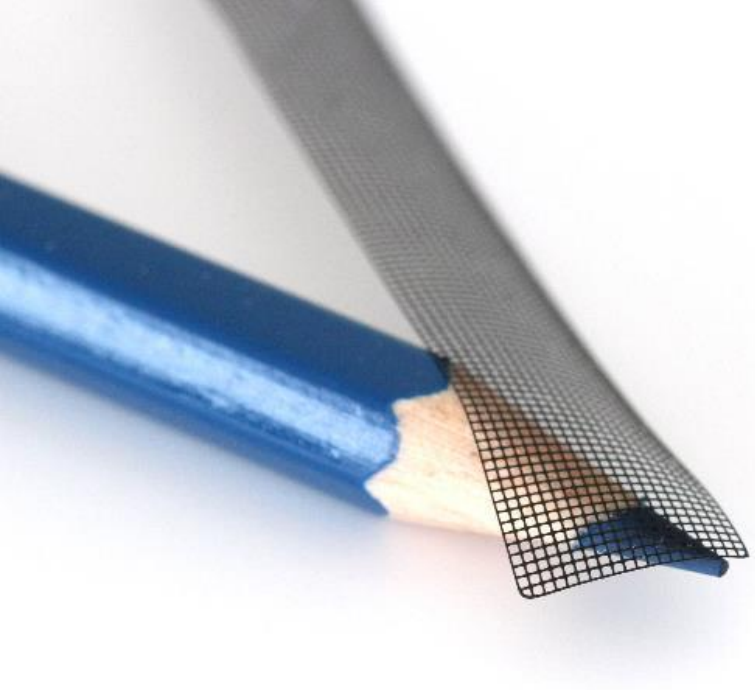


cubicure printing performance polymers

Hot Lithography

high precision 3D-printing of tough and temperature resistant photopolymers

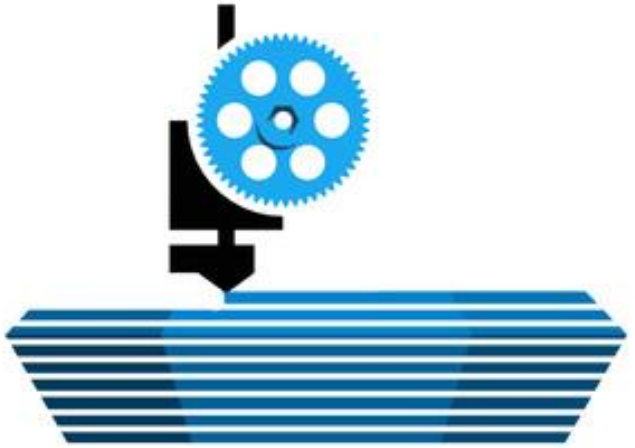
Dr. Robert Gmeiner

Zwick/Roell TestXpo, Ulm, 18.10.2017

Additive Manufacturing

3D-model

slicing



layer-by-layer build-up in a 3D printing setup

What the industry really needs!

Additive manufacturing of functional polymer parts with highest precision

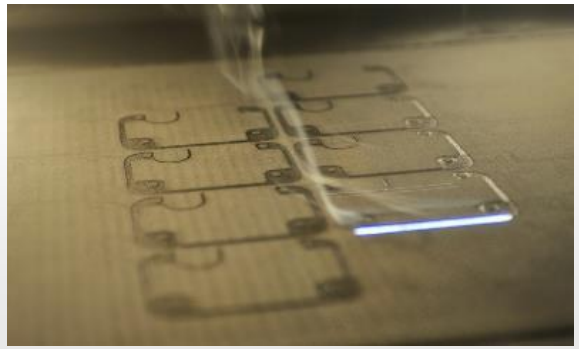
prototypes,
design objects,
functional
samples

functional parts for technical applications

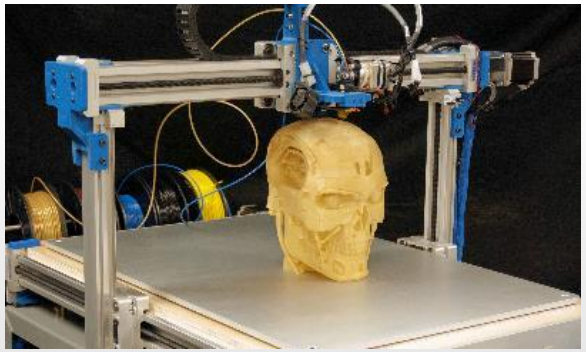
3D-Printing of polymers

3D-Printing

SLS

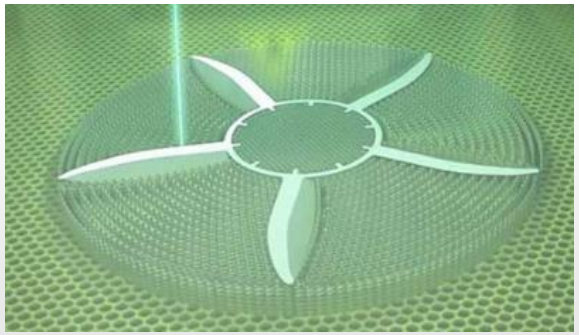


FDM

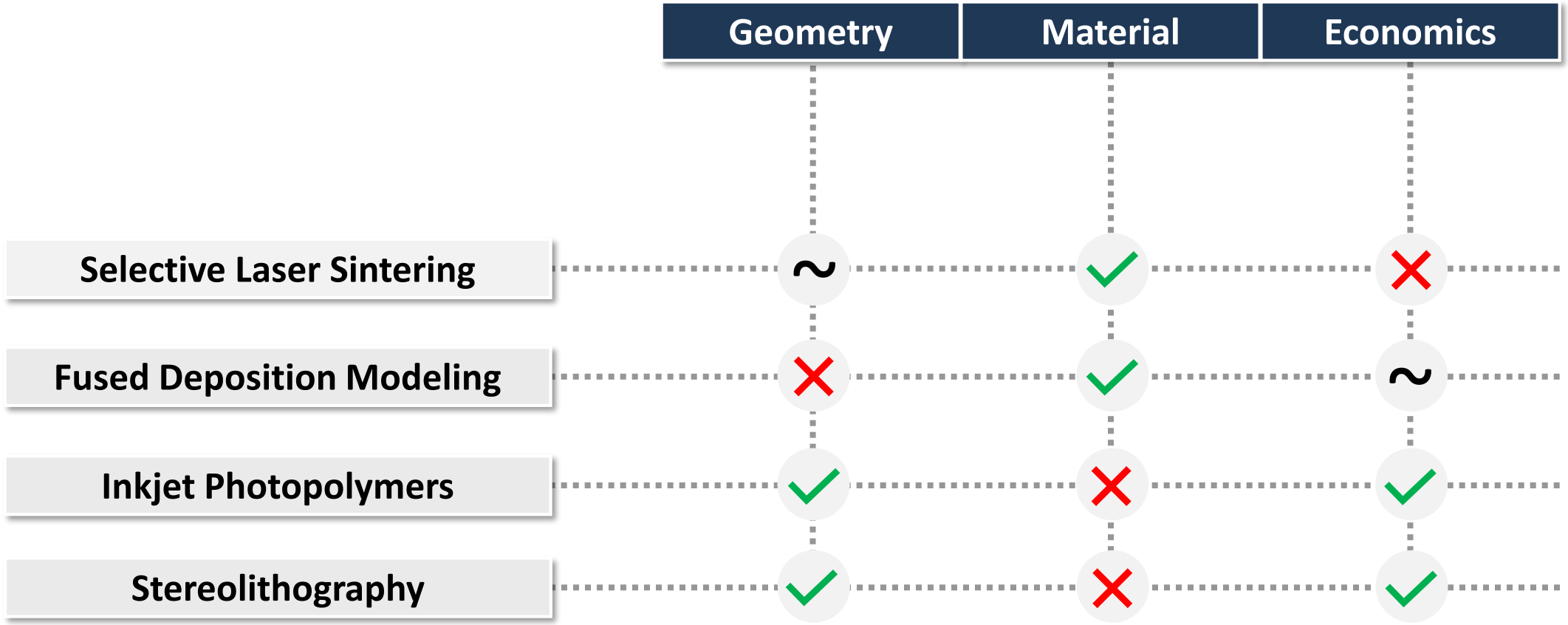


Inkjet

Stereolithographie (SLA, DLP)



Dilemma of 3D Printing



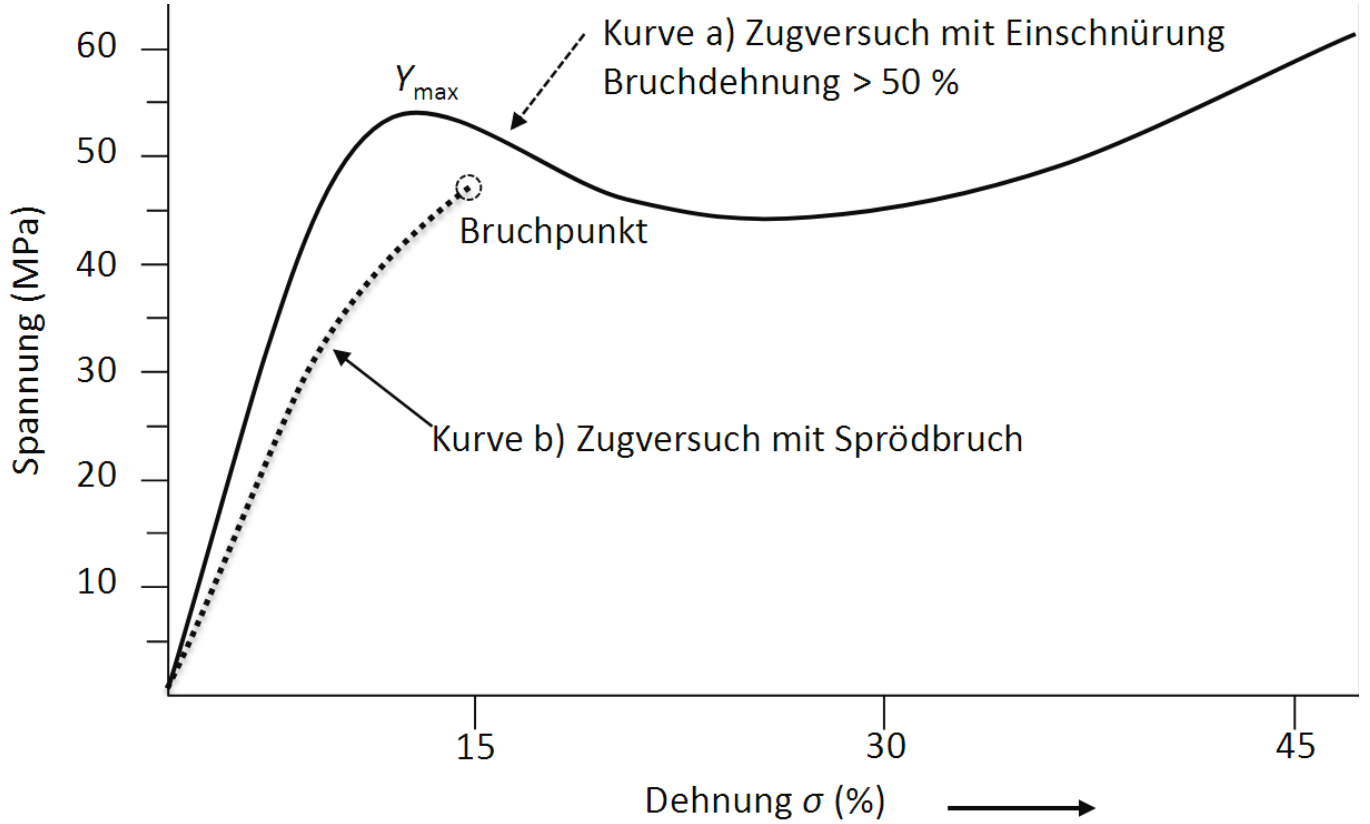
Injection molding quality needed!

Precision

Stereolithography

Mechanical properties

Thermoplasts



New material & process concept

Development of the Hot Lithography technology

Combination of photopolymers and thermoplasts

Material

- Development of new materials
- High temperature + photopolymerization

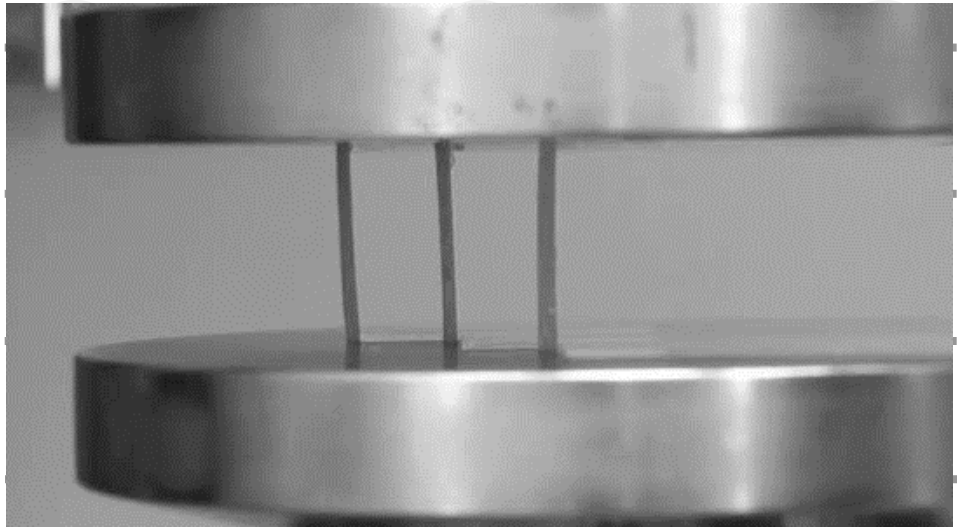
New printing technology needed

Process

- Heated process area
- Material coating mechanism

Dilemma of 3D Printing

	Geometry	Material	Economics
Hot Lithography by Cubicure	✓	✓	✓
Selective Laser Sintering			
Fused Deposition Modeling			
Inkjet Photopolymers			
Stereolithography			



Cubicure GmbH

Lithography-based additive manufacturing of polymers for technical applications

cubicure printing performance polymers

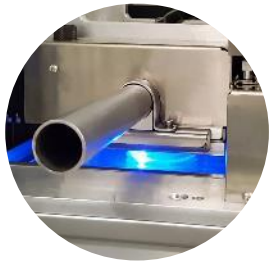
Spin-Off of TU Wien (2015)

> 8 years of experience in lithography-based 3D-printing

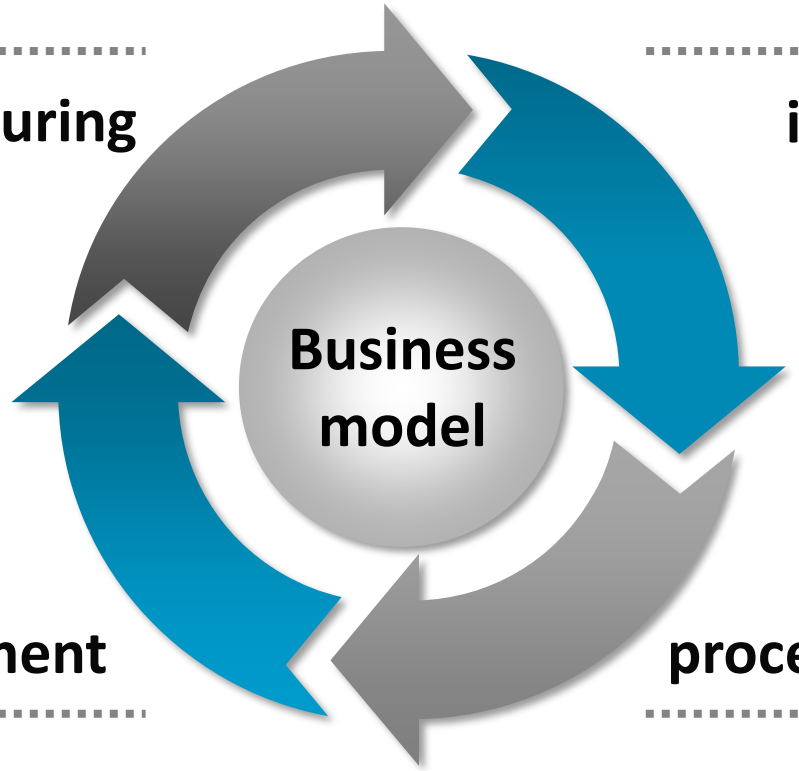
Infrastructure

11 employees
100 m² chemical laboratory
380 m² office and shop floor

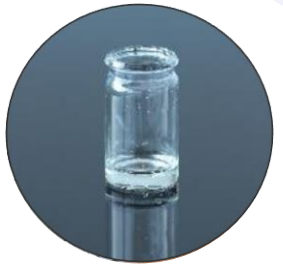
Cubicure GmbH



additive manufacturing systems



innovative resins



material development

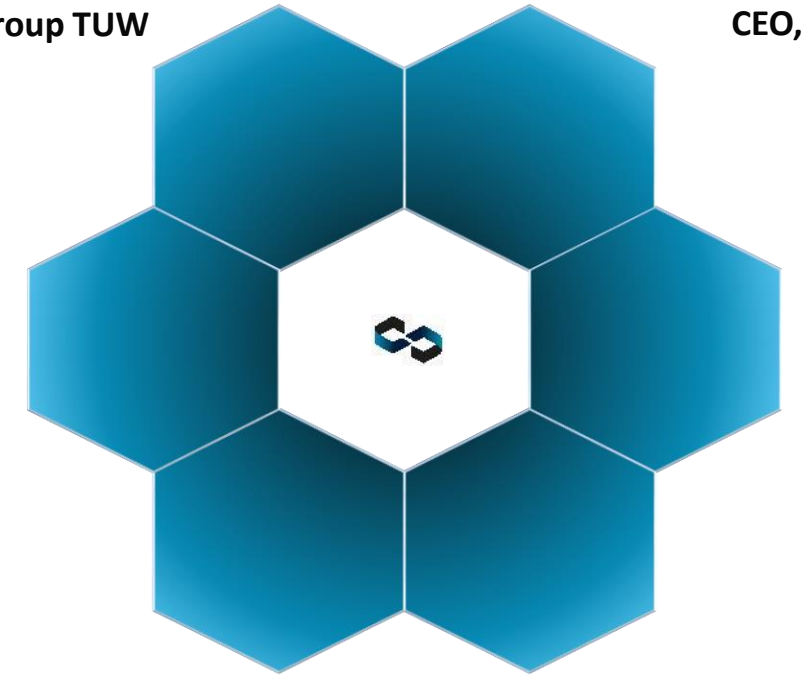
process development

Shareholder

Prof. Jürgen Stampfl
Head of AMT group TUW

Dr. Robert Gmeiner
CEO, Cubicure GmbH

Dr. Johannes Homa
CEO, Lithoz GmbH



Prof. Robert Liska
Organic technologies TUW

Dr. Hans Langer
EOS e-Manufacturing Solutions

DI Johann Oberhofer
CEO, AMB GmbH

Lithographic 3D-printing

1 Laser light source

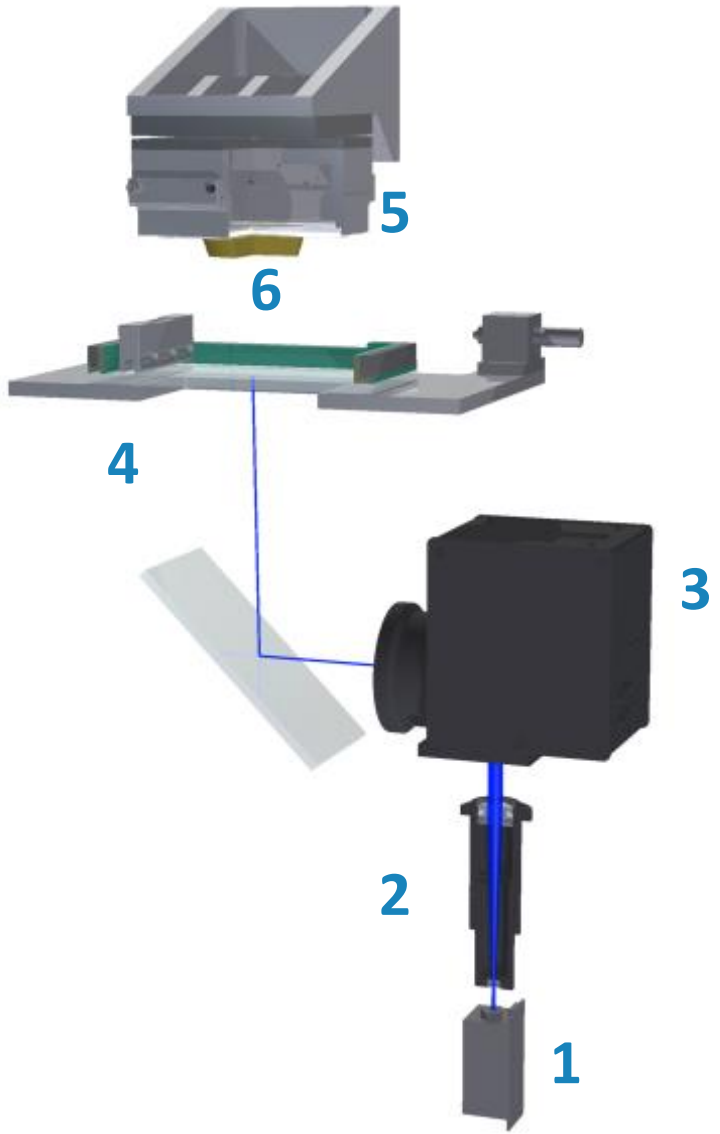
2 Optical system

3 Scanning system

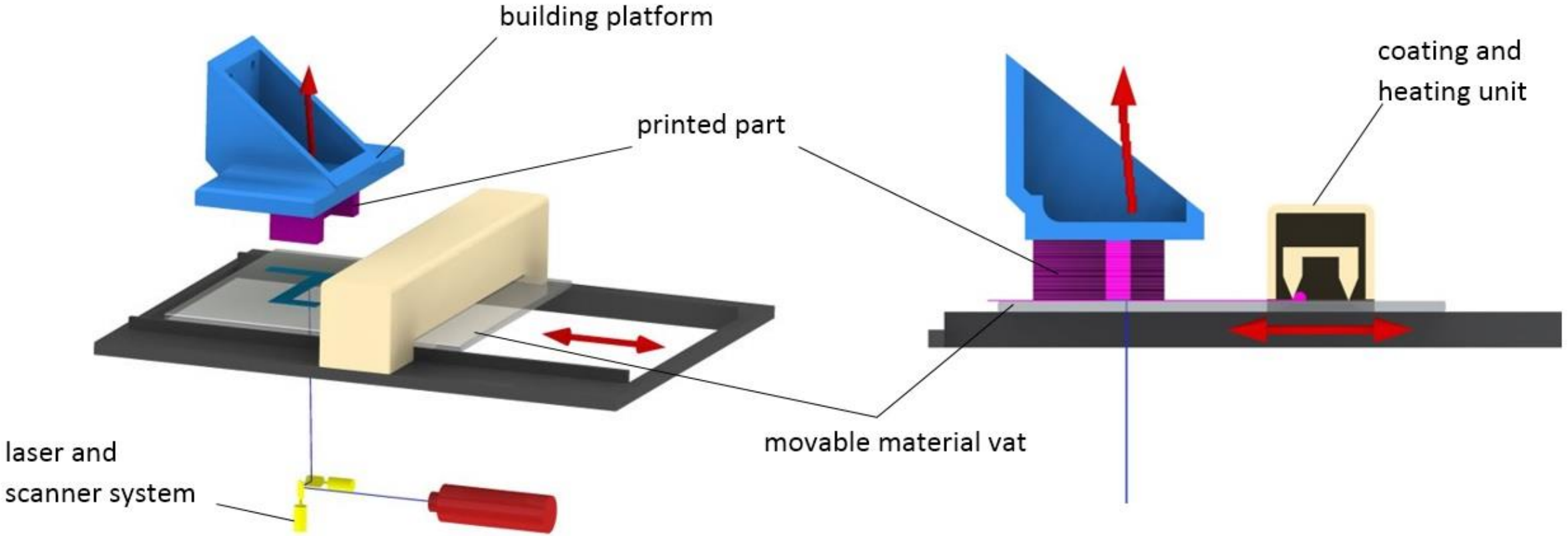
4 Coating system

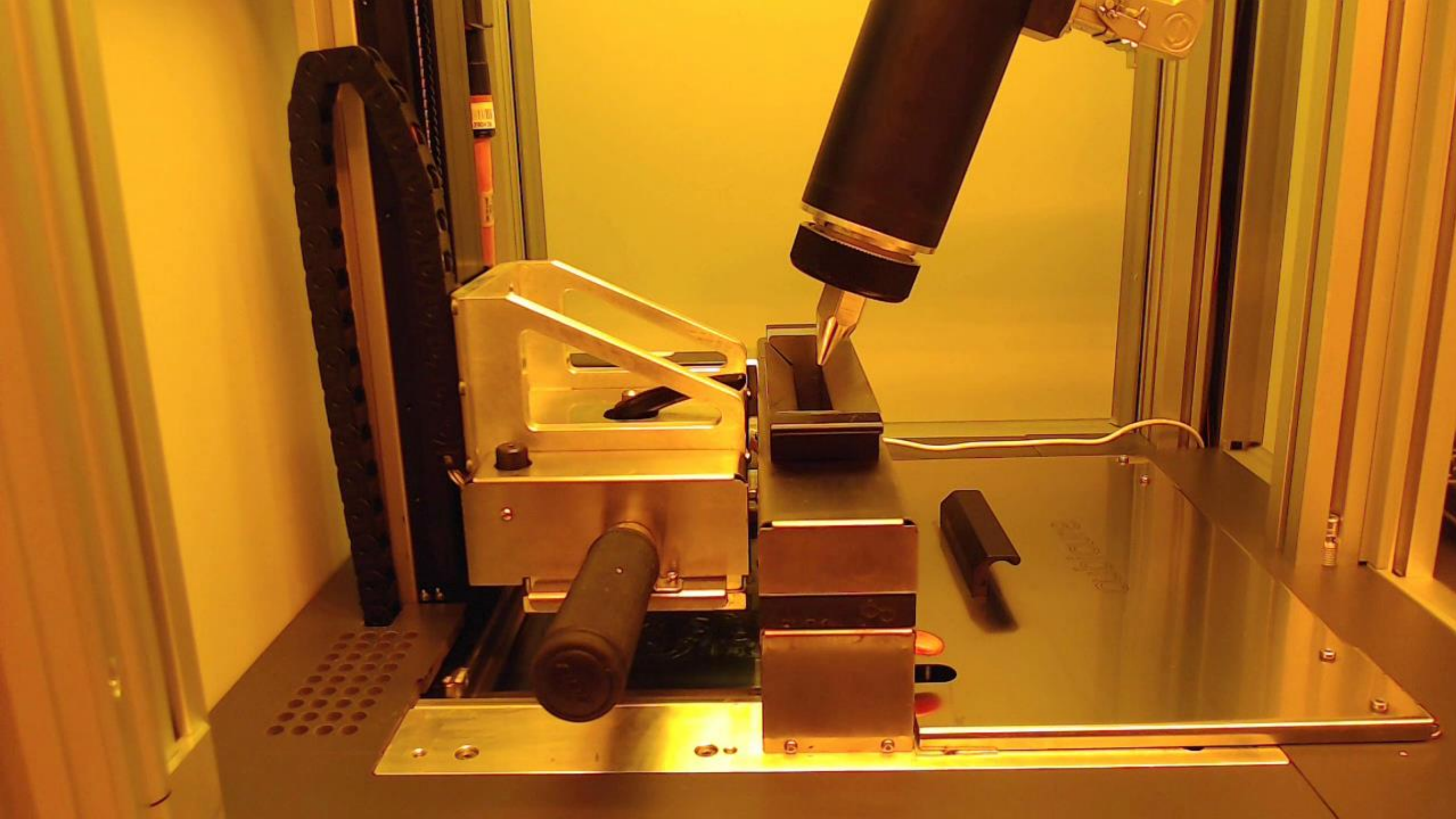
5 Building platform

6 Printed part



Hot Lithography





Hot Lithography

New, patented technology

process heating, highest precision

High viscous resins

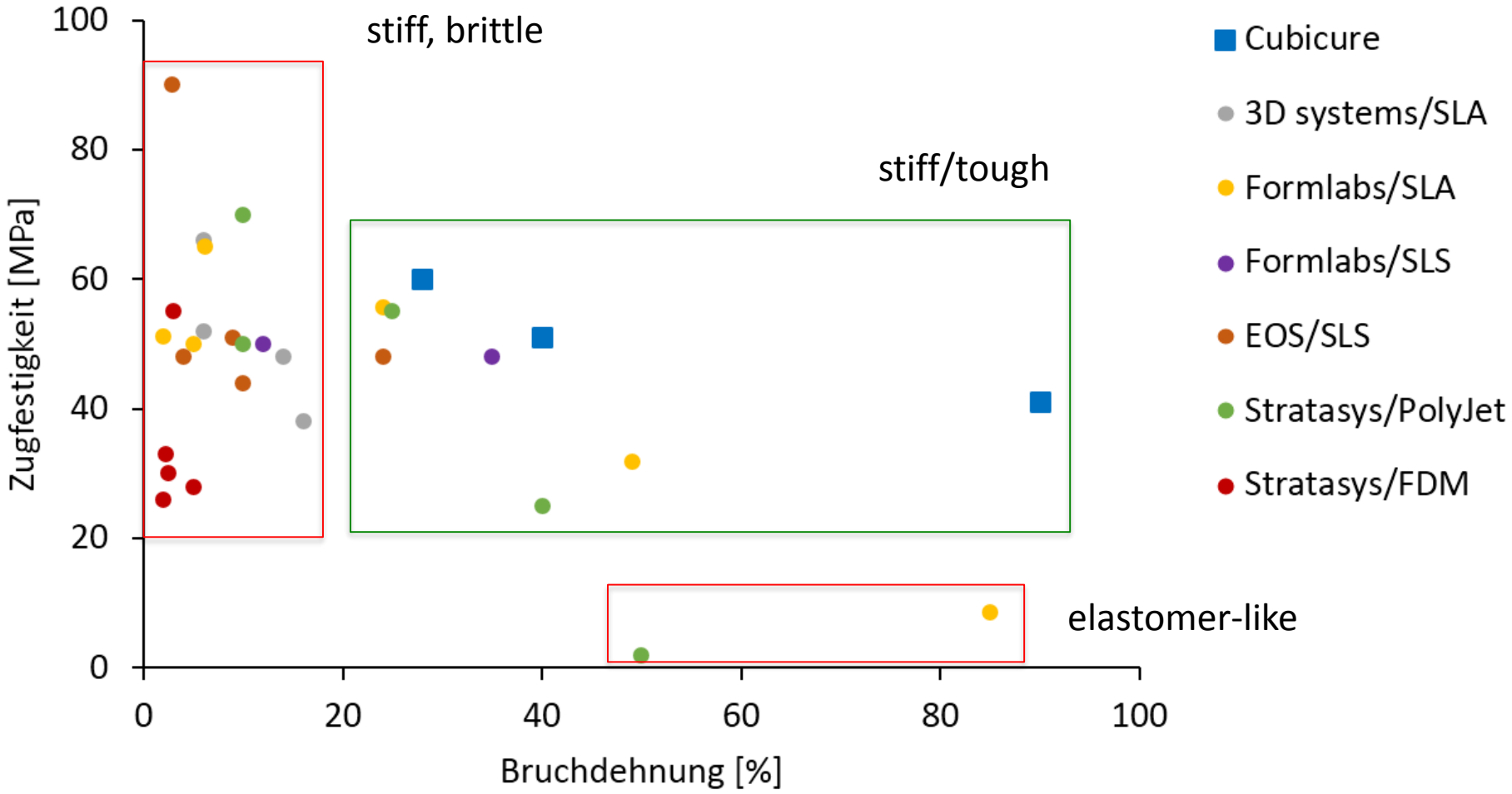
good thermo-mechanical properties

HL Manufacturing System

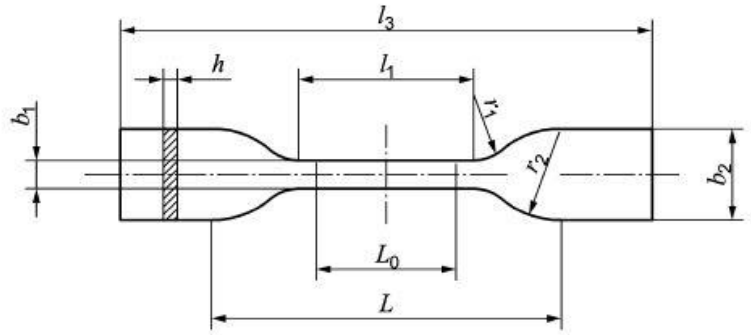
Caligma 200

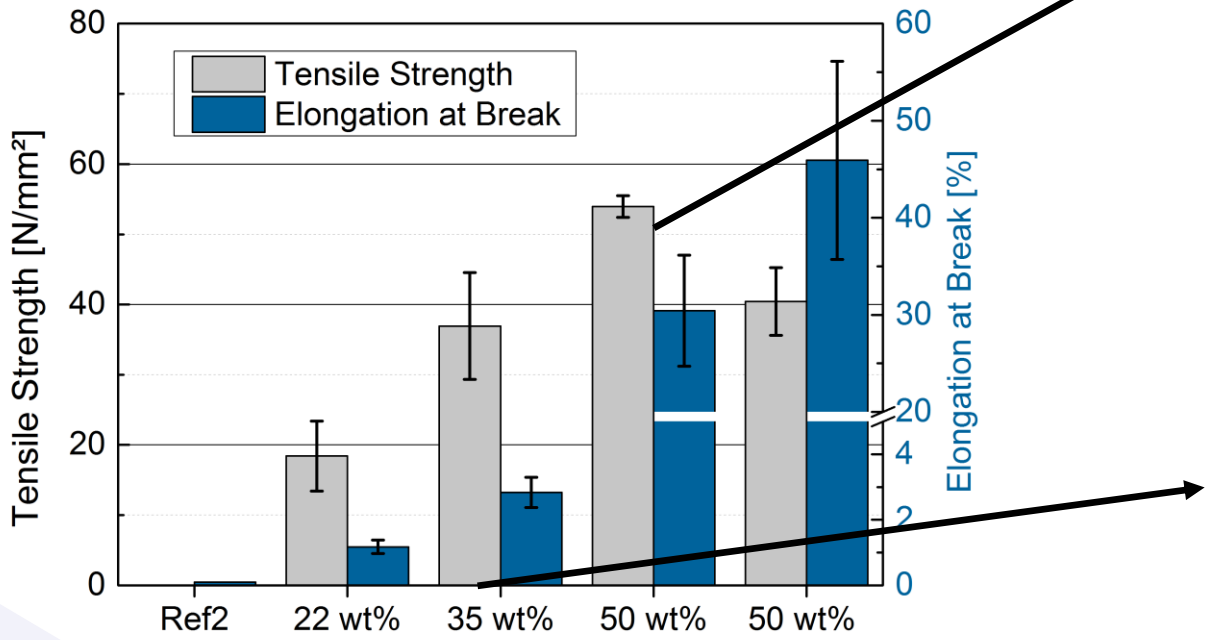
- Hot Lithography technology (up to 120°C)
- Cubicure photopolymers
- conventional photopolymers
- laser system (wavelengths of 375 or 405 nm)
- resolution: 10 to 100 µm
- building envelope: 200 x 100 x 300 mm³

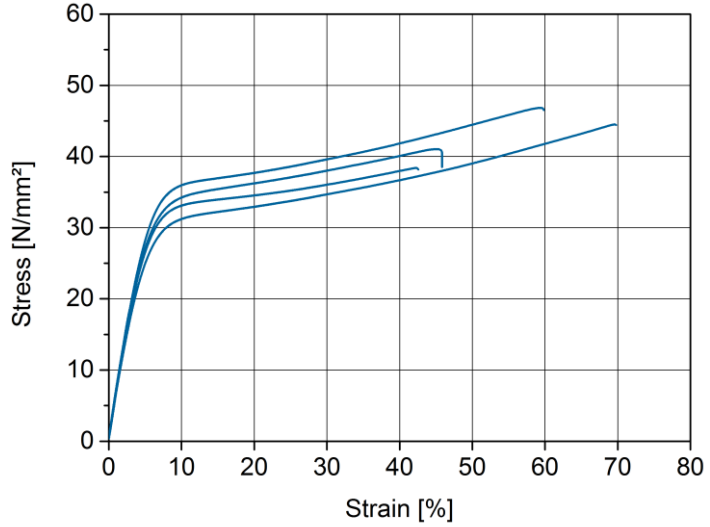
Material development

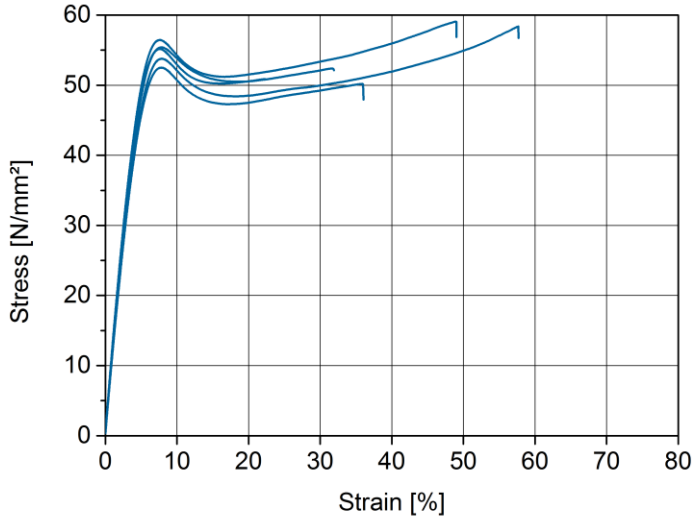


Material development





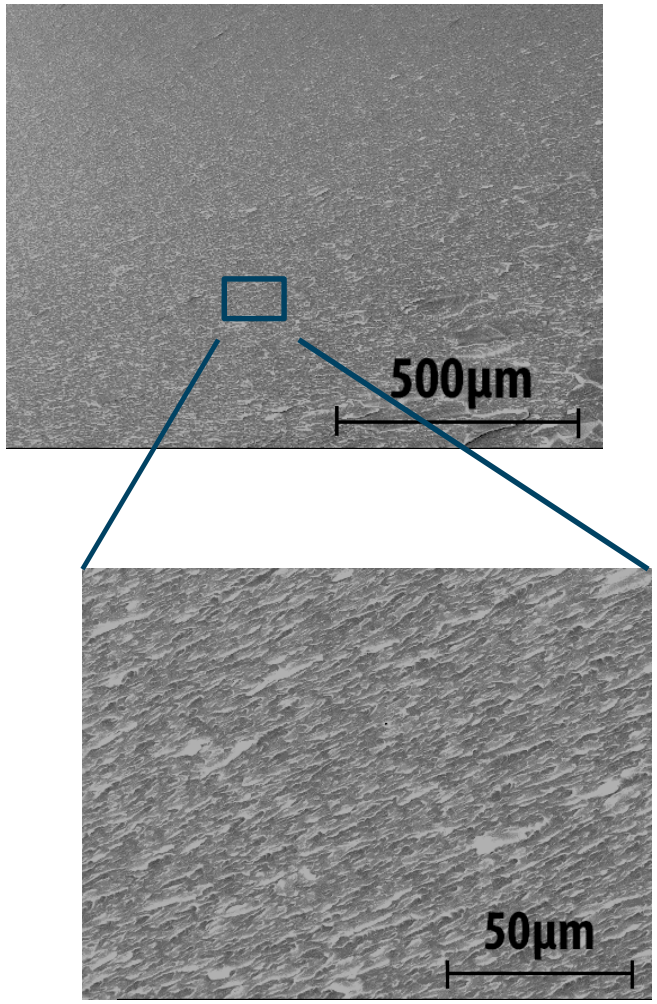




Material development

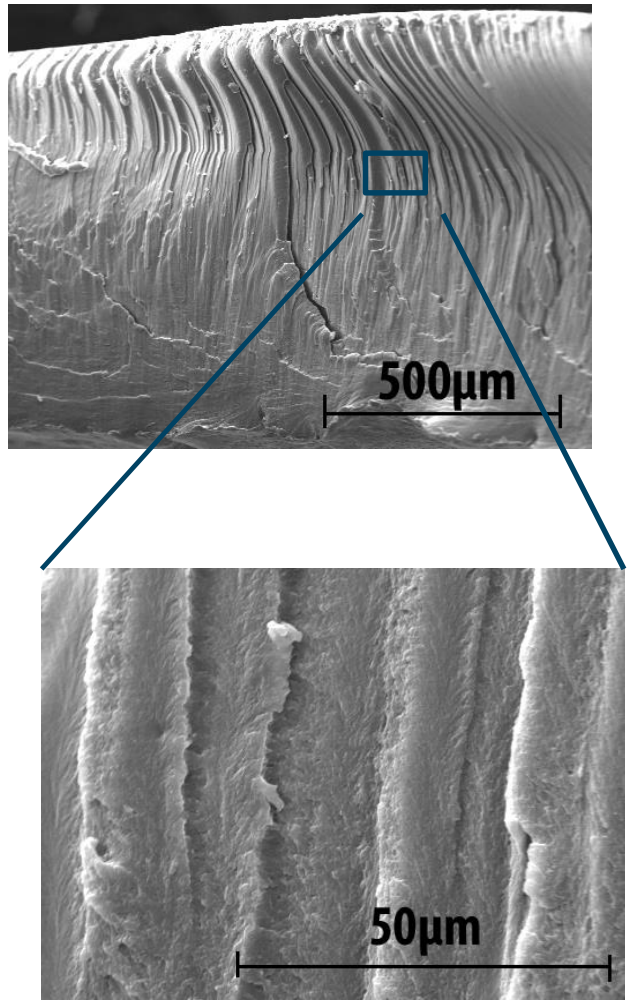
brittle fracture:

conventional photopolymers

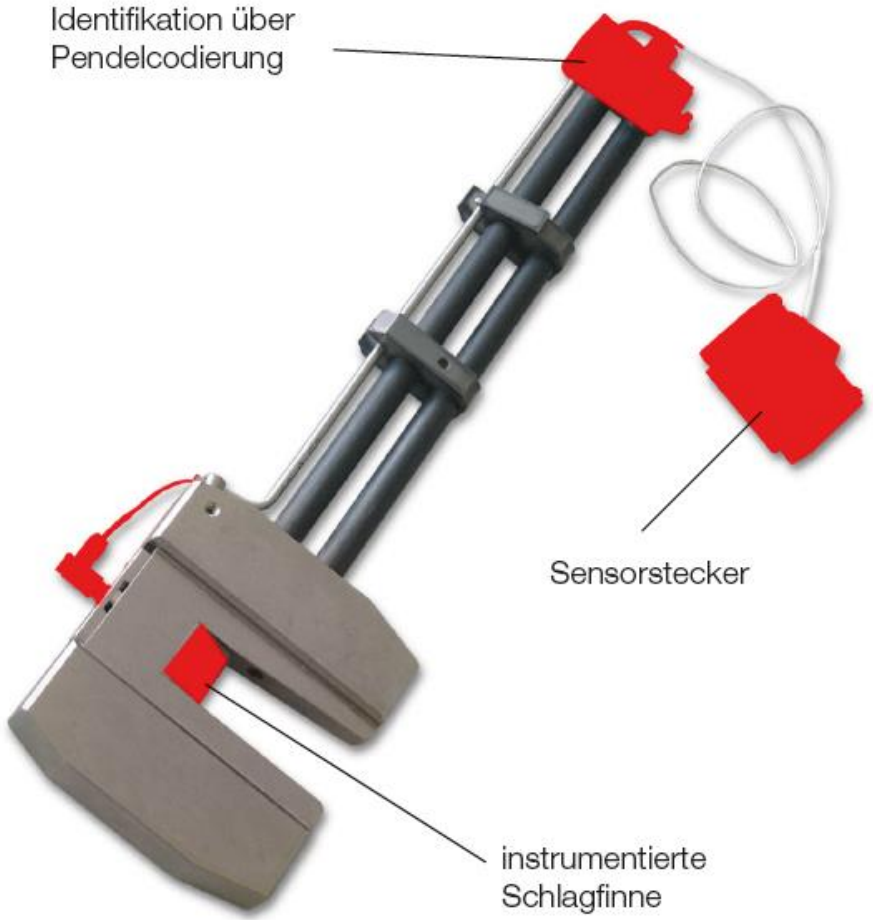


ductile fracture:

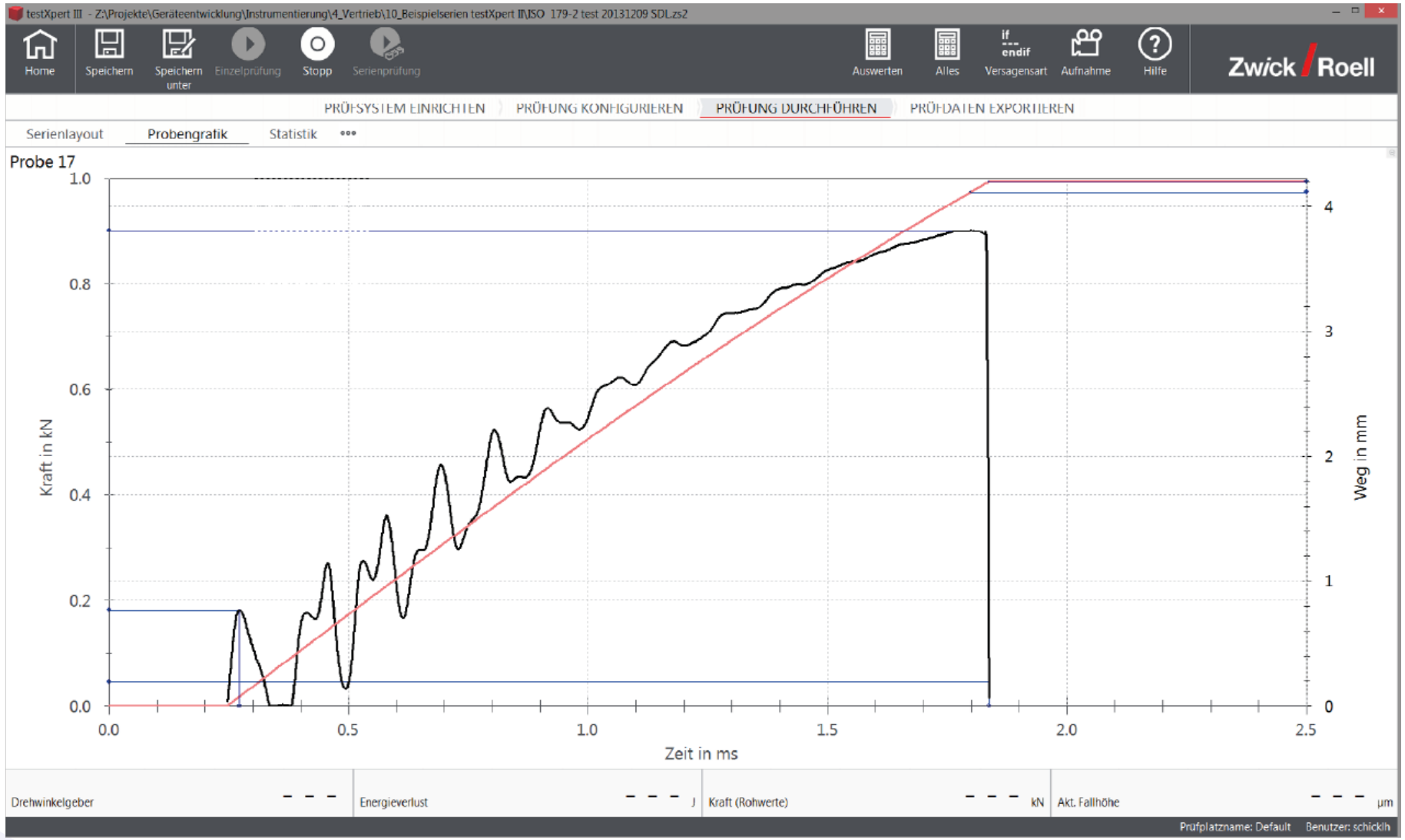
Cubicure materials



Material testing



Material testing



Engineering parameter

Material parameter	
Strength:	35-55 MPa
E-modulus:	1,5-4 GPa
Toughness (Charpy):	30-120 kJ/m²
Elongation at break:	20-100 %
Temperature resistance:	100°C

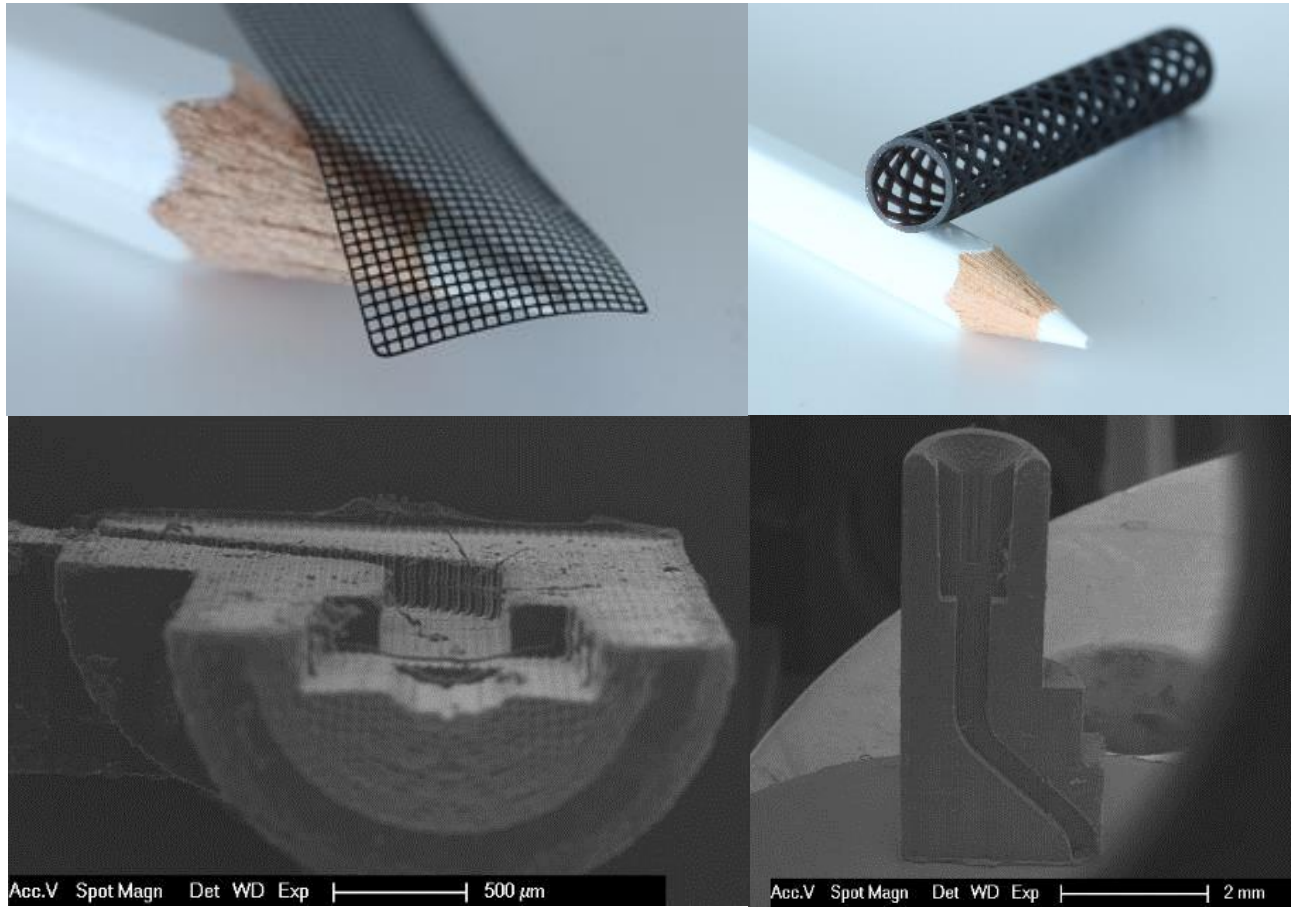
Process parameter	
Laser focus (x,y-res.):	10-100 µm
Layer thickness (z-res.):	10-100 µm
R_a value (average):	< 2 µm
R_z value (average):	< 12 µm

Material testing

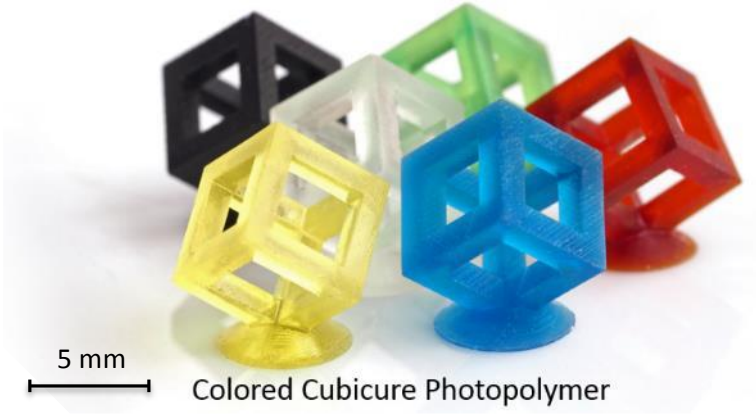
Classification according to ÖVE/ÖNORM EN 60695-11-10:
Flammability class HB 40
Specimen thickness: 1,34mm

Functional prototyping

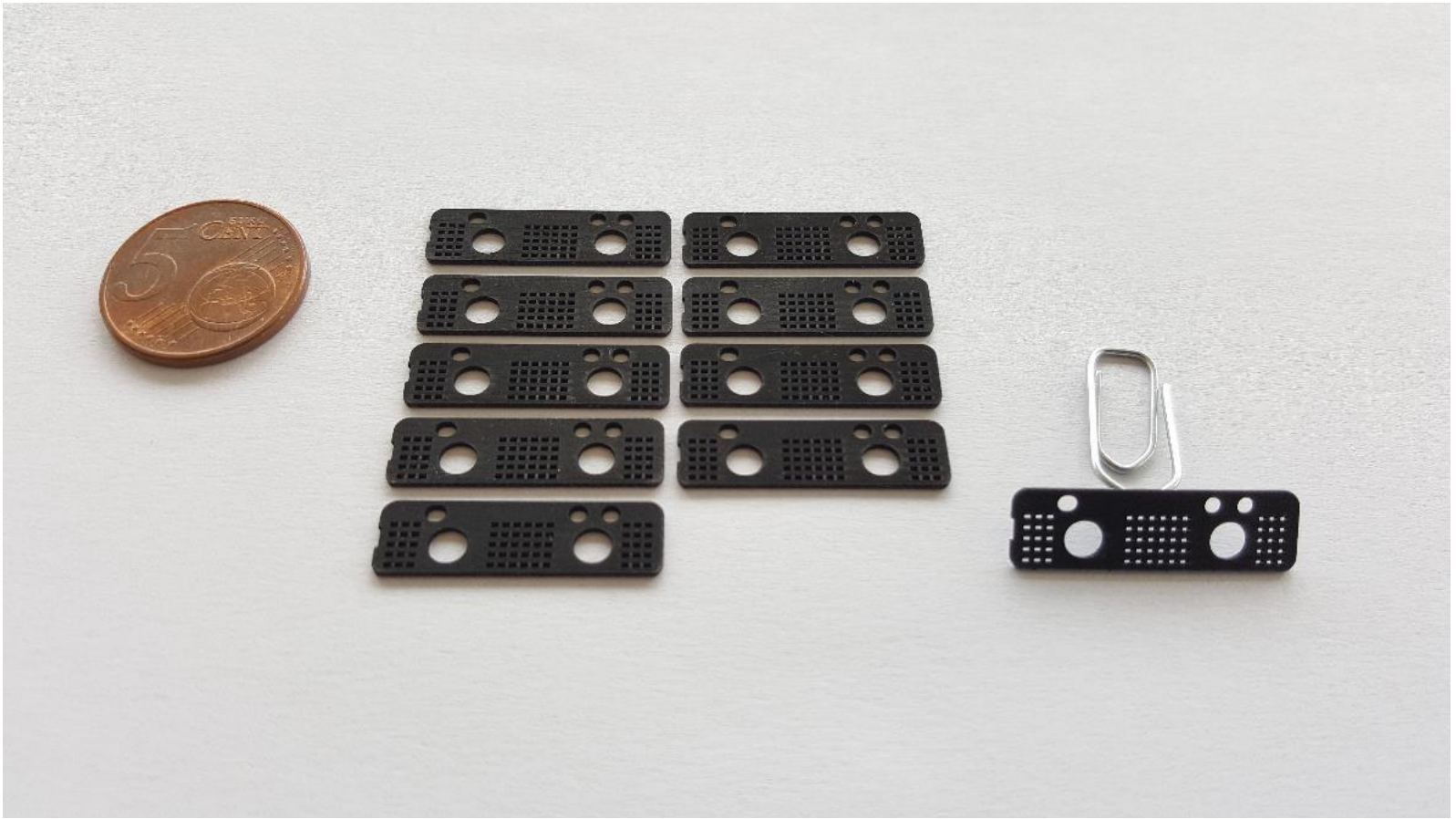
- Highest precision
- Fine structures, details
- Unlimited complexity
- Individualization



Functional prototyping

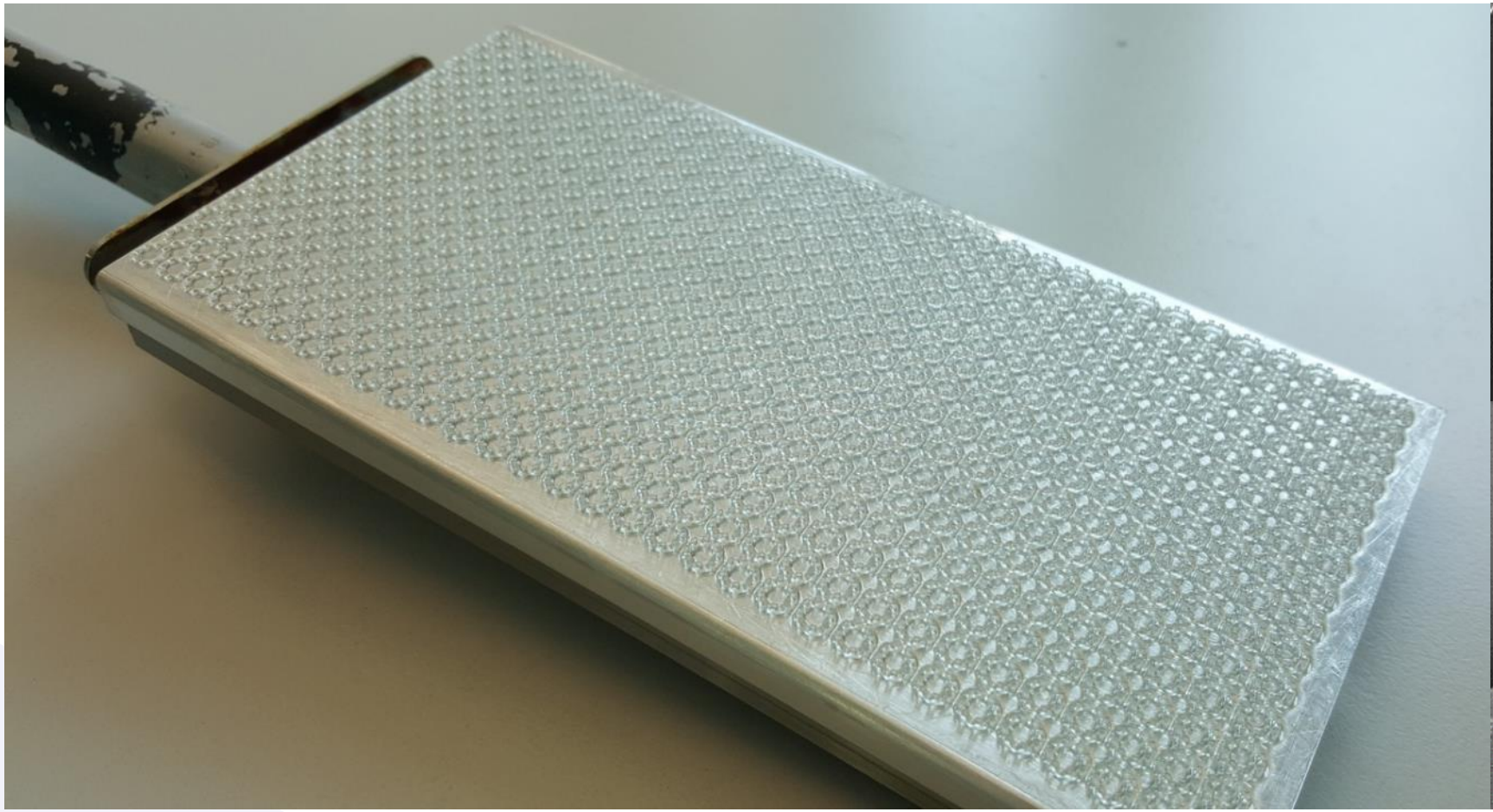


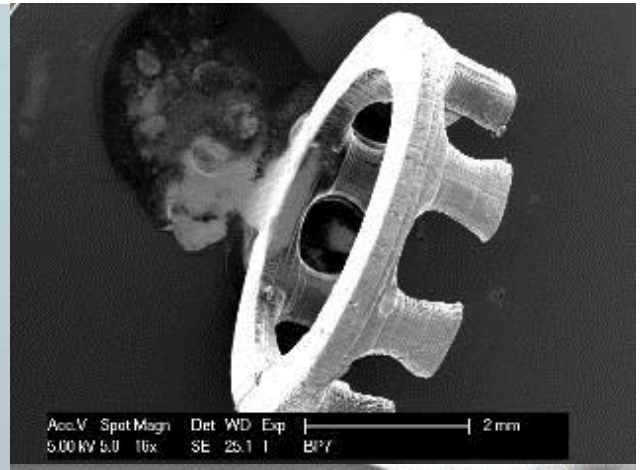
Functional prototyping & small series

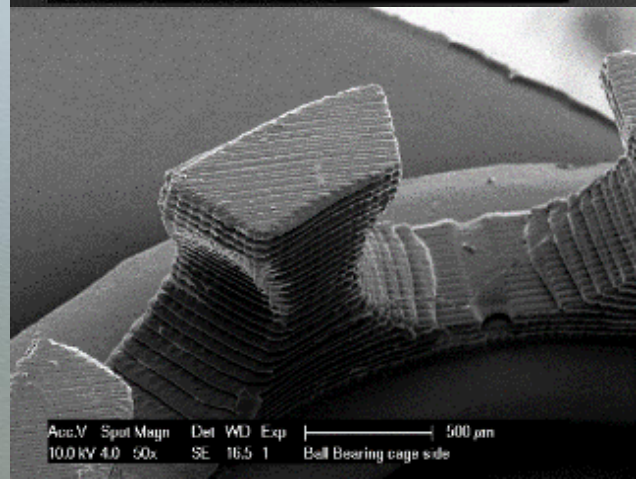


Series production

465 ball bearing cages in 2,5 h







Case study

Sample carrier

Requirements:

- 100 pcs.
- Geometry
  - Sample holding mechanism
  - Filling / Defilling
- Material
  - cleanable (smooth surfaces, dish washer at 60°C)
  - Crack resistant (drop height 1,5 m)
  - Reusable/durable

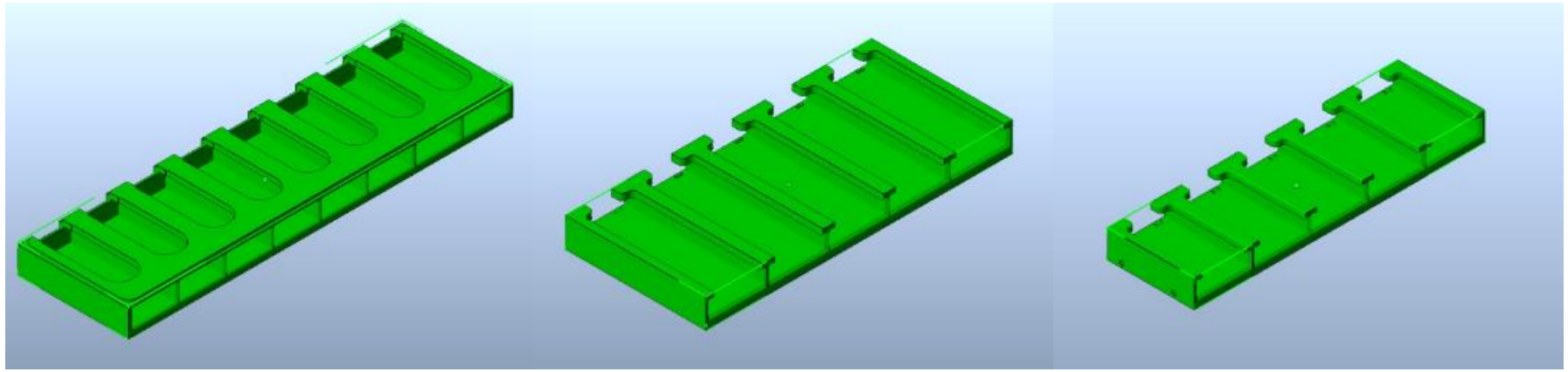
Case study

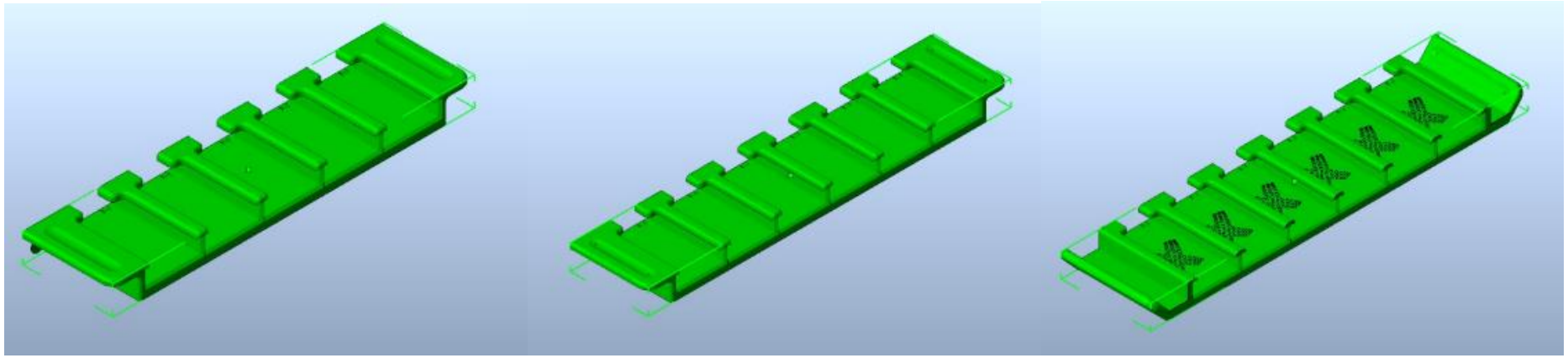
How to manufacture?

- Injection molding — 100 pieces?
- FDM — surface, precision?
- Multijet Modeling — 60 °C + tough?
- Stereolithographie — 60 °C + tough?
- Laser sinterning (SLS) — surface?
- Hot Lithography

Case study

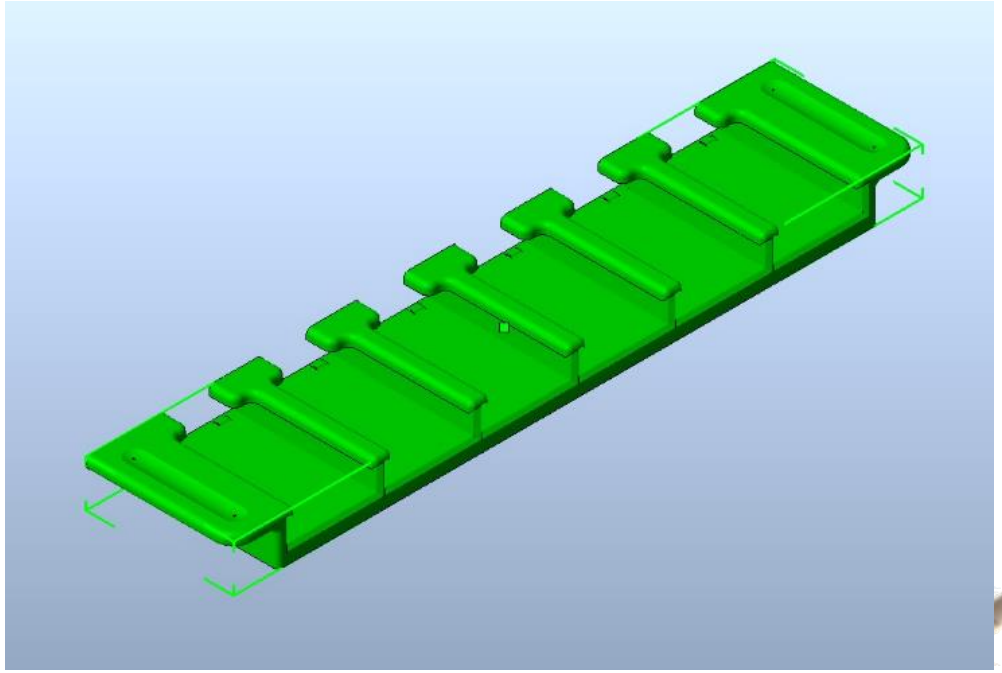
Design iterations

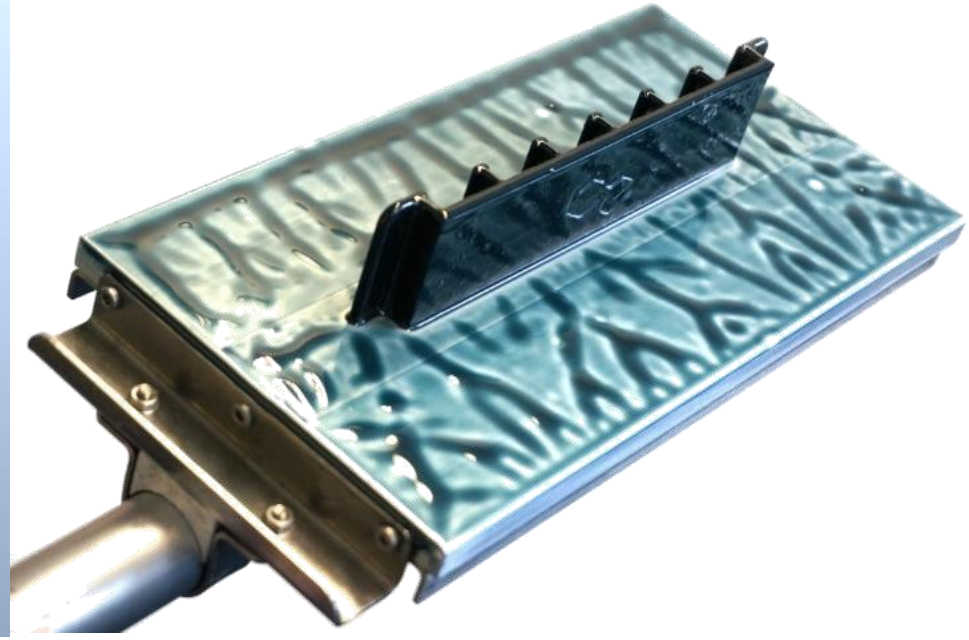




Case study

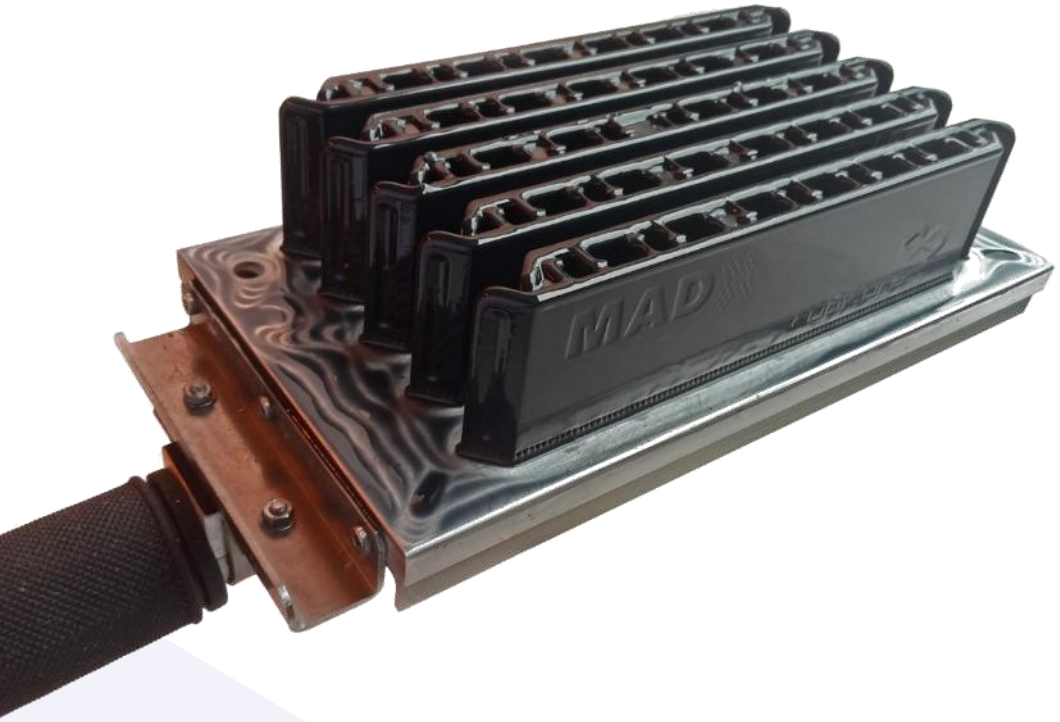
1 design = 1 functional prototype

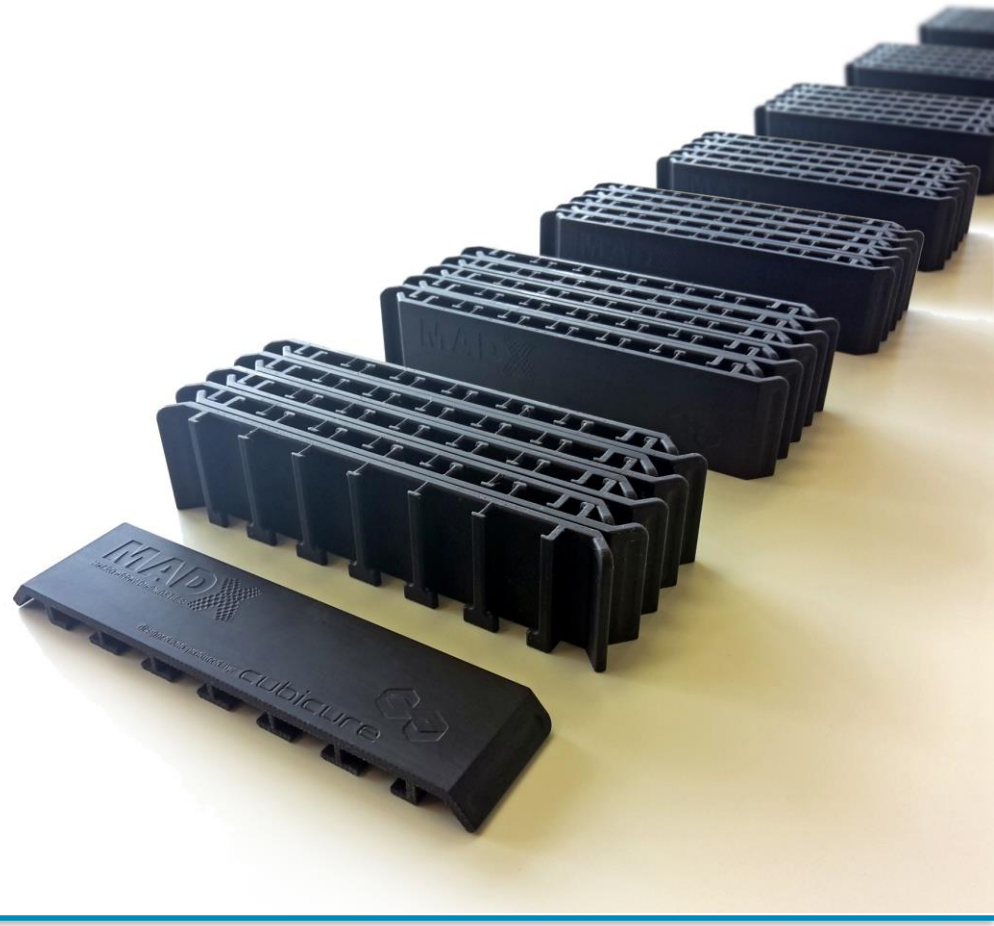




Case study

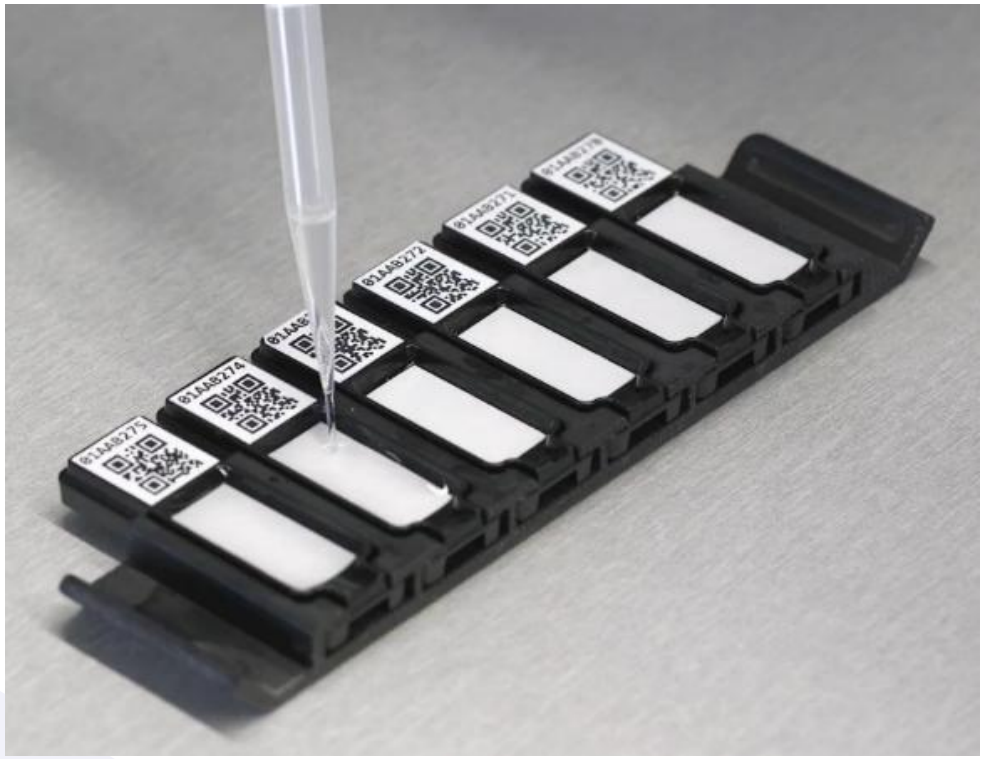
Scalability: prototyping = pre-series or series production





Case study

Final product made by Hot Lithography

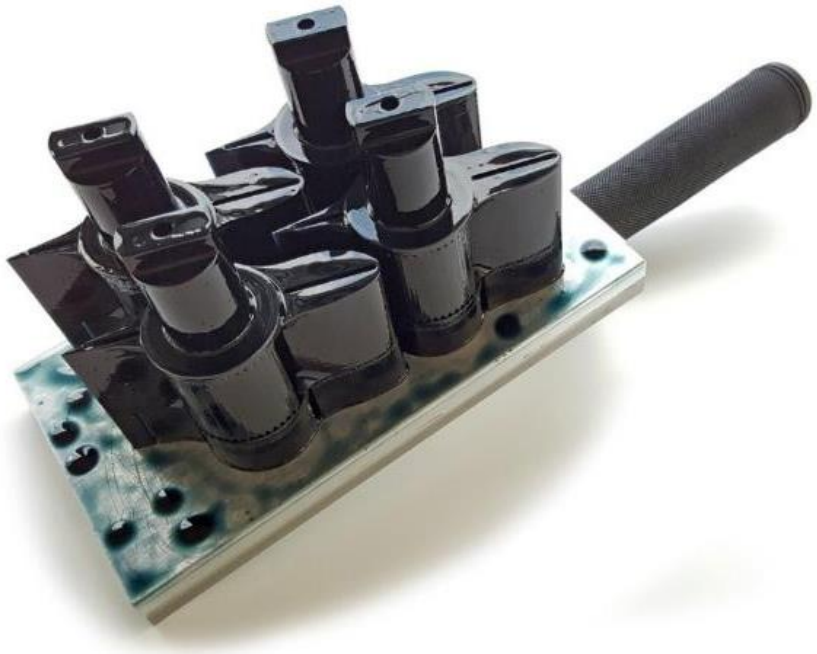


Case study 2

Spare part logistics: Acces key for car parking system

Case study 3

Turbine blades for prototype test stand



Awards

- Science to Business Award 2015 (S2B)
  Rudolf Sallinger Fonds
- Mercur Award of Vienna chamber of commerce; Start-Up Star 2016

Trade fairs

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Frankfurt am Main, 14.–17.11.2017

cubicure printing performance polymers

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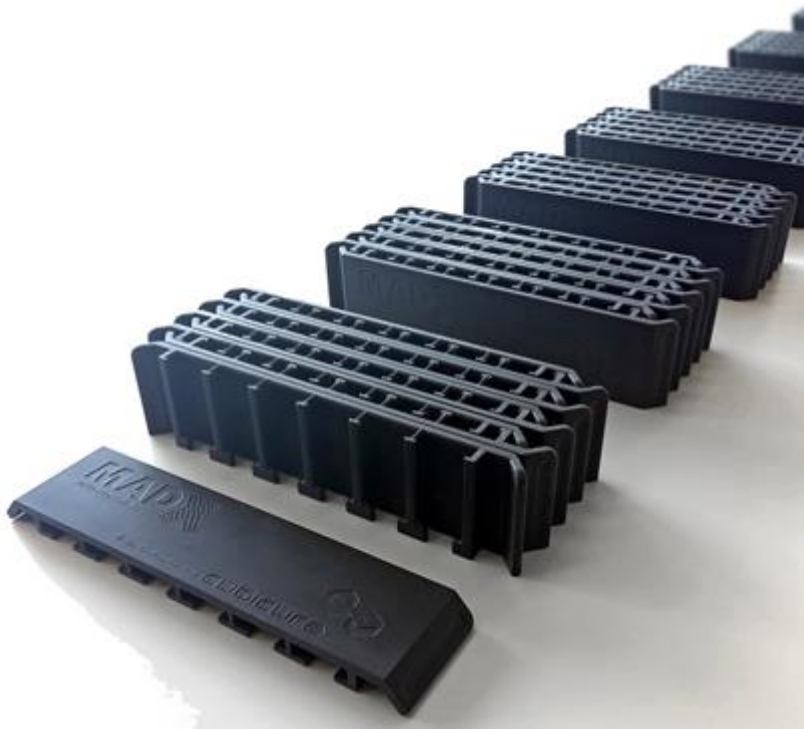
Cubicure GmbH

Gutheil-Schoder-Gasse 17

Tech Park Vienna

1230 Vienna | Austria