ACTIVITIES 2019 - 2025

Martin Malý, Ing., Ph.D.

Institute of Machine and Industrial Design
Faculty of Mechanical Engineering
Brno University of Technology

Brno 22. 3. 2025

ÚSTAV
KONSTRUOVÁNÍ

CONTENT

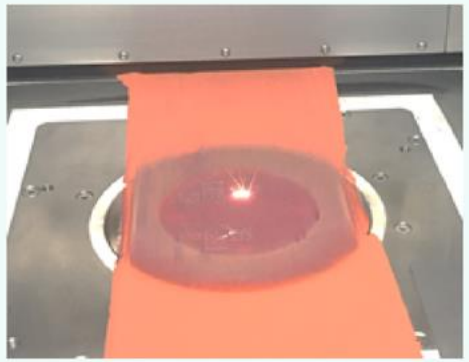
- Finished Projects
- Current projects
- Research activities
- Future research plan
- Teaching activities
- Future teaching plan
- Contractual research
- PR activities
- Summary
- Publications

Finished Projects

ESA ADDAC

Additive Design for Aerospace Applications Capabilities
2017 - 2020, team member

Processing of pure copper
Miniaturized heat-switch component

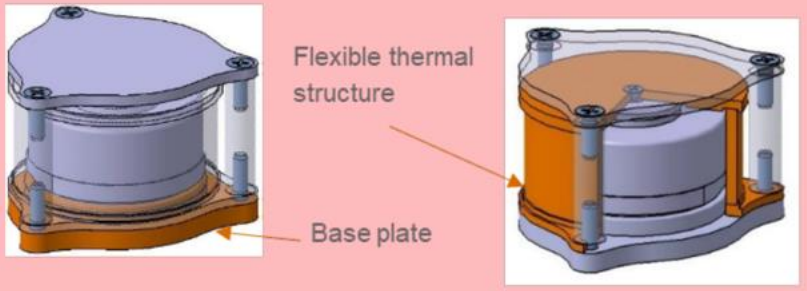


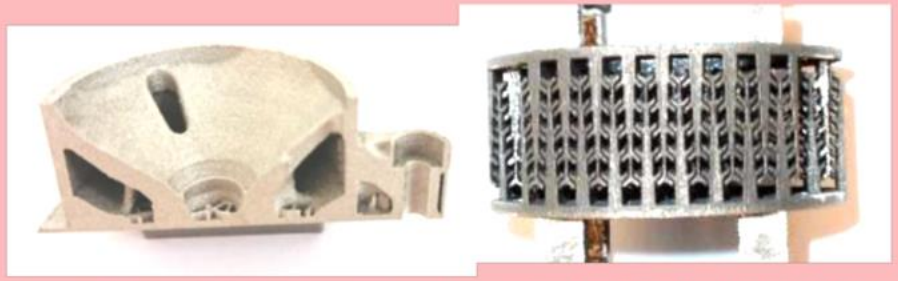
Main outcome

Pure copper processing with 99.9 % relative density
MALÝ, M. ... Effect of high-temperature preheating on pure copper thick-walled samples processed by laser powder bed fusion. JMP, 2022.

2x Gfunk
MAŠEK, ... MALÝ, M ... Additive manufacturing capabilities for heat switch technology: EUCASS 2022.

ESA Reliable SLM production from Ti6Al4V alloy according to latest ECSS standard, 2022 - 2023





Base plate and flexible thermal structure made of ALSI10Mg, Mašek 2022

Finished Projects

TAČR Zéta

AM of Turbine Engine Components from Heat-Resistant Alloy Inconel 939
2020 - 2022, project leader

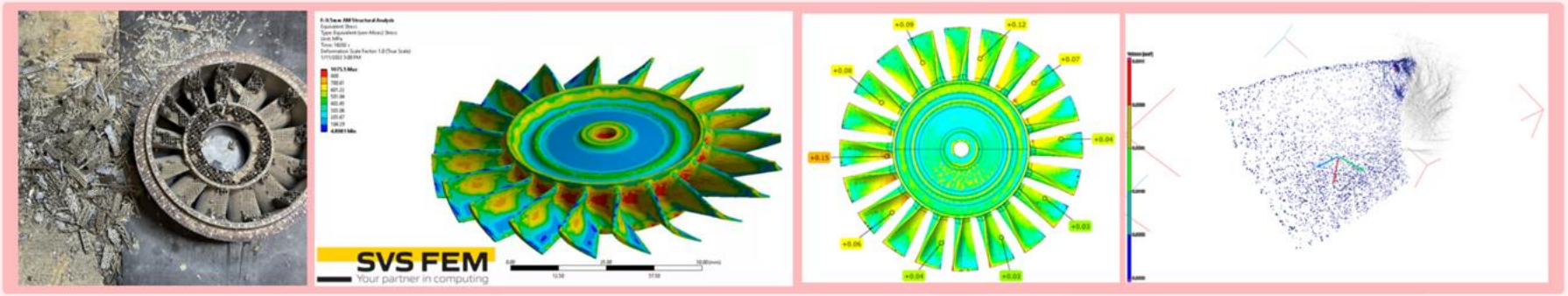
Reliable processing of IN939
TJ40 jet engine components

Main outcome

Reliable production process (AM, HT, finishing)
Material model for FEM and AM simulation
Design rules for AM

2x Gfunk, Vsouh
Stator with inner cooling channels
Rotor tested in real jet engine

MALÝ, M. ... Heat treatment of AM Inconel 939 - 2025, 70 %



Finished Projects

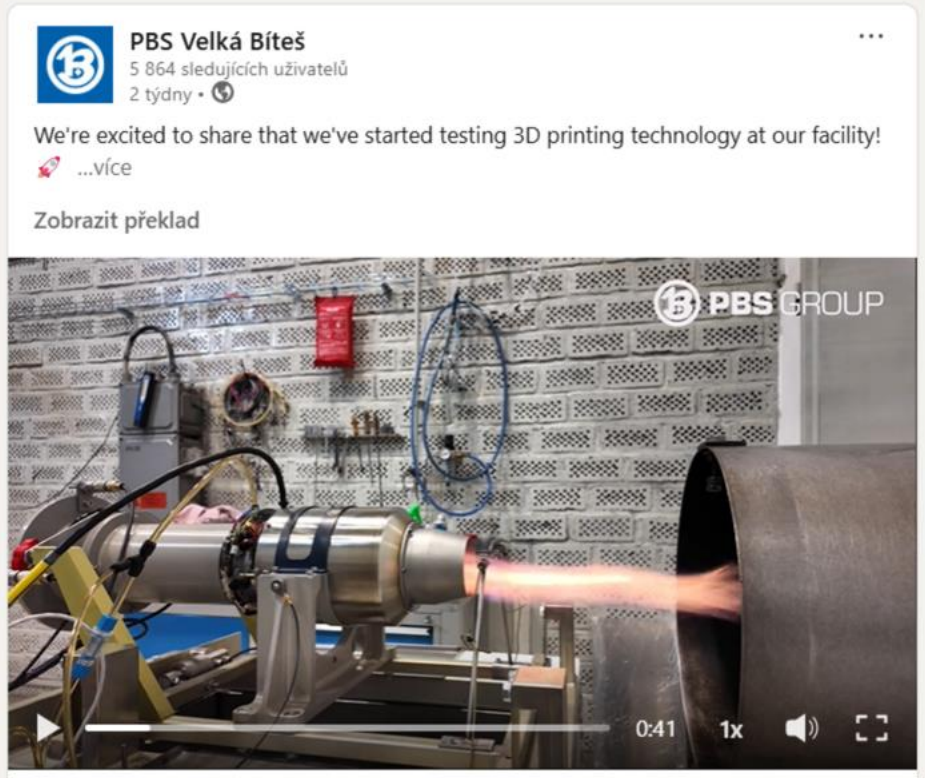
TAČR Zéta

AM of Turbine Engine Components from Heat-Resistant Alloy Inconel 939
2020 - 2022, project leader

Reliable processing of IN939
TJ40 jet engine components

Main outcome

Contractual research



Finished Projects

TAČR Trend STREAM

Surface treatment of very thin structures realized by 3D metal additive manufacturing
2021 - 2024, team member

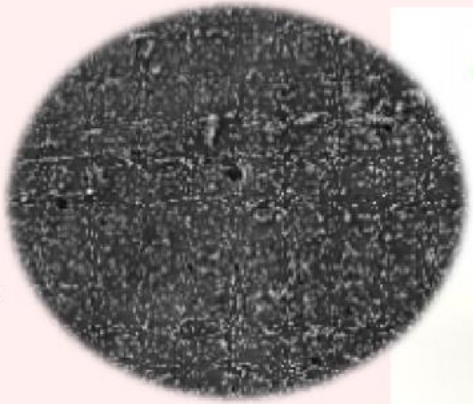
Surface improvement AlSi10Mg
Process parameters
Electrochemical polishing

Main outcome

PP for AlSi10Mg with low surface defects
Electrochemical process decreasing Ra by 50 - 70 %
Industrial scale, applicable into inner channels

2x Gfunk, OT

MALÝ, M. ... Surface improvement of AlSi10Mg thin structures produced using L-PBF - 2025, 40 %



Finished Projects

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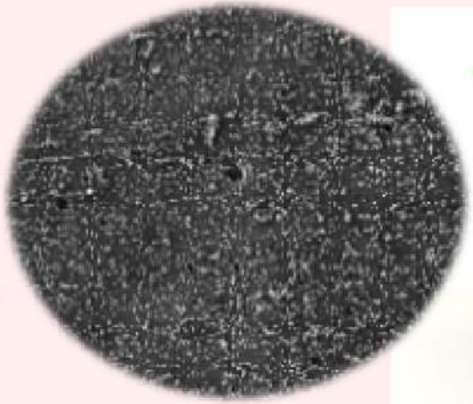


Current projects

NCKII Mestec

Cutting tool for the production of stator sheets for electric motors fabricated using L-PBF, 2023 - 2025, team member

Cutting tool production

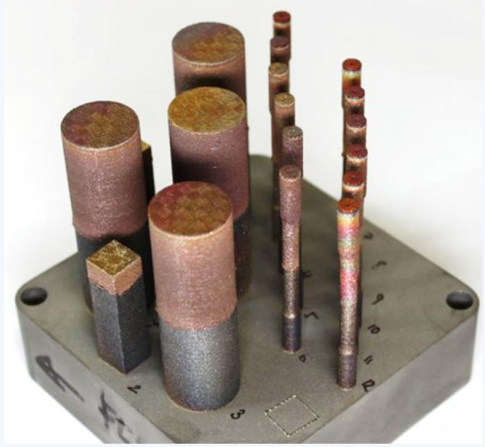
HT, > 60 HRC, high accuracy

GAČR - Multimaterial

Structurally controlled wave propagation in multi-material 3D printed bodies, team member, 2023 - 2026

L-PBF process setup

CuCr1Zr, Mar-60, sharp interface

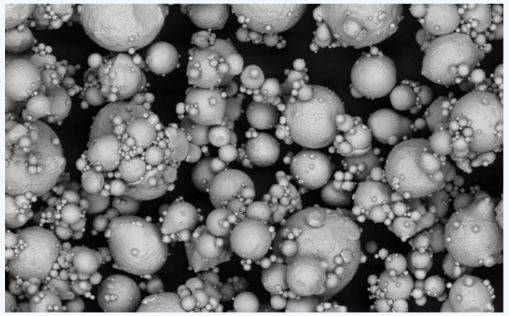


AV Lumina Quaeruntur

Transition metal borides nanodispersion strengthening as a new avenue for advanced AM superalloys for a sustainable society, team member 2025 - 2029

L-PBF process setup

IN939 + metal borides



keybrazing.com

DiSTT

Digital Skills Transformation Toolkit for a Resilient Labour Market, team member, 2024 - 2026

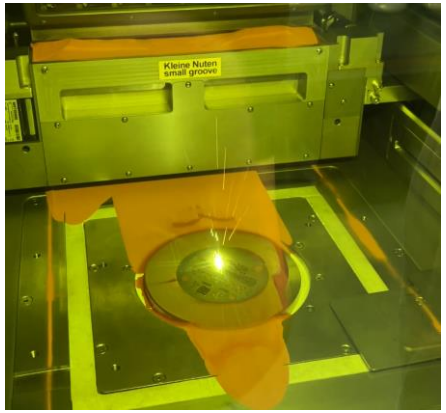
Metal powder AM skills for engineering applications

Research activities

Reduction of residual stress using preheating

Ti6Al4V, Inconel 939

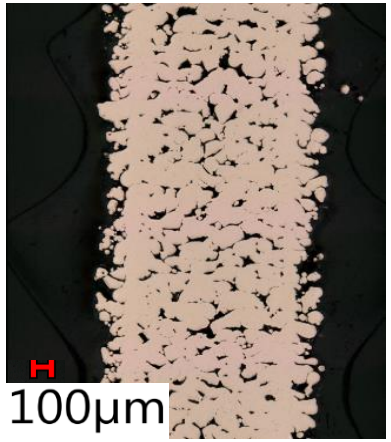
- Reduction of support structures

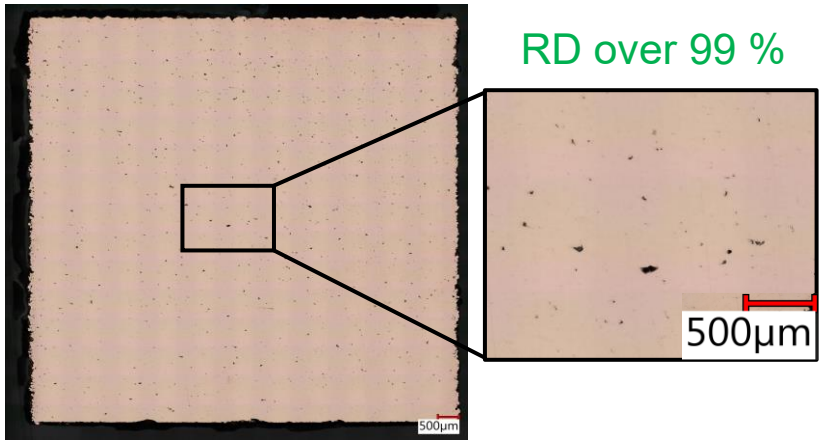


Increase of relative density of reflective material using preheating

Copper

RD 92.2%

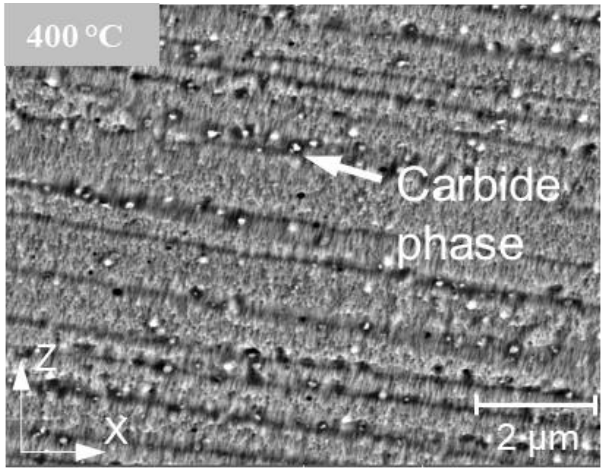




Research activities

Reduction of residual stress using preheating

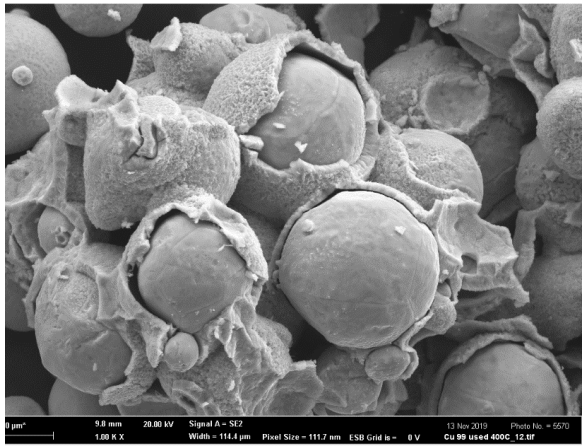
- Ti6Al4V – lower RS, powder oxidation
- Inconel 939 – higher RS, carbide phase

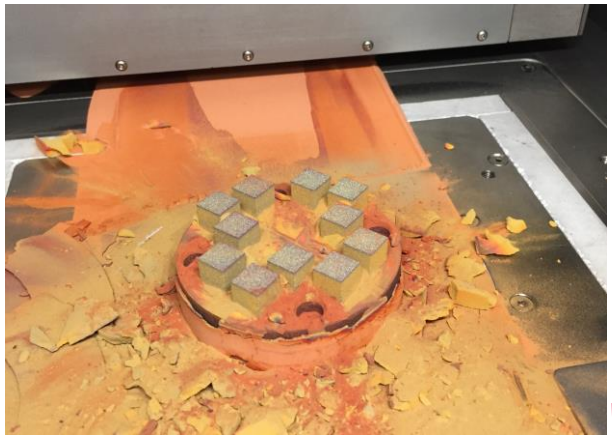


Increase of relative density of reflective material using preheating

Copper

- Powder oxidation





Research activities

Processing of metal materials using SLM technology at elevated temperatures

- 7. 3. 2023

„…research studies contained what some may consider to be “negative” results, but for sure add value to the overall field of research. I will for sure be introducing these papers to my students as examples of how to present such results….“ Michael Tucker

Future research plan

Advanced materials and technologies in metal AM

- Non – traditional materials for metal AM
  - Is there better way how AM process can be set? (Data science, ML, AI)
- Custom L-PBF system, EB-PBF, ECH3DP
  - data collection, better control, new material posibilities, µm scale

Future research plan

Advanced materials and technologies in metal AM

- TAČR Sigma 2024 – BeamShape LaserForge - Zařízení pro laserový 3D tisk kovových materiálů ve vakuu
  - Kurz Laser maintenace training HiLASE Centre Dolní Břežany
- TAČR Sigma 2024 – Software pro zvýšení produktivity kovového 3D tisku
  - Introduction to computer science CS50x Harvard
- 2025 – Znalostní transfer metod pro zpracování kovových materiálů technologií PBF
  - Dissertation topic

… Projekt je celkově dobře připravený … k podpoře **nedoporučuji** kvůli neprokázání motivačního účinku … má změnit trh…, by mělo být možné **financovat soukromými prostředky**.


CS50 Certificate

CS50 congratulates

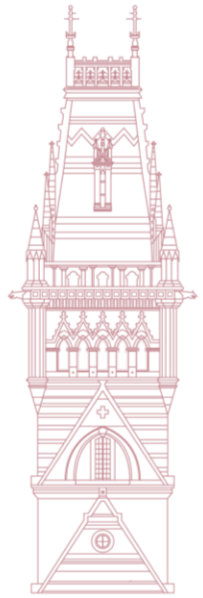
Martin Maly

on completion of CS50x, including ten problem sets and one final project.

Awarded from Cambridge, Massachusetts,
in the year two thousand twenty-four.

David J. Malan
Gordon McKay Professor of the Practice of Computer Science
Harvard University

https://cs50.harvard.edu/certificates/89261a25-131c-4c64-976d-f3eee5930998




LASER & SAFETY TRAINING CENTRE

CERTIFIKÁT

o úspěšném absolvování školení

Martin Malý

absolvoval ve dne 25. 9. 2024

LSTC | Údržba laseru
Certifikát vydalo Centrum HiLASE.

OBSAH ŠKOLENÍ
- měření výstupních parametrů laseru,
- čistění optických komponent laseru,
- nastavování laserového paprsku.

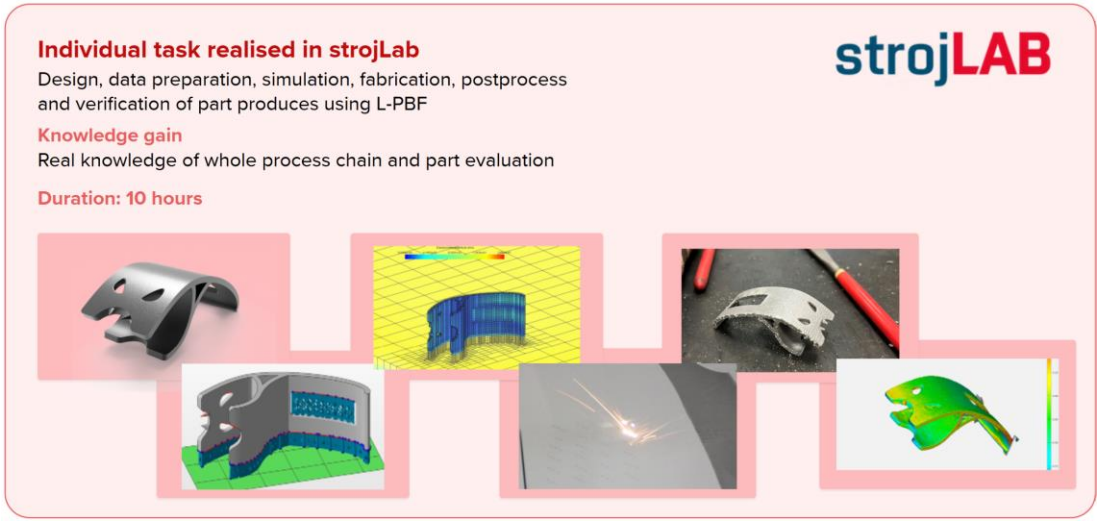
DÉLKA ŠKOLENÍ 1 den

Dolní Břežany, 25. 09. 2024

Martin Smrž
Vedoucí oddělení vývoje pokročilých laserů

Teaching activities

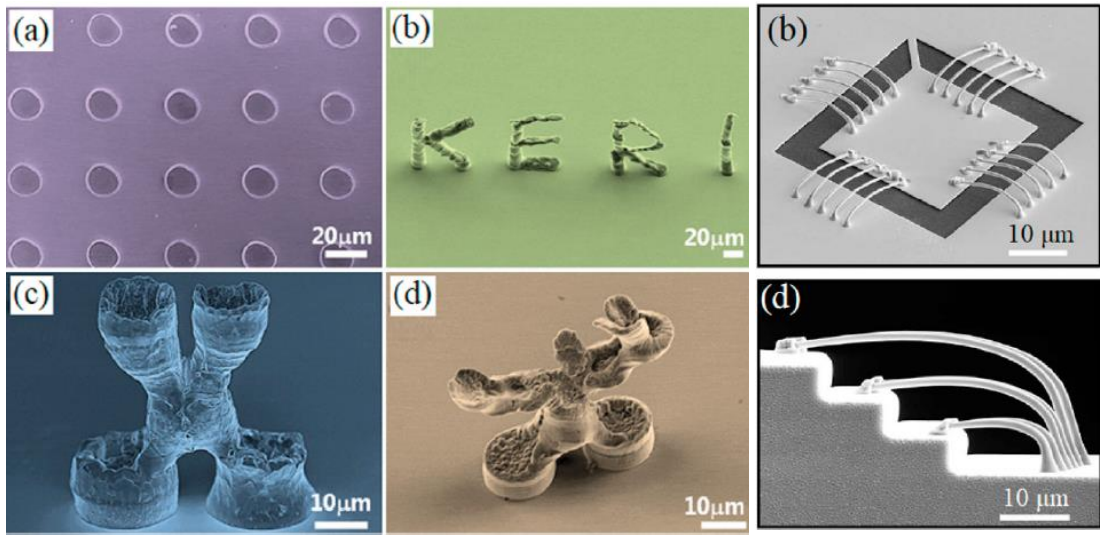
- ZAT – A
  - Innovation in methods for the design of experiment, 2019
  - Innovation in the application of design rules for 3D printing, 2020
  - English language 2023
  - L-PBF process simulation in Netfabb 2024
  - Integration to strojLab 2025
- Diploma thesis supervision
- Dissertation specialist supervisor
- 1K, 2K
- BP, SoČ



Future teaching plan

Metal 3D printing

- DDT2025 - Zpracování pokročilých materiálů technologií EBM
- ECH3DP
  - Soč/BP 2025 - Návrh zařízení pro elektrochemický 3D tisk
  - 3D tisk magnetických obvodů ??
- Kurzy kovového 3D tisku

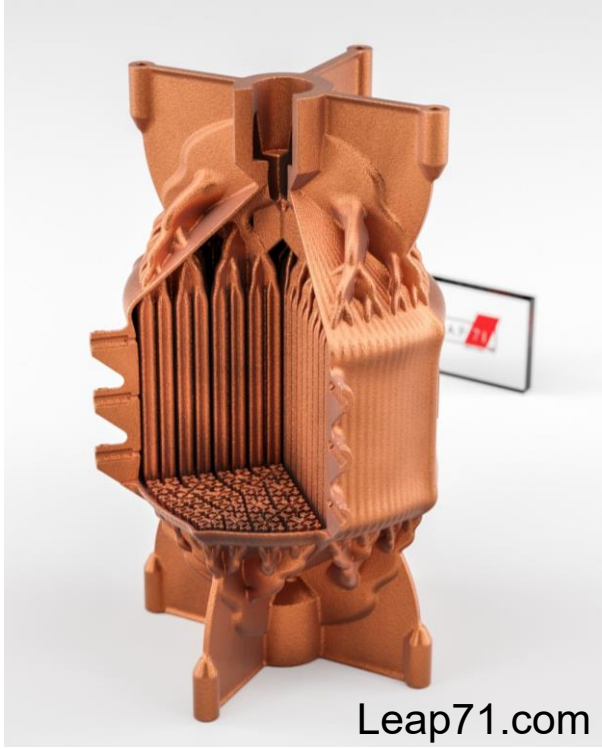


Xinchao Li 2022

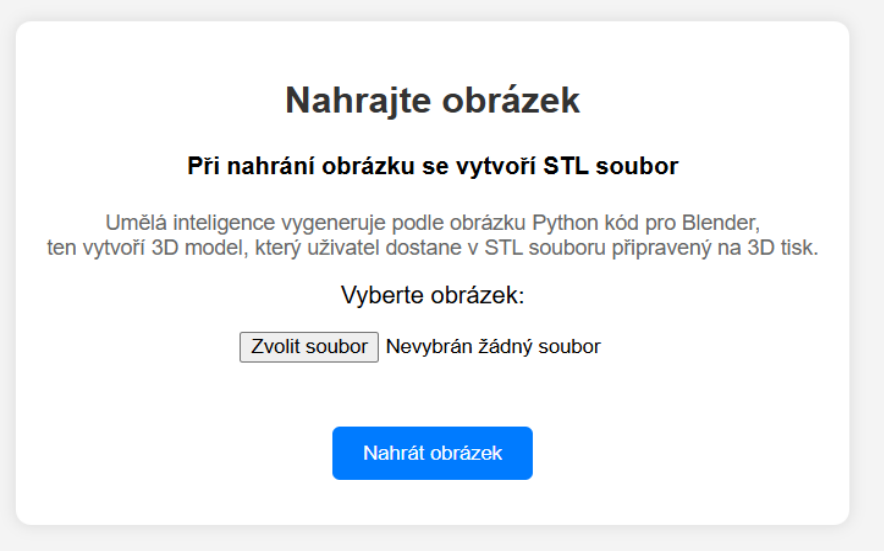
Future teaching plan

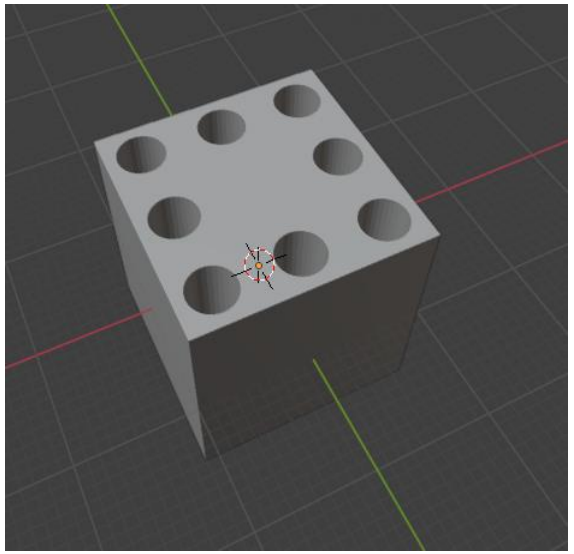
Design with additive manufacturing

- Computational engineering
  - PicoGK - Leap71
  - nTopology
- AI in AM
  - CS50's Introduction to Programming with Python – 20%
  - CS50's Introduction to Artificial Intelligence with Python – 10%


Leap71.com

SoČ 2024 - Využití AI v návrhovém procesu strojních součástí

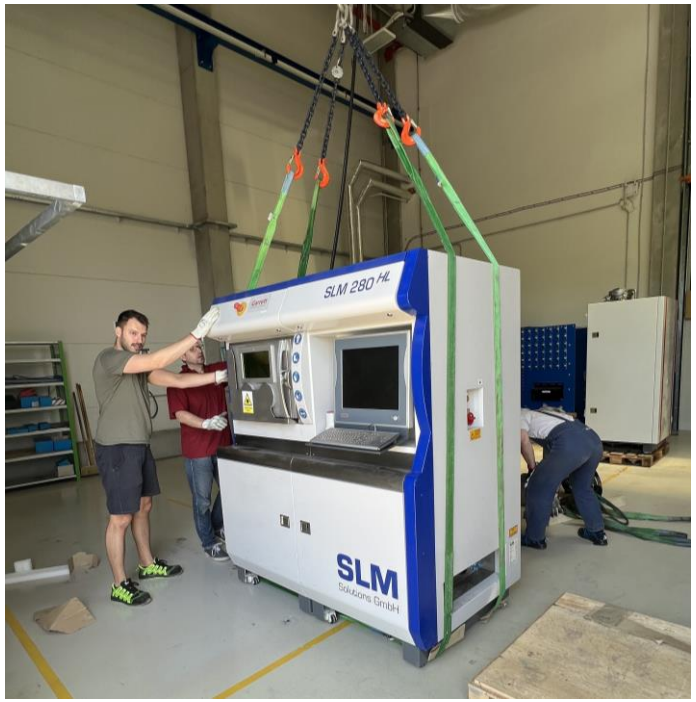




SoČ/BP 2025 - 3D algoritmické modelování strojních komponent

Contractual research

- Pricing
- SLM lab management
- Machine operator and technician



PR activities

- 120 years of VUT
- Czech European Researches´ Nights, DoD
- Střední škola
- Invent Arena, Třinec 2024
- MSV Brno 2024
- DiSTT kurzy
- Pneuracer

Summary

2019

- Second year Ph.D. student
- Department of Reverse Engineering and Additive Technologies
- Supervisor: doc. Ing. Daniel Koutný, Ph.D.
- **Processing of metal powders by selective laser melting technology at elevated temperatures**
- International mobility of researchers at the Brno University of Technology 31.10.2018
- 1. Article - Effect of Process Parameters and High-Temperature Preheating on Residual Stress and Relative Density of Ti6Al4V Processed by SLM
- IF: 0

Summary

2025

- Department of Reverse Engineering and Additive Technologies
- Institute of Physics of Materials of the Czech Academy of Sciences
- Researcher, IF: 3
- Material and process specialist for PBF
- Project manager, business assistant
- Supervisor and teacher

2025 plan

- Heat treatment of AM Inconel 939 – 70 %
- Surface preparation of AM AlSi10Mg for Elchem. process – 20 %
- Processing of 13Ni400 tool steel using L-PBF – 40 %
- Assistant professor
- Answer to 20-30 emails „splnit do.. „

Publications

WoS

- MALÝ, M.; NOPOVÁ, K.; KLAKURKOVÁ, L.; ADAM, O.; PANTĚLEJEV, L.; KOUTNÝ, D. Effect of Preheating on the Residual Stress and Material Properties of Inconel 939 Processed by Laser Powder Bed Fusion. Materials, 2022, roč. 15, č. 18, ISSN: 1996-1944.
- MALÝ, M.; KOUTNÝ, D.; PANTĚLEJEV, L.; PAMBAGUIAN, L.; PALOUŠEK, D. Effect of high-temperature preheating on pure copper thick-walled samples processed by laser powder bed fusion. Journal of Manufacturing Processes, 2022, č. 73, s. 924-938. ISSN: 1526-6125.
- MALÝ, M.; HÖLLER, C.; SKALON, M.; MEIER, B.; KOUTNÝ, D.; PICHLER, R.; SOMMITSCH, C.; PALOUŠEK, D. Effect of Process Parameters and High-Temperature Preheating on Residual Stress and Relative Density of Ti6Al4V Processed by Selective Laser Melting. Materials, 2019, roč. 12, č. 6, s. 1-13. ISSN: 1996-1944.

Other

- MALÝ, M.; KOUTNÝ, D.; MICHÁLEK, M. Processing of metallic materials by Laser Powder Bed Fusion at elevated temperatures. Metal Additive Manufacturing Conference 2023. October 17 - 19, 2023. WKO, Vienna: Metal Additive Manufacturing Conference 2023, 2023. s. 129-139.
- MAŠEK, J.; LÖFFELMANN, F.; POPELA, R.; KUBÍK, P.; ŠEBEK, F.; KOUTNÝ, D.; MALÝ, M.; PANTĚLEJEV, L.; PAMBAGUIAN, L. Additive manufacturing capabilities for heat switch technology: Key challenges & knowledge gaps. Lille, Francie: EUCASS association, 2022. s. 1-15..
- HERNANDEZ TAPIA, L.; CARRANZA-TREJO, A.; KASHIMBETOVA, A.; TKACHENKO, S.; KOLEDOVÁ, Z.; KOUTNÝ, D.; MALÝ, M.; ČELKO, L.; MONTUFAR JIMENEZ, E. Microstructure of Selective Laser Melted Titanium Lattices and In Vitro Cell Behaviour. In Proceedings 30th Anniversary International Conference on Metallurgy and Materials. Tanger, 2021. s. 1179-1185. ISBN: 978-80-87294-99-4.

THANK YOU FOR YOUR ATTENTION

Martin Malý, Ing. Ph.D.

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www.**ustavkonstruovani**.cz