

Od laserového navařování k aditivní výrobě LMD

Stanislav Němeček





RAPTECH





5-osé obrábění



Soustružení
Frézování

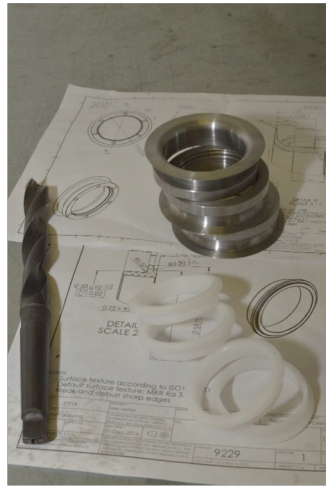
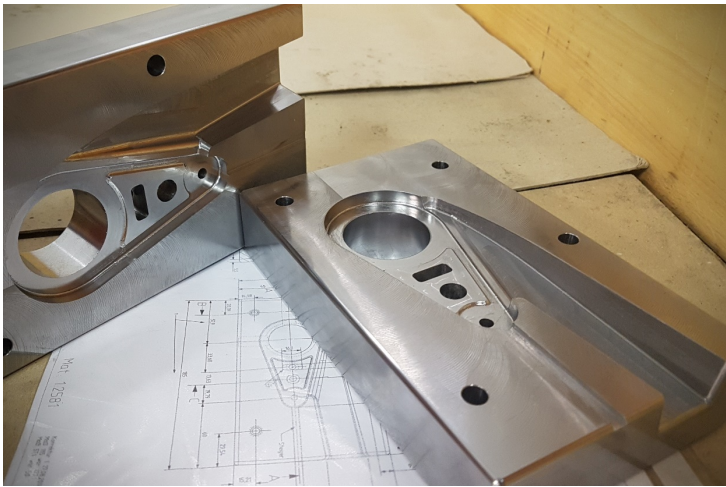
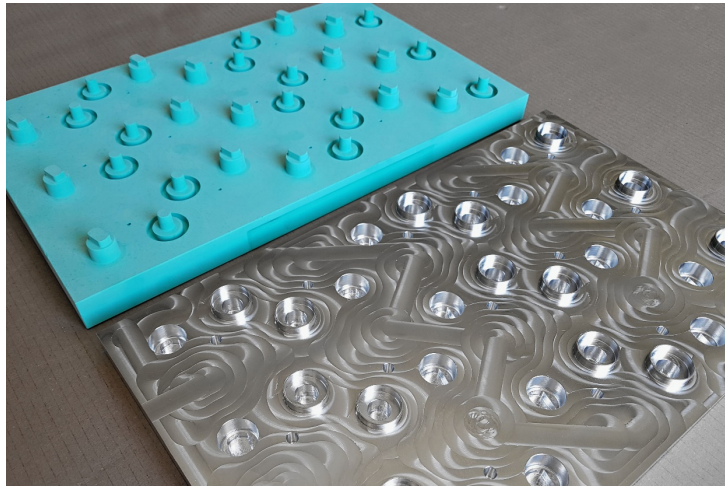


Nástrojárna

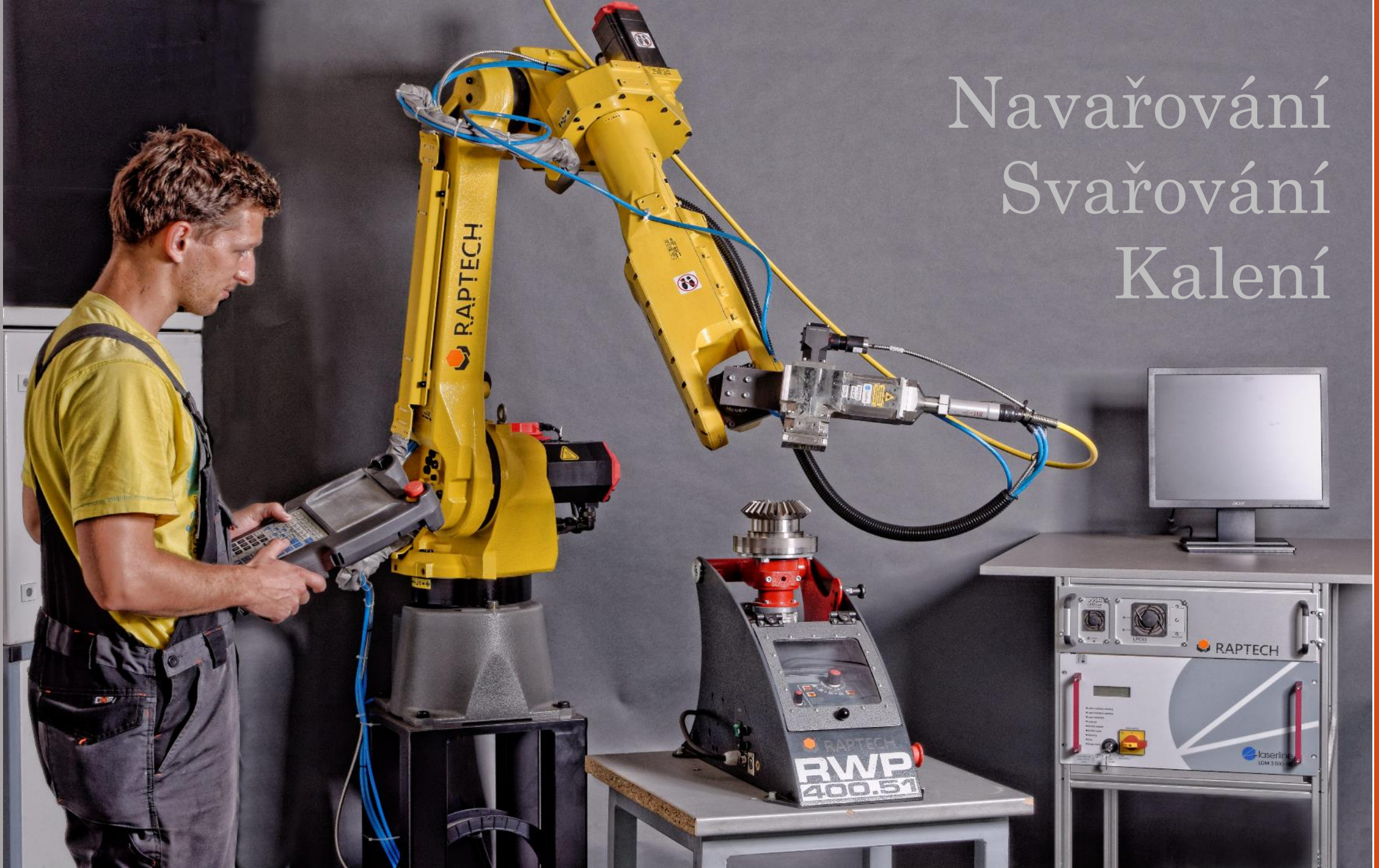
Precision machining

Rapid prototyping
nástroje, zápustky, přípravky...

Příklady

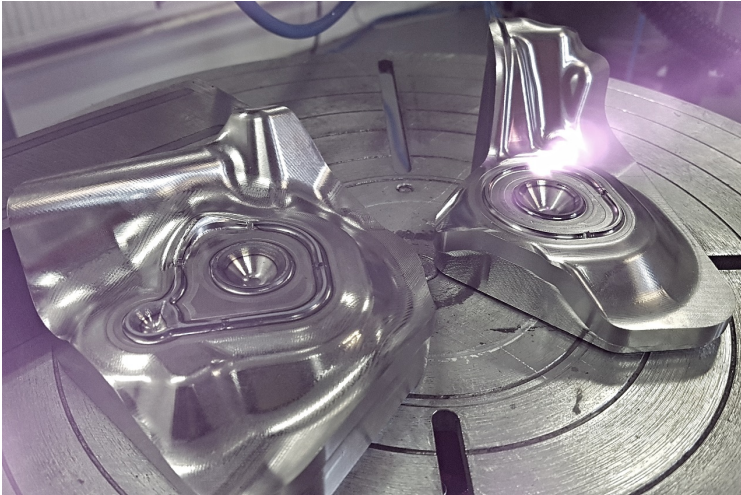


Navarování Svařování Kalení



Laserové

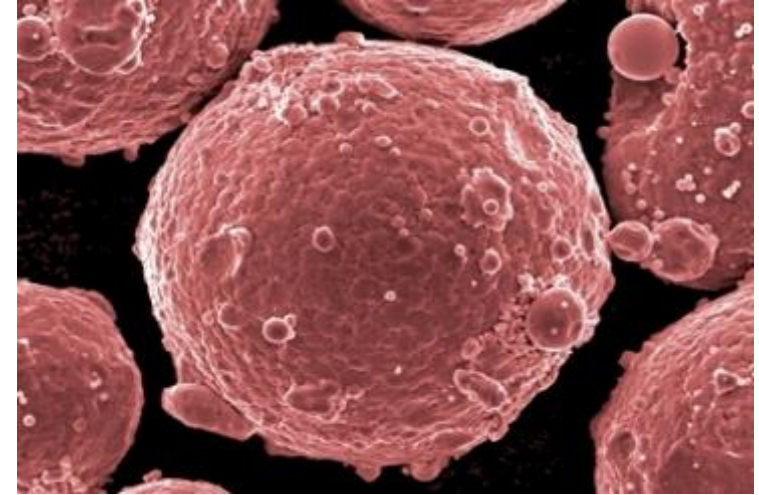
Kalení



Svařování



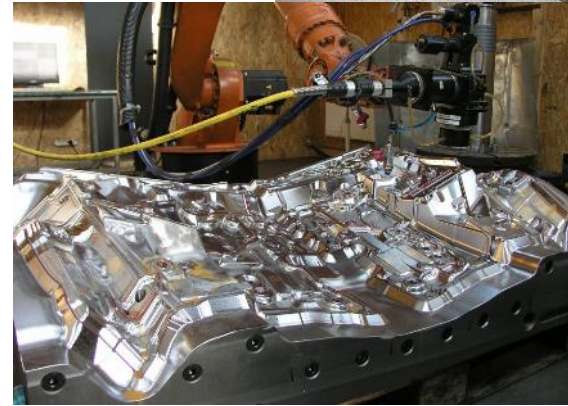
Navařování



Laser material processing

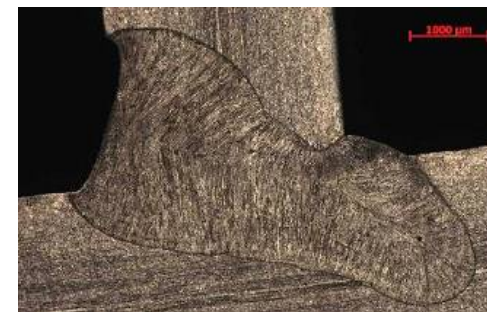
Our core bussines...

Laserové kalení

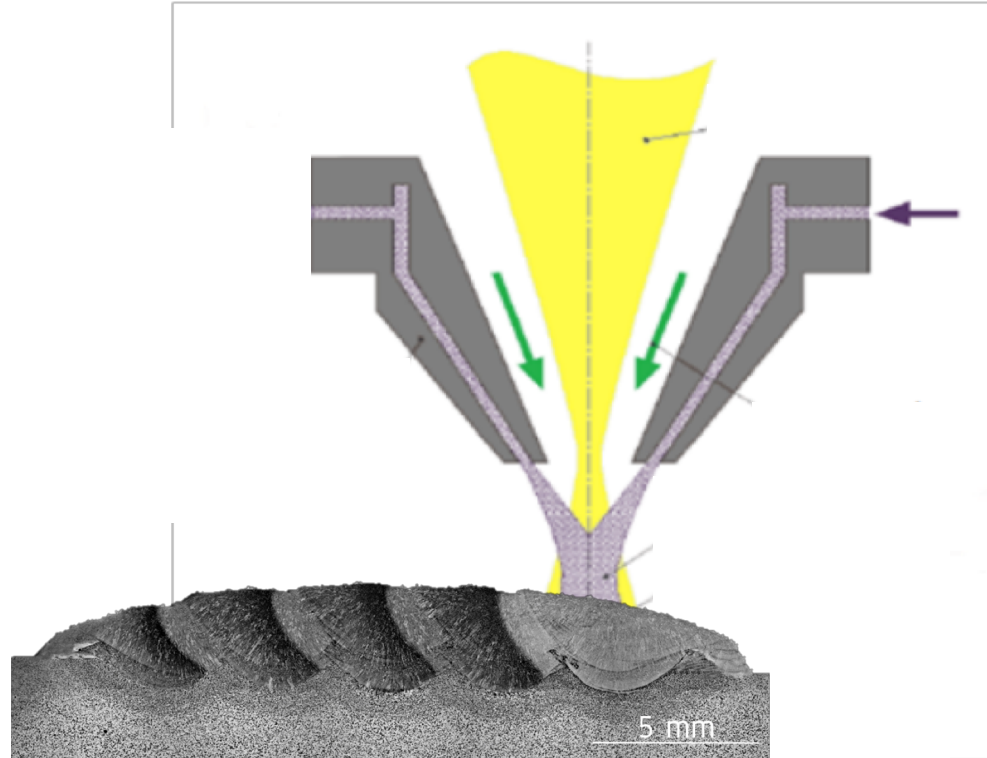
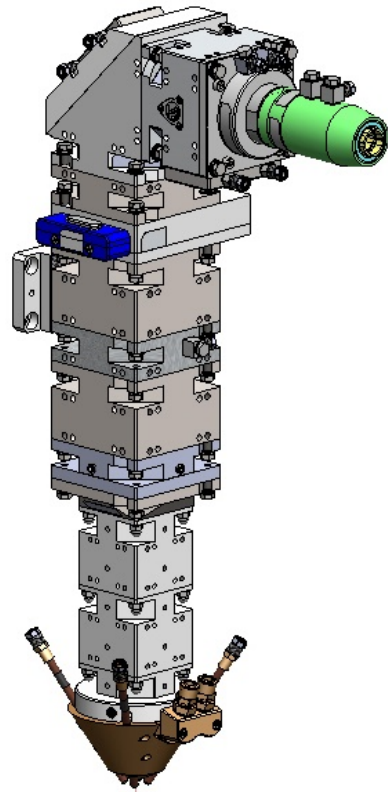


Laserové svařování

- automotive
- AHS oceli – jemnozrnné, vícefázové
- speciální profily a aplikace
- svařování silných stěn s PM
- heterogenní spoje



Laser cladding



Laser cladding



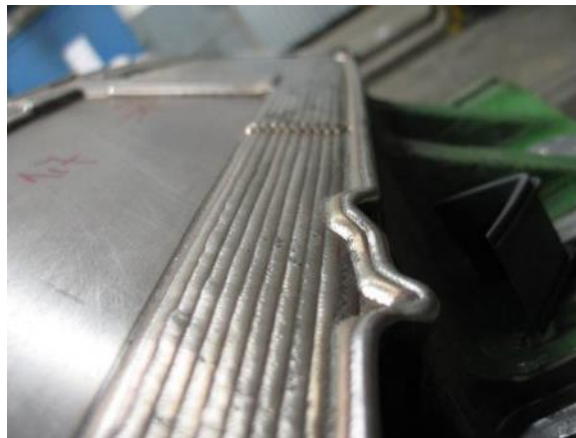
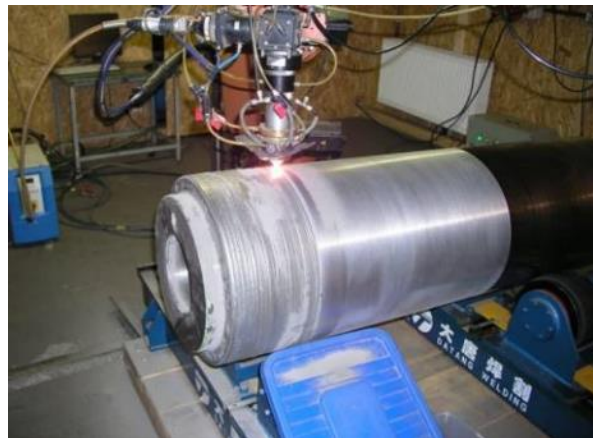
Důlní průmysl

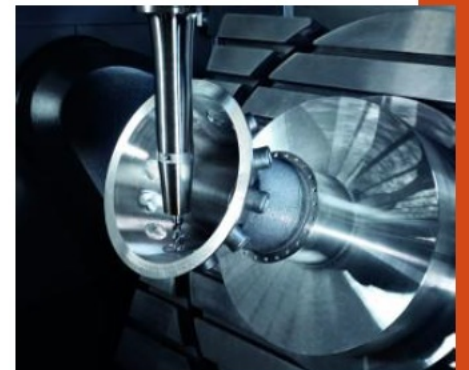
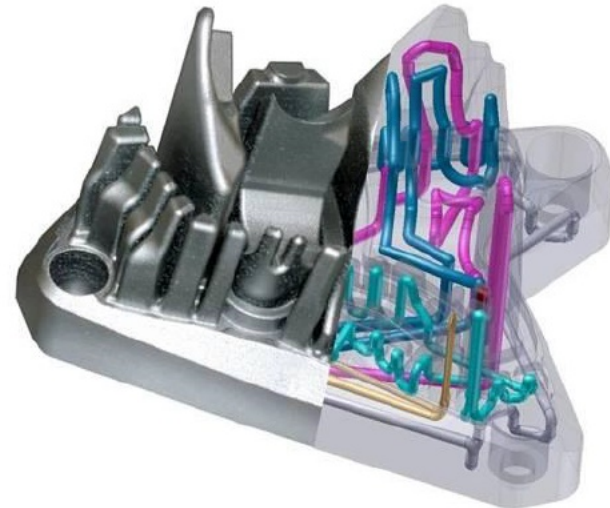
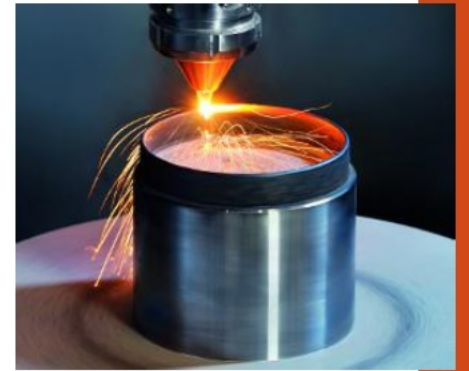


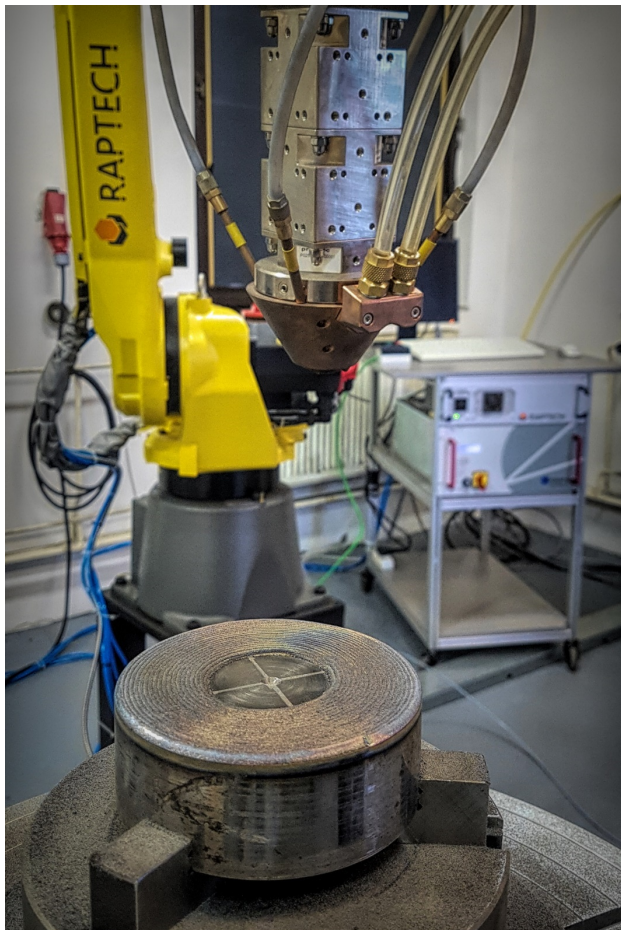
Tvářecí nástroje



Kluzné plochy





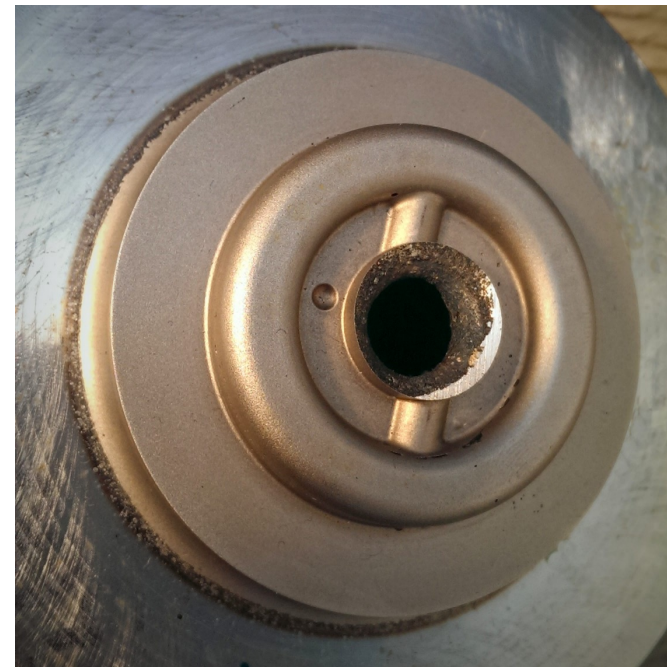


Aditivní výroba

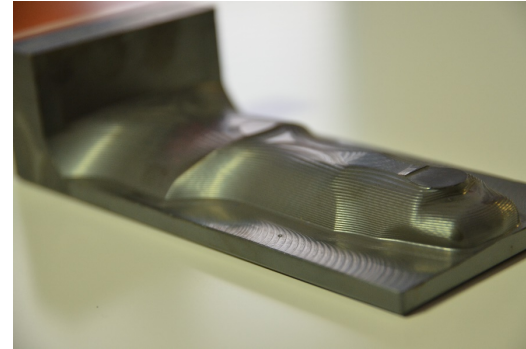
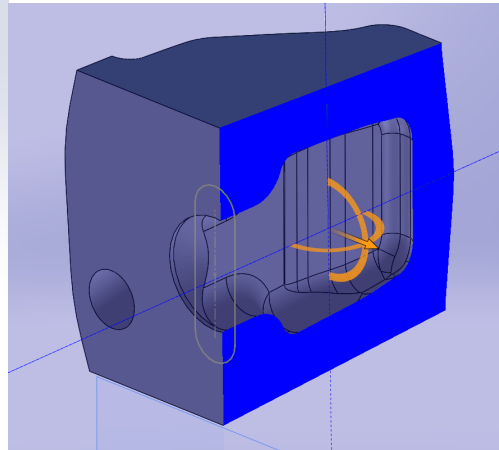
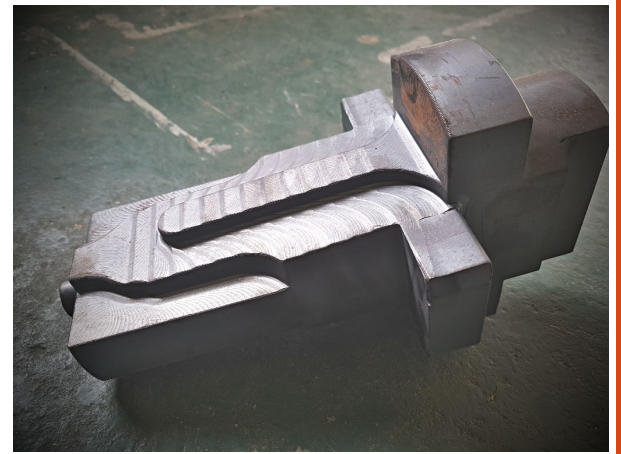
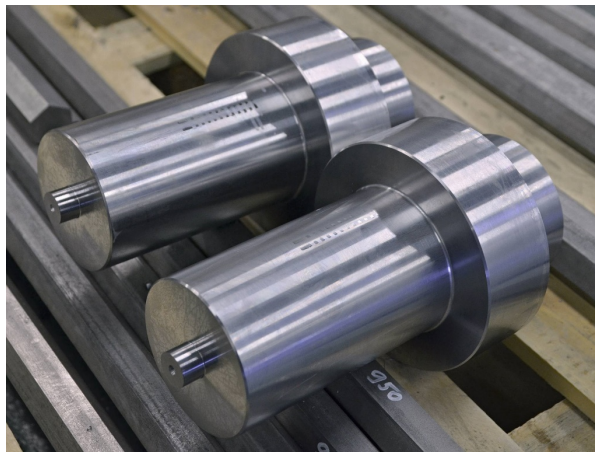
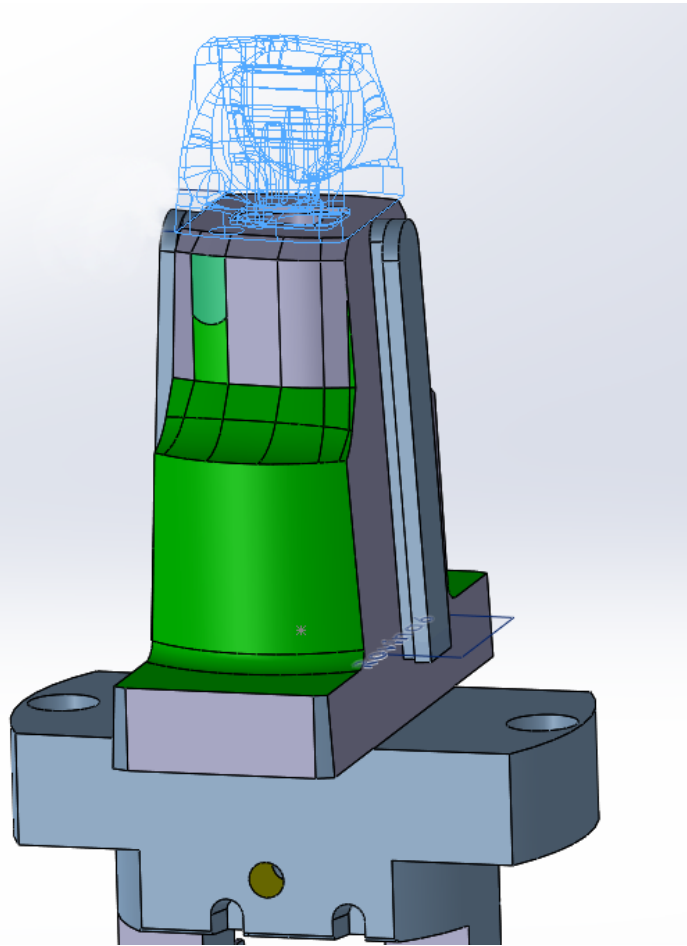


Subtraktivní výroba

Laser cladding vs. Additive manufacturing

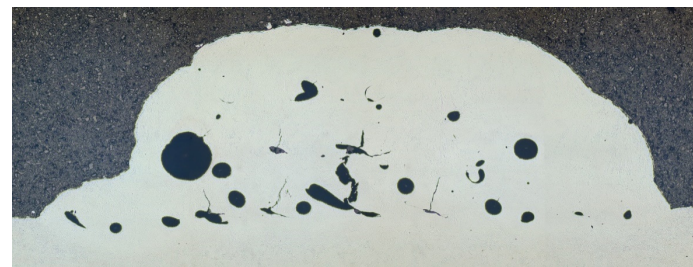
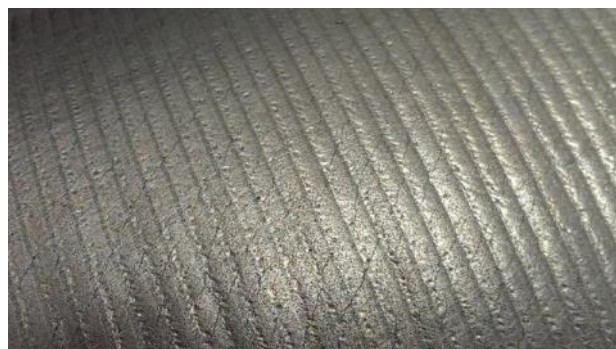


2D navrhování

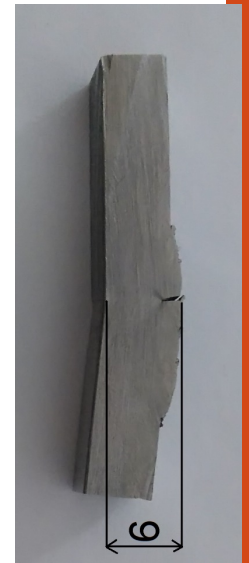
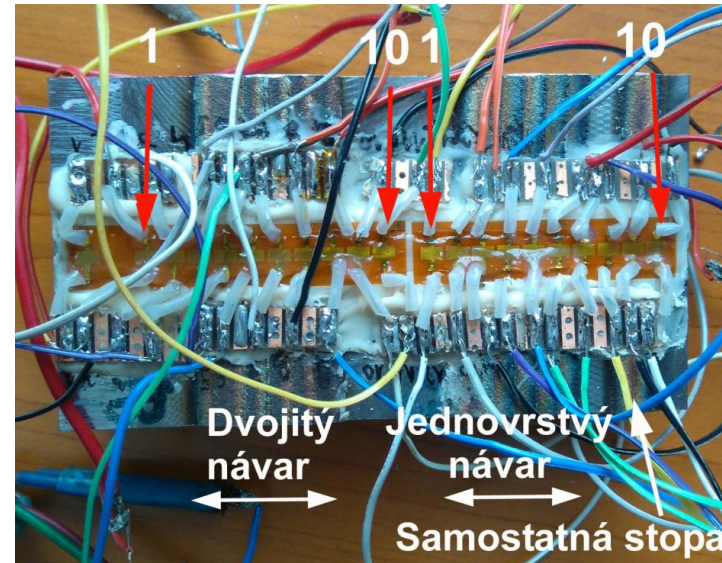
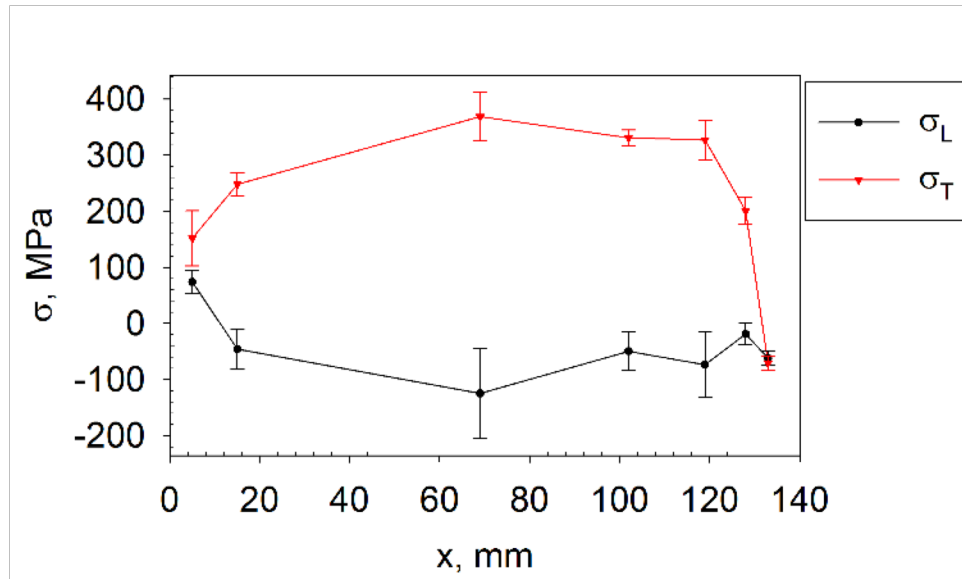


2,5D navařování

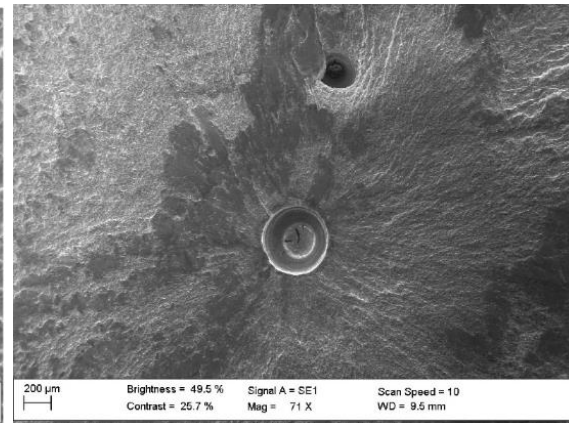
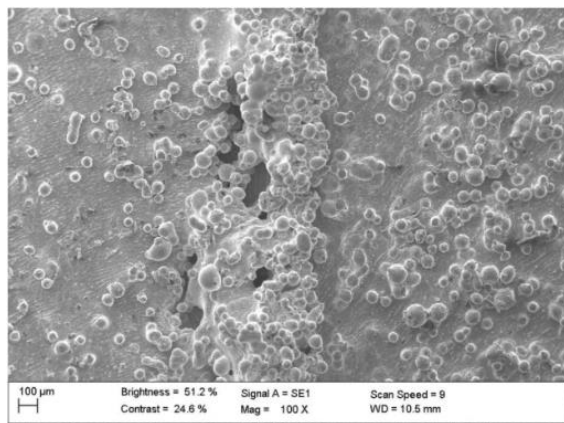
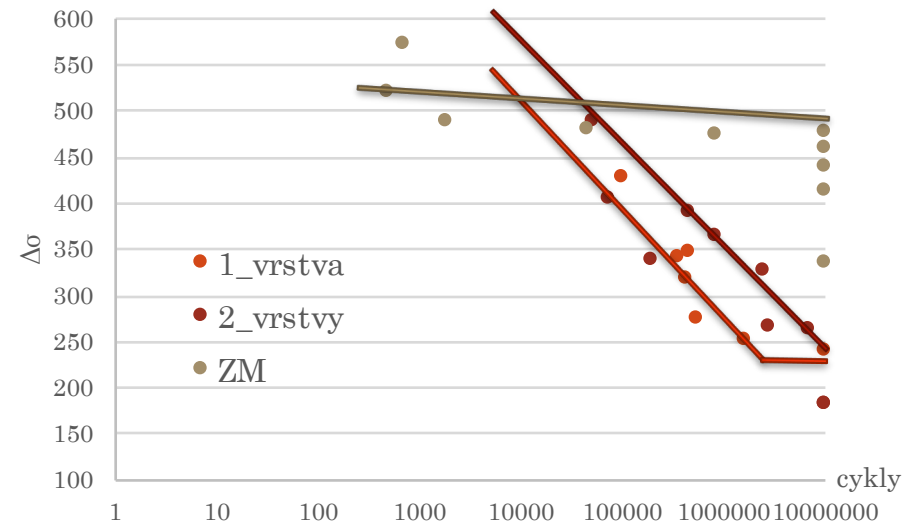
Vady návarů



Pnutí a únava

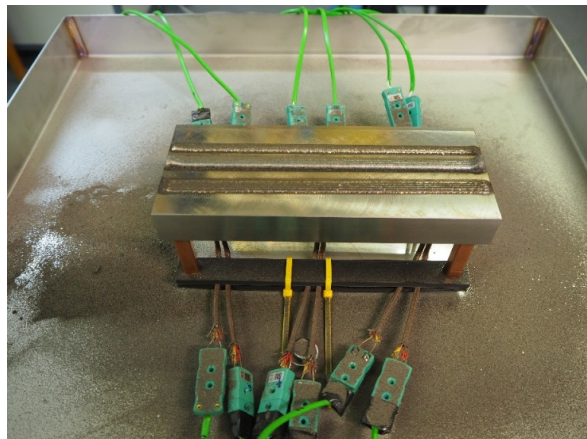
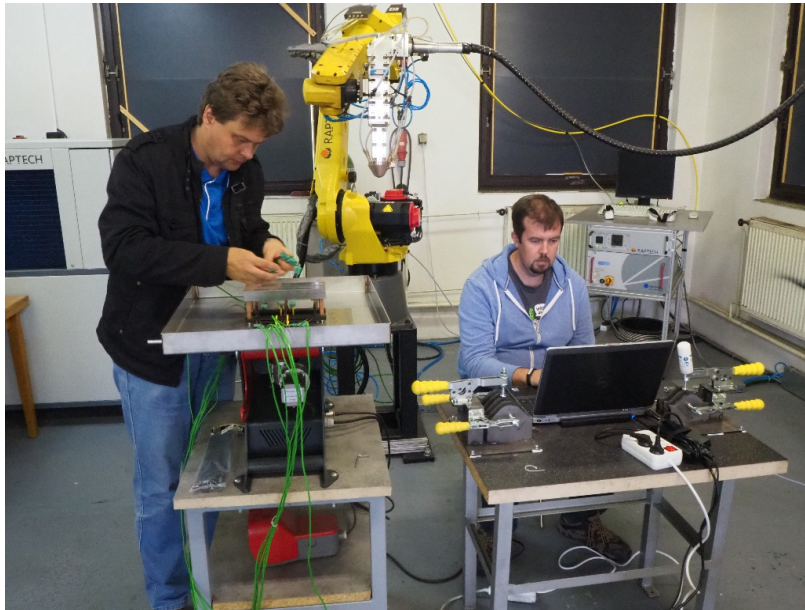


Únavové křivky



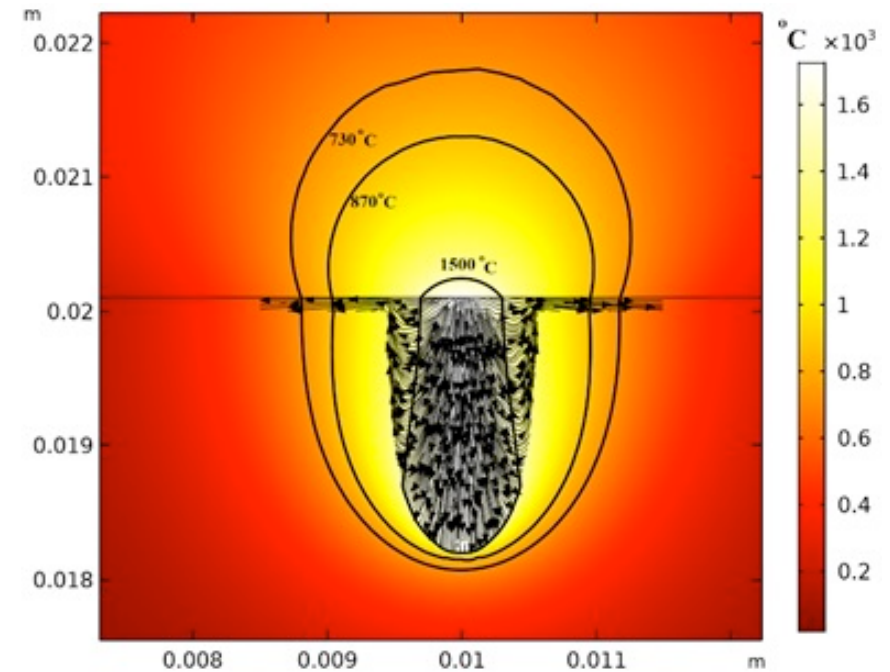
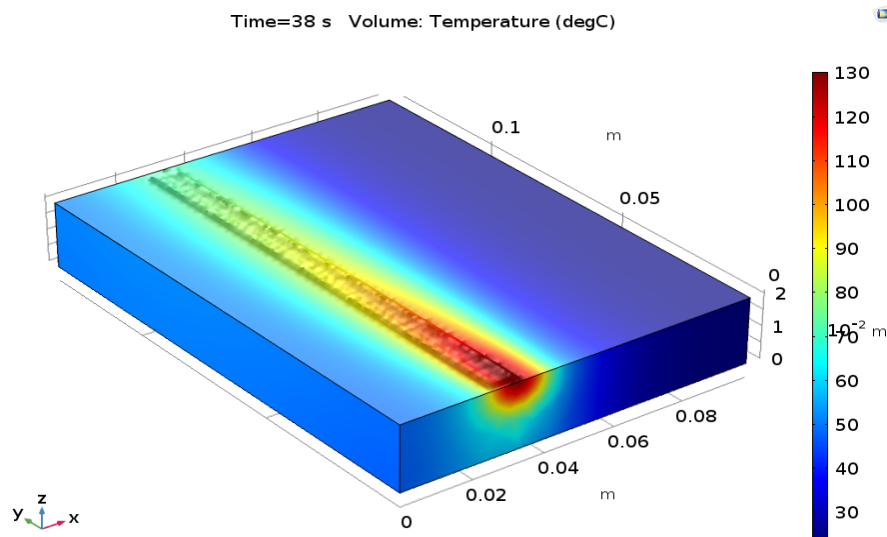
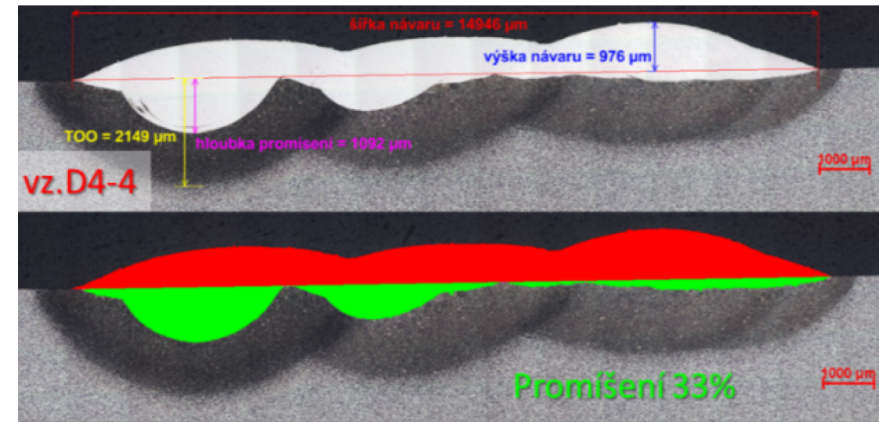
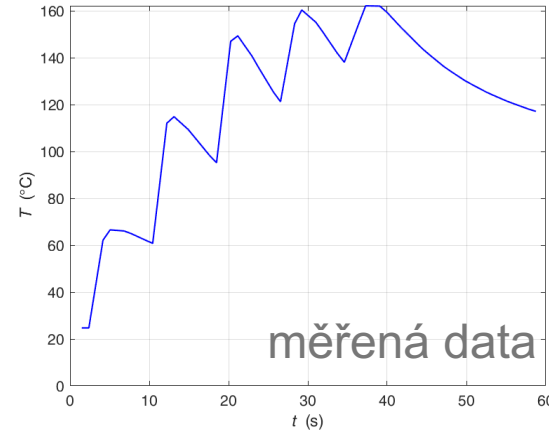
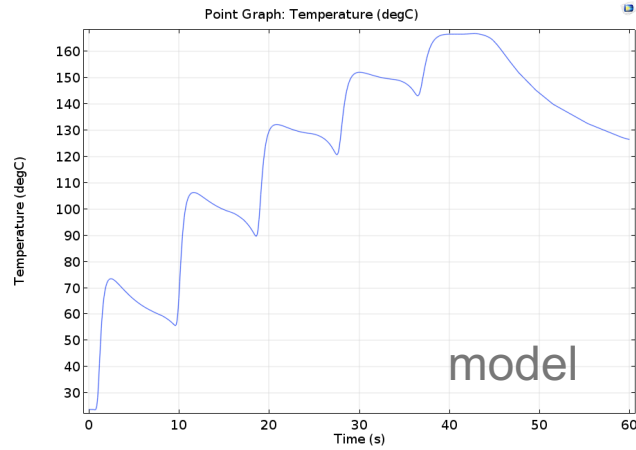
SVUM – I. Černý, J. Kec
 ČVUT – N. Ganev, K. Trojan

Simulace



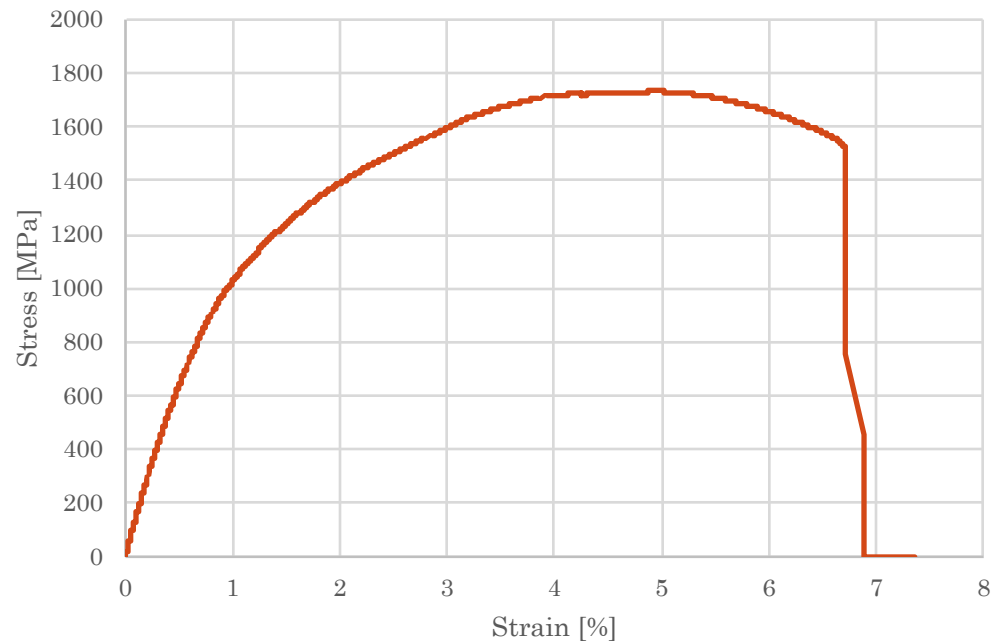
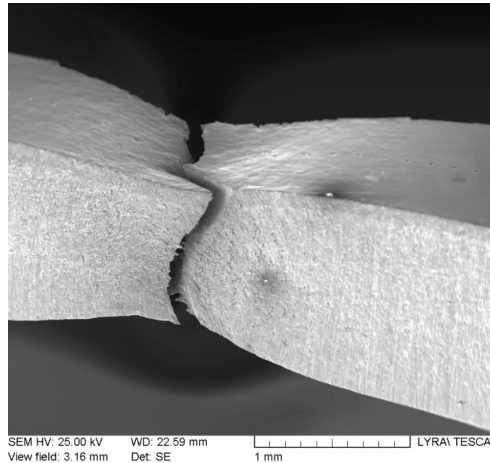
ZCU FEL – V. Kotlan a kol.

Simulace



ZCU FEL – V. Kotlan a kol.

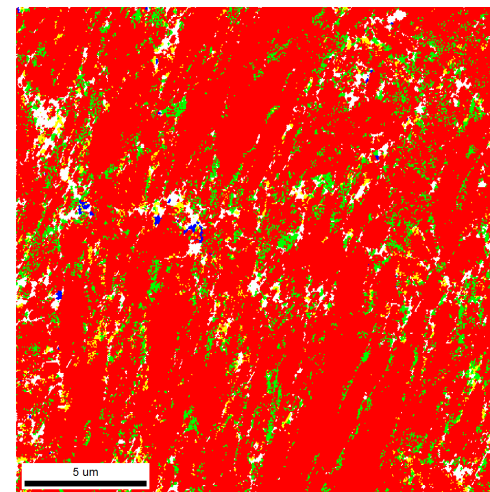
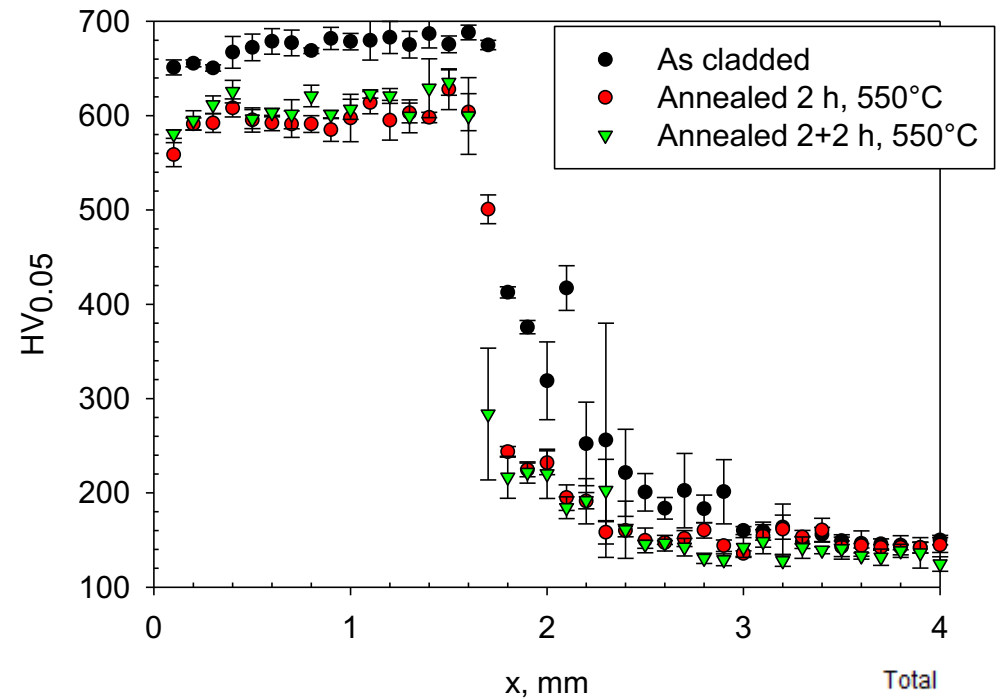
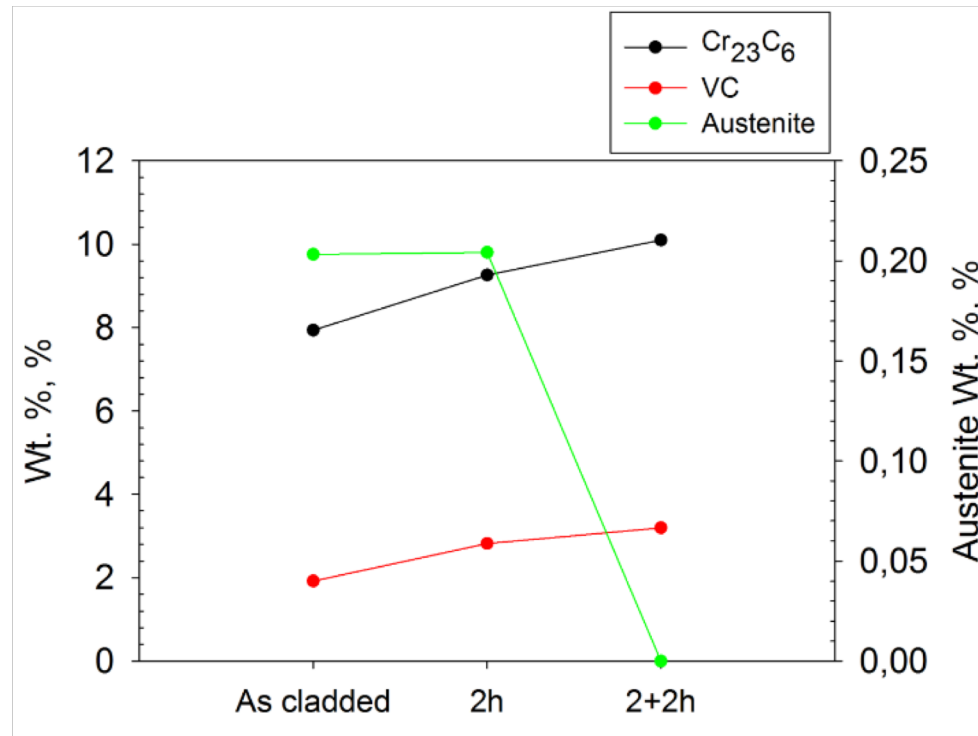
Vlastnosti prášku H13



University of Groningen – J.Ocelík
ČVUT – N. Ganev, K. Trojan

Žihání

	Ferrite Wt.%	Cr ₂₃ C ₆ Wt.%	VC Wt.%	Austenite Wt.%
As clad	89.94	7.94	1.92	0.20
550°C /2h	87.72	9.26	2.82	0.20
550°C/2+2h	86.71	10.10	3.19	0.00



Phase	Total Fraction
Ferrite	0.838
Cr ₂₃ C ₆	0.083
VC	0.025
Austenite	0.002

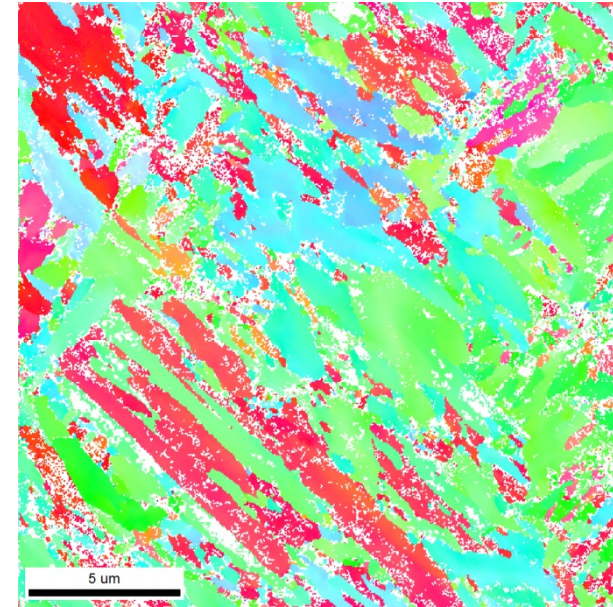
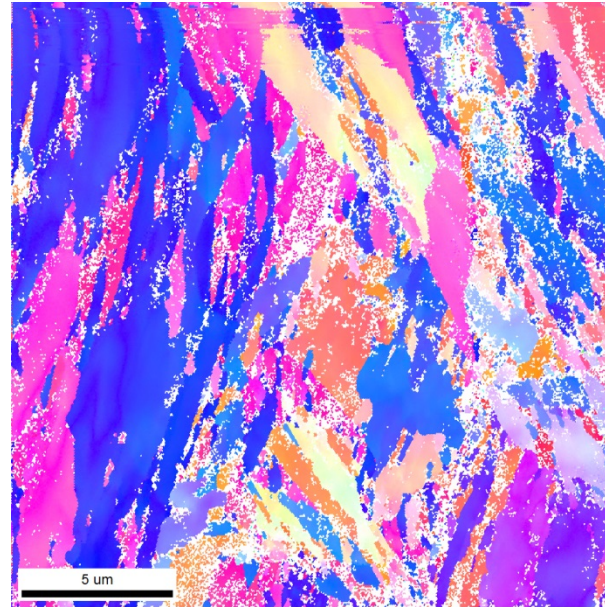
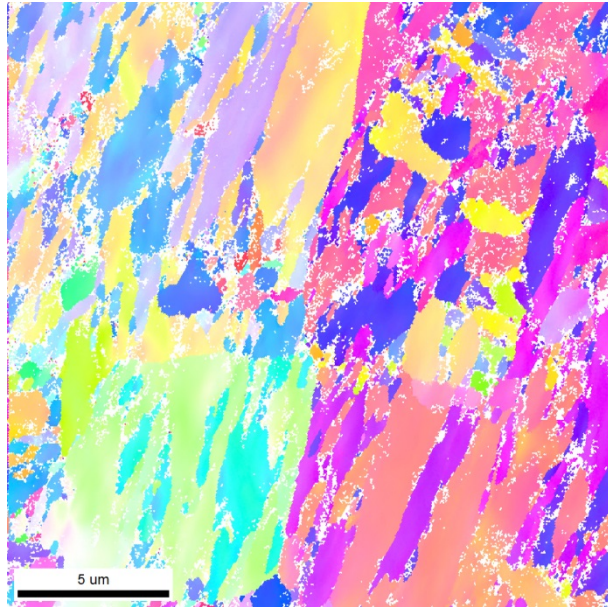
University of Groningen – J. Ocelík
 ČVUT – N. Ganev, K. Trojan

EBSD žíhaných vzorků

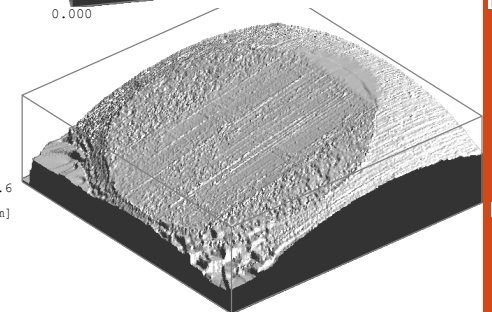
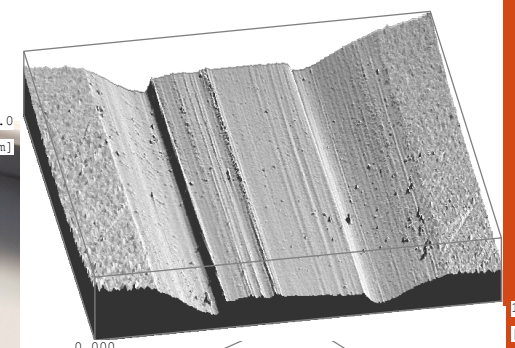
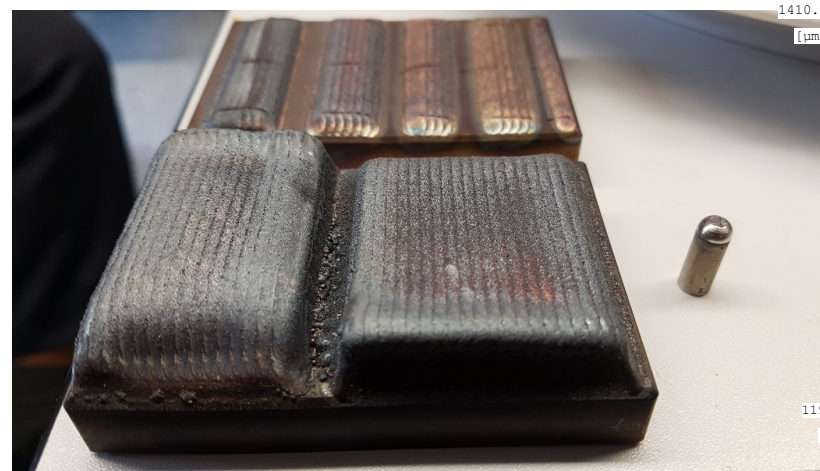
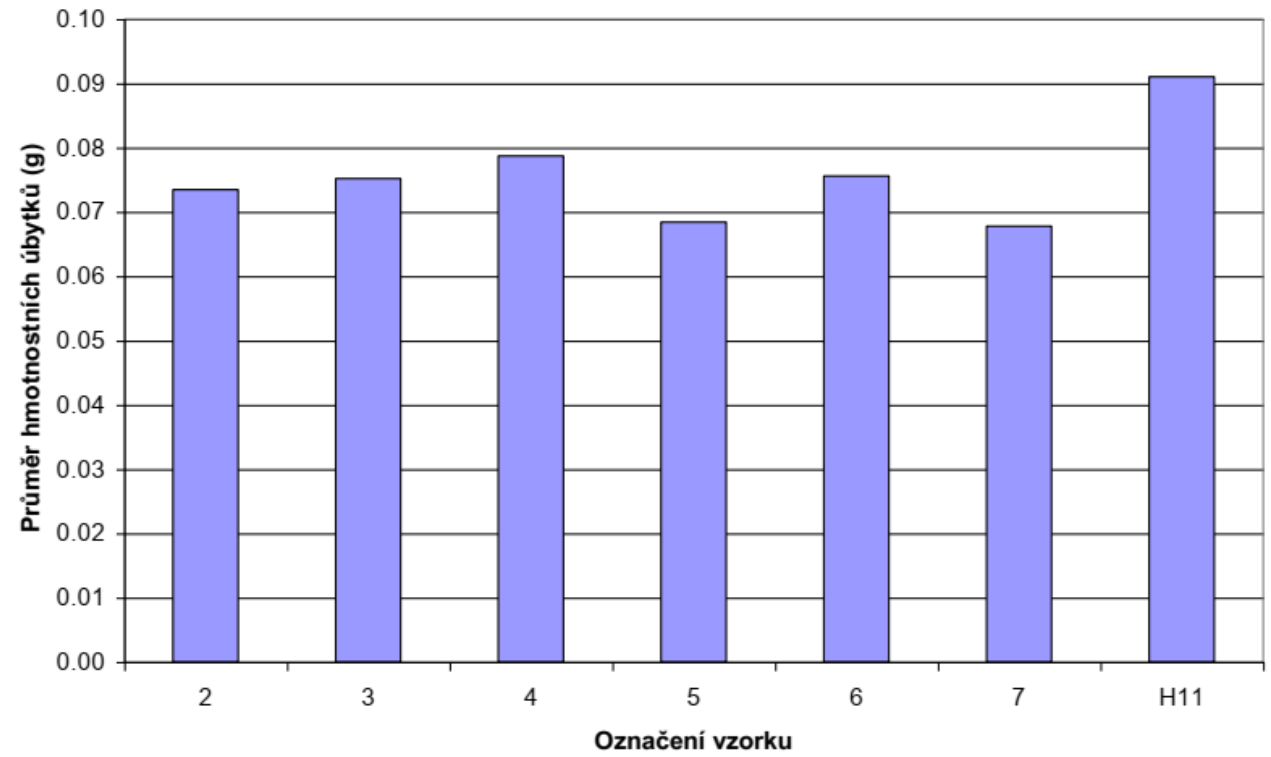
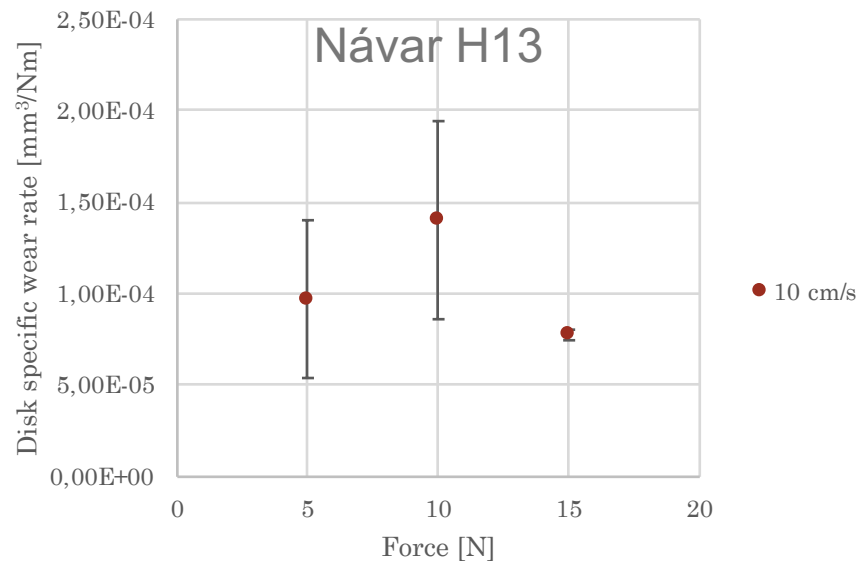
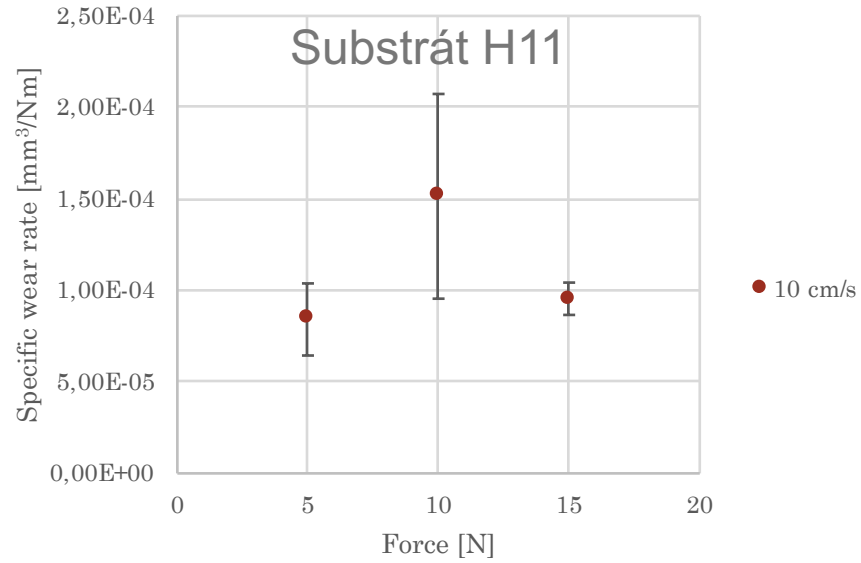
As cladde
Ferrite

550 °C 2h

550 °C 2+2h



Tribologie



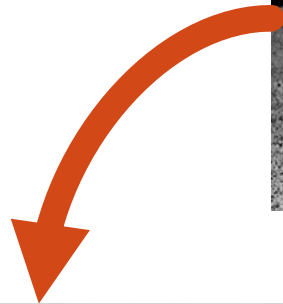
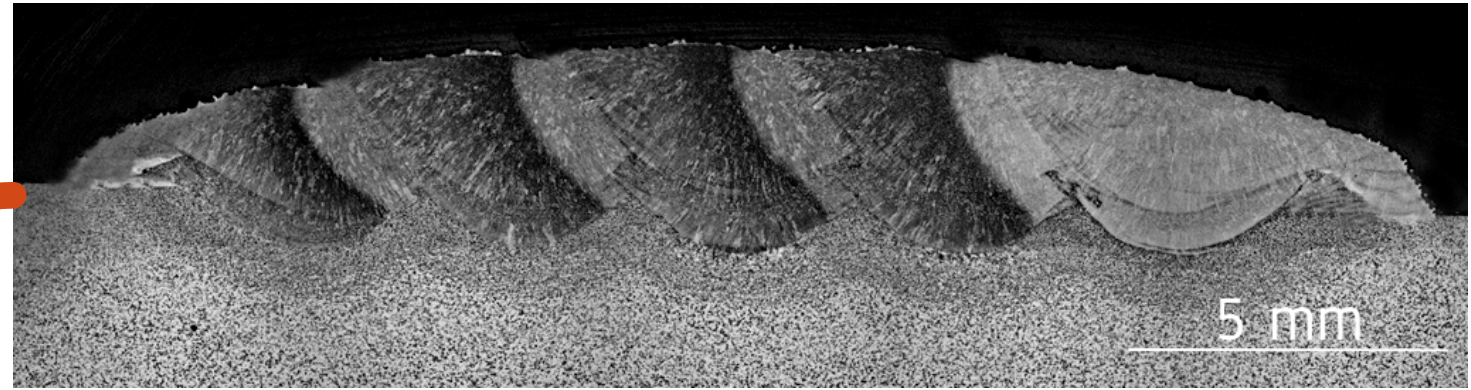
1455.0

[μm]

1159.4

[μm]

3D tisk



Využití laserů v průmyslu



6. ročník mezinárodní konference

- laserové zpracování materiálu
- aditivní výroba
- elektronový paprsek

PLZEŇ
8.-9. DUBNA 2019

MM Průmyslové
spektrum

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Kontakt

