

DED laserske izdelovalne tehnologije (Tehnologija LENS)

3D-TISK / PRILOŽNOSTI ZA INDUSTRIJO; GZS, Dimičeva 13, Ljubljana

Mag. Matej Balažič

BALMAR →



BALMAR-stranke in projektni partnerji

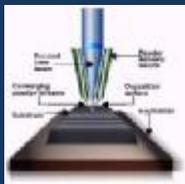


CENTER ODLIČNOSTI za tehnologiji

LENS® in Aerosol Jet® - **OPTOMECH**
Production Grade 3D Printers... with a Material Difference

LENS (Laser Engineered Net Shaping)

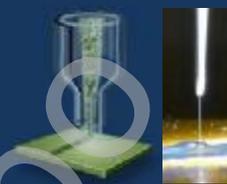
- Countless Metals
- High Power Laser (to 4kW)
- Low-Cost Com'l Powders
- Superior Mech Properties



Structural → METALS → Wear-Resistant → Conductive

AEROSOL JET (Aerodynamic Focusing)

- Countless Material Types
- Features as small as 5um
- Low Temp, Non-Contact
- Very High Throughput



Polymers Energy Ceramics
Semiconductors Biomaterials



Sodobne laserske izdelovalne tehnologije

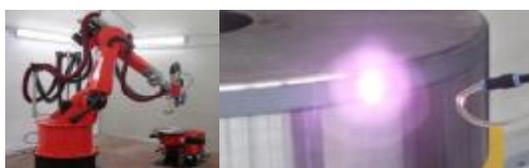
Posteljna izdelava-3D tisk



Lasersko navarjanje-3D tisk



Lasersko utrjevanje,
spajanje in rezanje



Tiskanje elektronskih vezij-3D
tisk



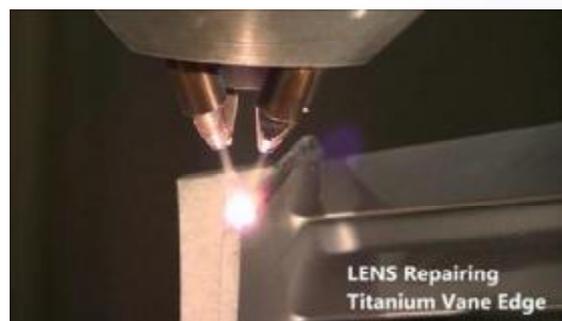
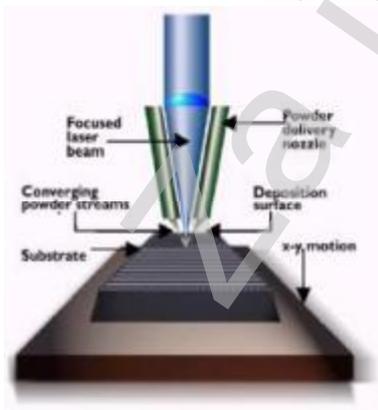
Lasersko navarjanje-LENS tehnologija (Laser Engineered Net Shaping)



LENS (Laser Engineered Net Shape)

LENS (Laser Engineered Net Shape) je poznana tudi pod sledečimi pojmi: Direct Energy Deposition (DED), Laser Metal Deposition (LMD), and Laser Cladding

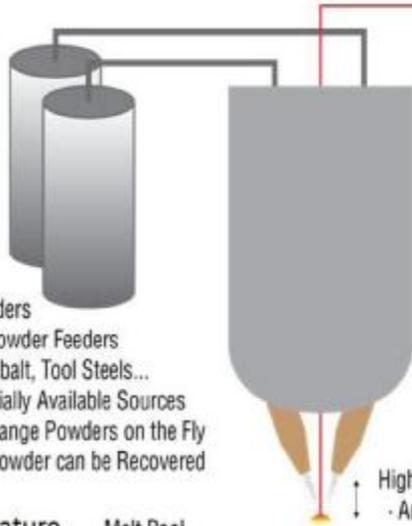
LENS Process





Powder Feeders

- Up to 4 Powder Feeders
- SS, Ti, Cobalt, Tool Steels...
- Commercially Available Sources
- Mix or Change Powders on the Fly
- Unused Powder can be Recovered



- IPG Fiber Laser**
- 400 W to 4 KW
 - Build Rate 100 g to 1 kg/hour
 - High Uptime, Low Operating Cost

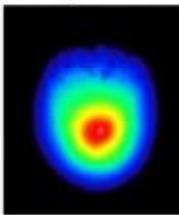
Deposition Head

- 4 nozzles, Water Cooled
- Delivers Powder to Laser Focal Point
- Specialty Heads Available



High Standoff 1 cm
- Add material to existing parts

Temperature



Melt Pool

- Melt pool diameter 200 microns to 4000 microns
- Part overbuilt by 200 microns to 1000 microns
- Layer thickness 200 microns to 2000 microns
- Specialty heads for internal deposition and non-line-of-sight regions
- Rapid Cooling - Excellent Mechanical Properties



LENS sistemi za 3D tisk kovinskih materialov

LENS klasični sistemi

		
450 Education	MR7 Research	850R Production

- Built on Optomec Automation Platforms
- Controlled Atmosphere Glove Box System
- Oxygen/Moisture Level <10 PPM
- Three AM Only Configurations
- Best in Class Metal AM Systems

LENS izdelovalni centri

		
HY18-CA Hybrid Controlled Atmosphere	HY18-OA Hybrid Open Atmosphere	AM18-OA Additive Open Atmosphere

- Built on Fryer CM Series CNC Platform
- Shield Gas & Controlled Atmosphere Systems
- Oxygen/Moisture Level ~ 40 PPM for CA
- Hybrid & AM Only Configurations
- Low Cost High Value Metal AM & Hybrid Systems

LENS Print Engine

Precision Repair



Laser Cladding / Coatings



Upgrade Used CNC



Robotic Systems



New Hybrid CNC Systems

Mobile Parts Hospital



OPTOMECH
Production Grade 3D Printers... with a Material Difference

Možnost uporabe tehnologij DED in smernice razvoja tehnologije

Razvoj novih kovinskih materialov

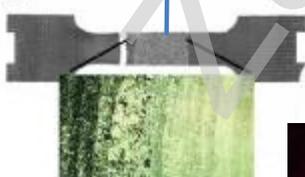
Funkcionalni prototipi

Hibridna izdelava in proizvodnja

Obnovitev obrabljenih izdelkov

Popravilo komponent

Ti-6-4



Nižji strošek/čas

Ti-22-23



Nižji strošek/čas



Nižji strošek/čas



Zmanjšanje odpada



Podaljšanja življenjska doba izdelka

- Hitrost navarjanja do 10 kg materiala na uro.

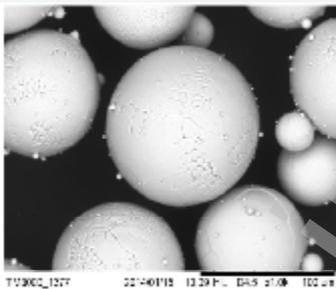


- Izdelava velikih struktur/izdelkov (1-5m), iz materialov kot so titan, nikelj, aluminij ter ostali kovinski materiali.

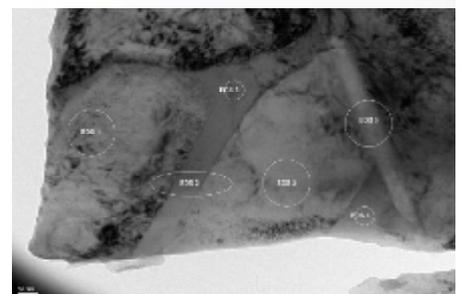


- Višja stopnja avtomatizacije izdelovalnega procesa

Zagotavljanje kakovosti procesa LENS



TU306C_1277 02-40115 12.29 P.L. DAS 2106 100.0x



IZDELOVALNI PARAMETRI

(Specifični za vsak material in geometrijo obdelovanja)

Reference podjetja

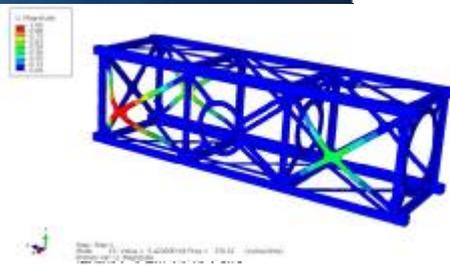
- Vesoljska industrija;
- Letalska industrija;
- Orodjarstvo;
- Vojaška industrija.



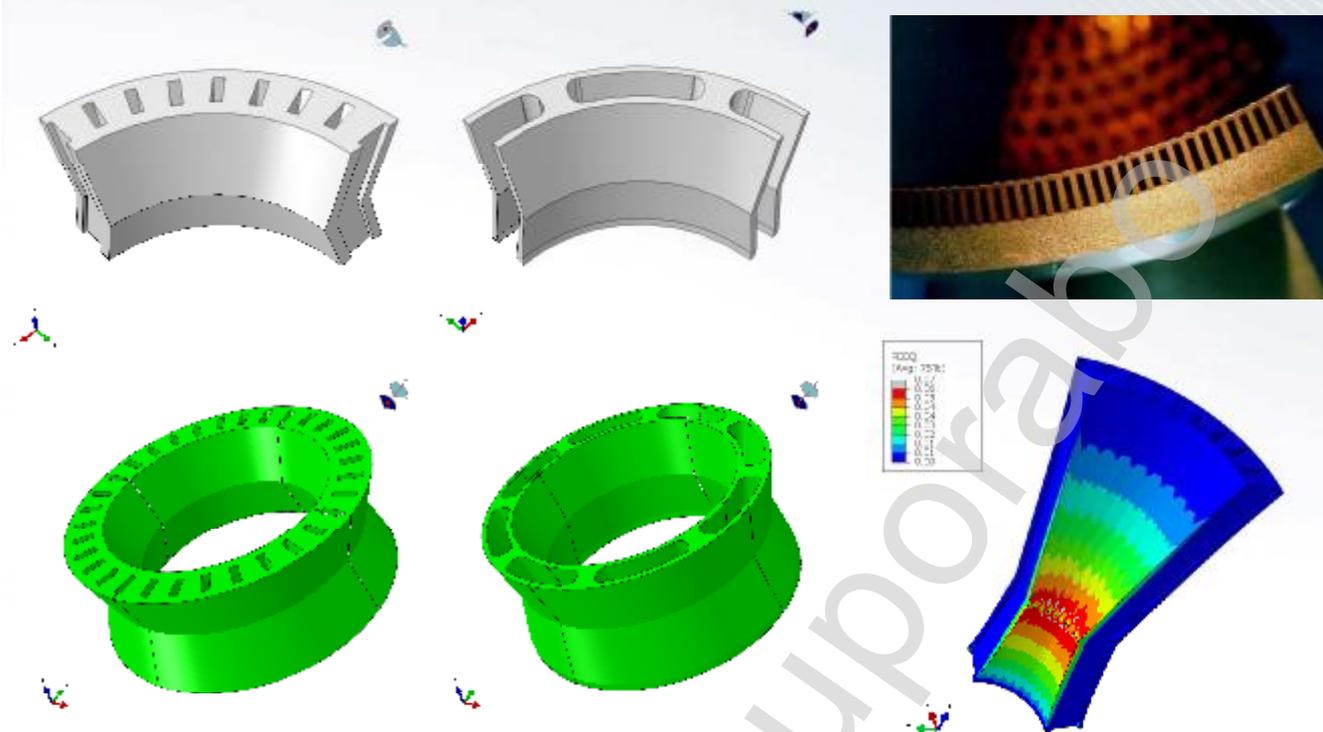
1. ESA (European Space Agency)



ESA/PECS Programme (2011-2014): *Development, Prototyping and Manufacture of special Metal Components for Space Applications with Advanced Laser Technology*
LENS (LENS FOR SPACE)



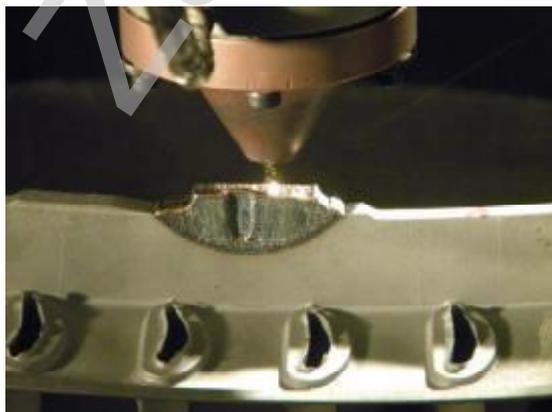
Razvoj izboljšanih oblik hladilnih kanalov pogonskih sistemov raketnega motorja
(razvoj na podlagi uporabe sodobnih laserskih izdelovalnih tehnologij)



2. Rolls Royce



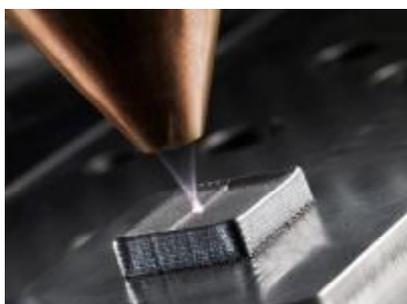
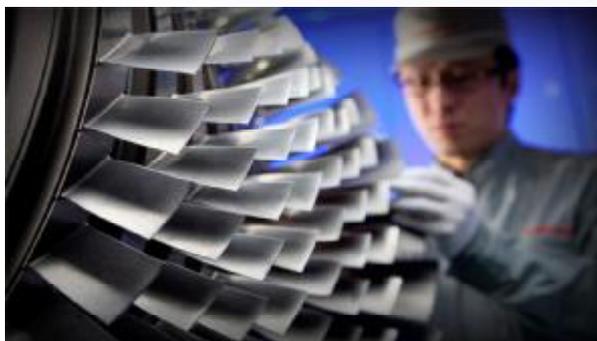
Rolls-Royce TREN T 900/1000 motor (gradnja/popravilo turbinskih delov)



3. Kawasaki Heavy Industries



Hibridna izdelava notranjih sestavnih delov reaktivnega motorja.



4. BERETTA –inovativen pristop spajanja komponent puške/primer prenosa znanja in tehnologije na ostala področja



11SMn37 ali 11SMnPb37 (1.0736/7)



repetitor= X30Cr13 (1.4028)

Glavna cev = 40NiCrMo2