

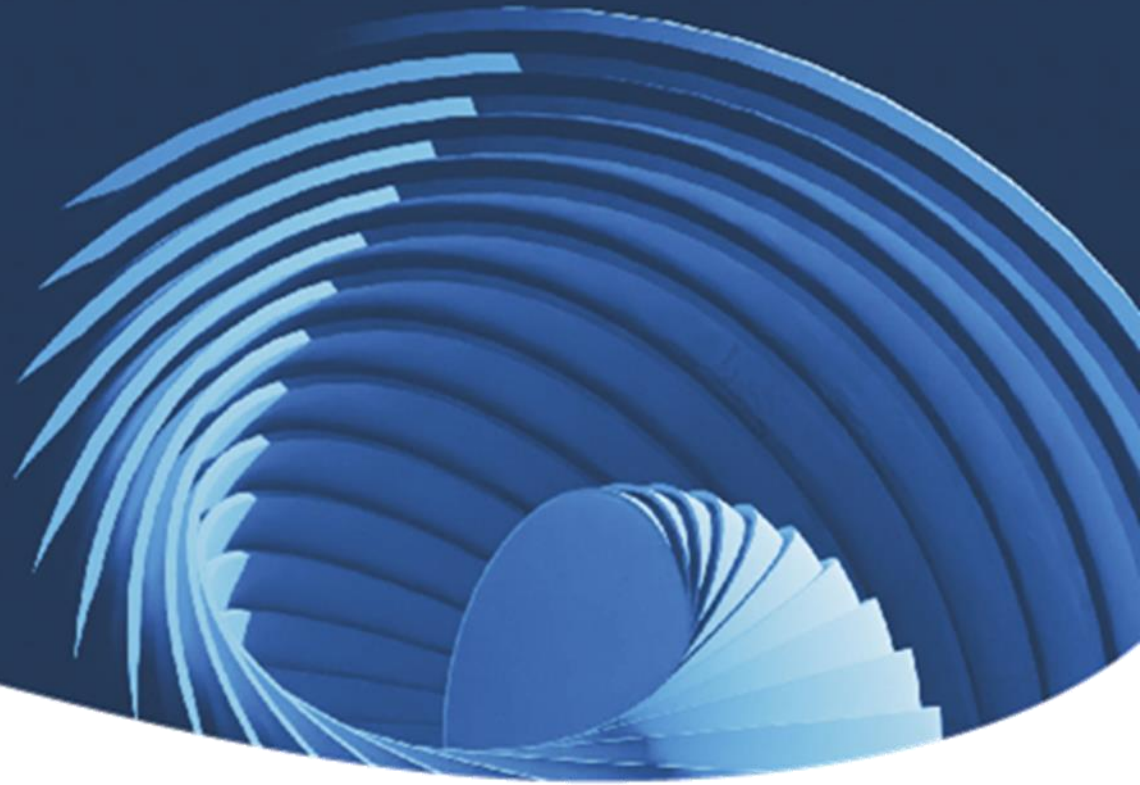


The new Competence Centre in AM and New Materials for the
Industrial Value Chain and the Green Transition

RM FORUM, Arese (MI), 25-26.09.2024



Weaream

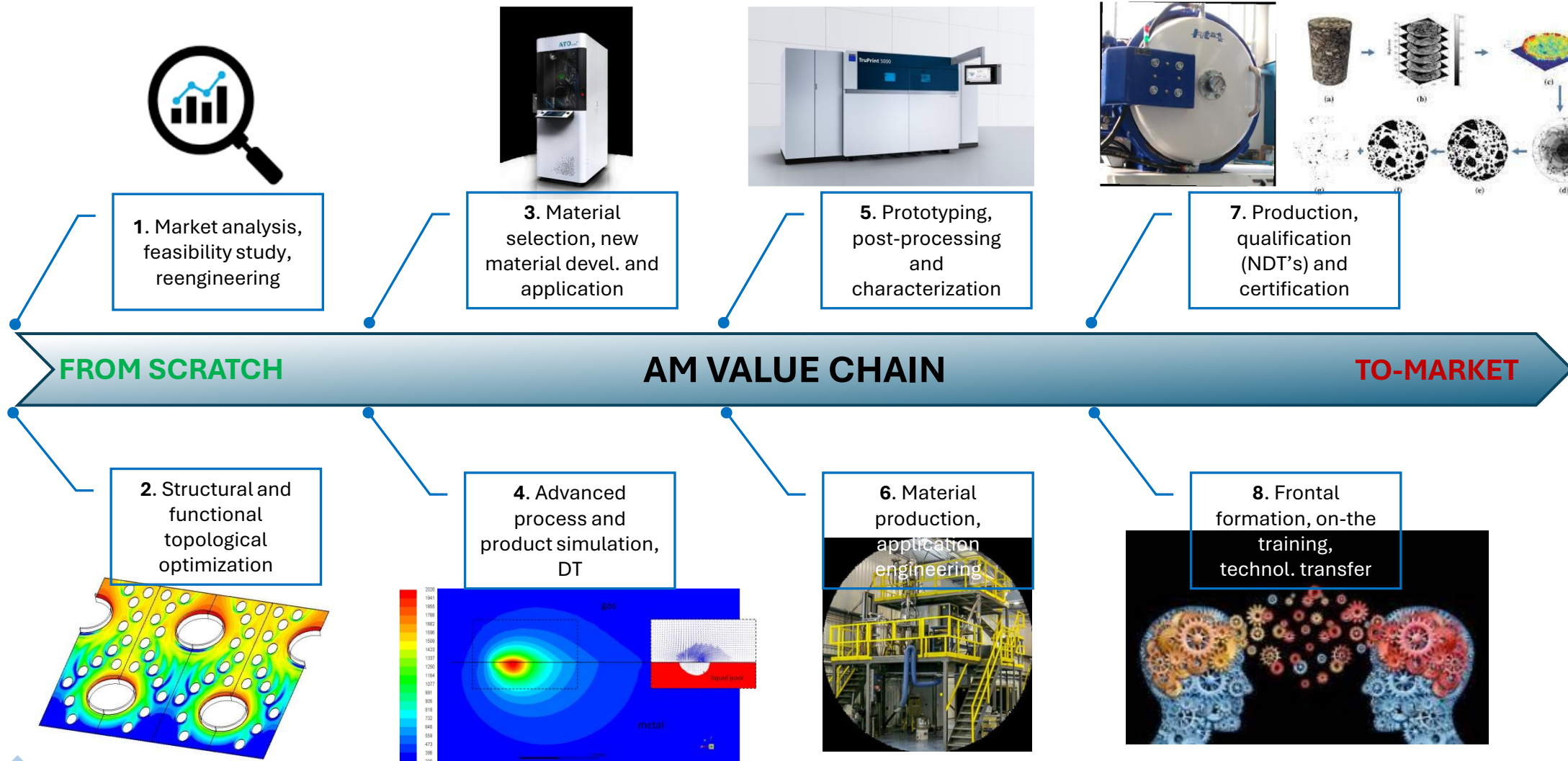


We are a Competence Center in Intelligent Additive Technologies, offering New Materials, and related post-processing and characterization for the European industry and SMEs of the present and future worldwide green competition

For additional information, please visit <https://weaream.it/>



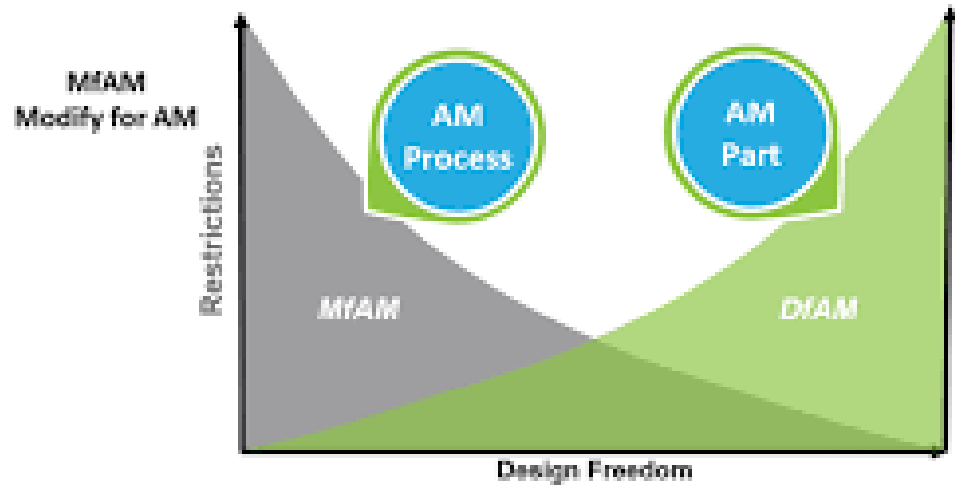
From scratch to market through AM



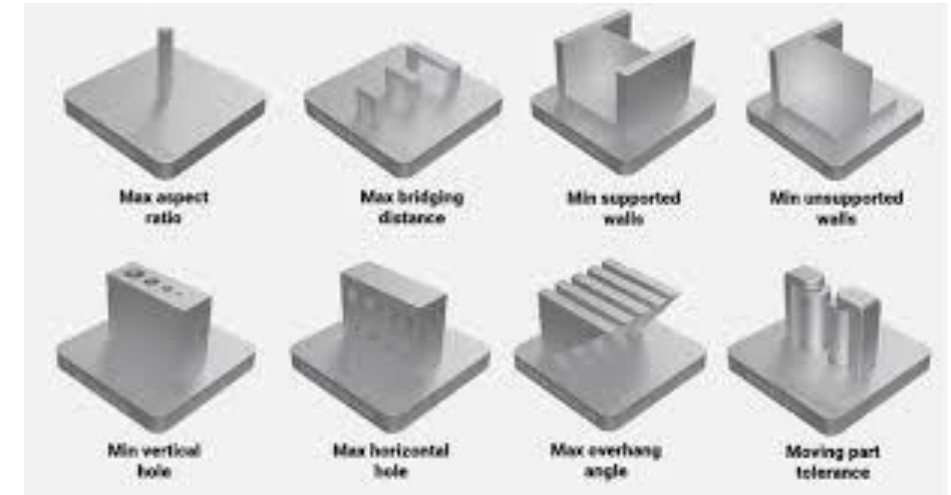
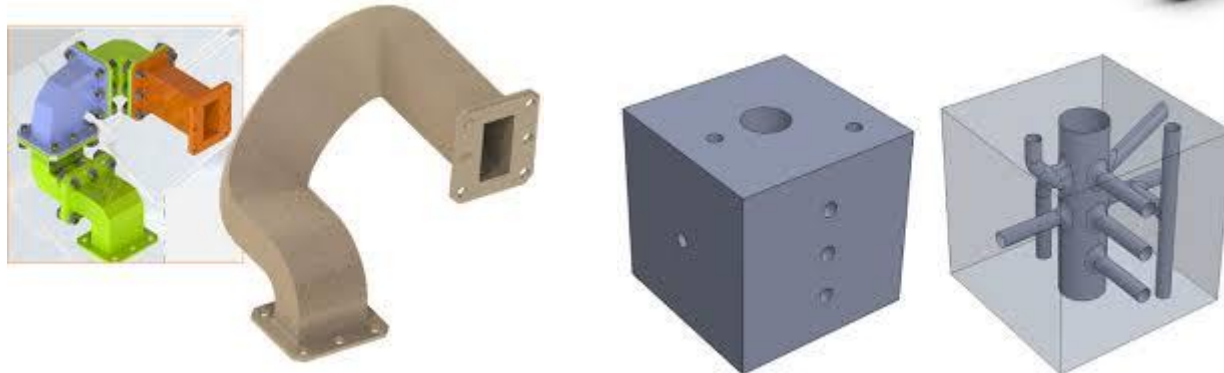


Designing for AM = MfAM + DfAM

Designers must balance the restrictive and opportunistic aspects of AM for success



DfAM
Design for AM

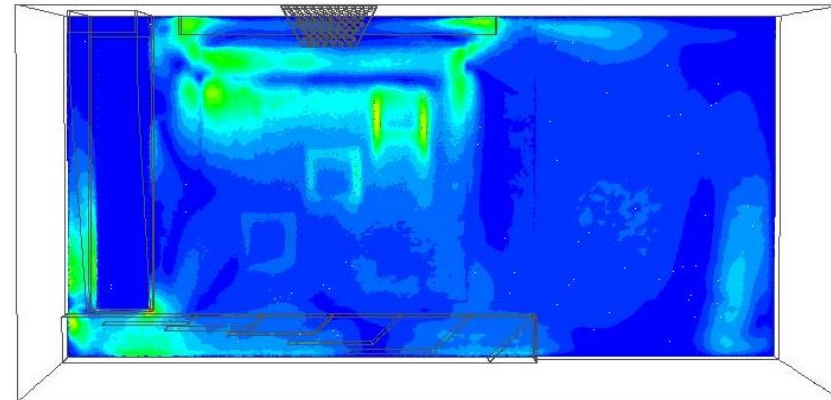
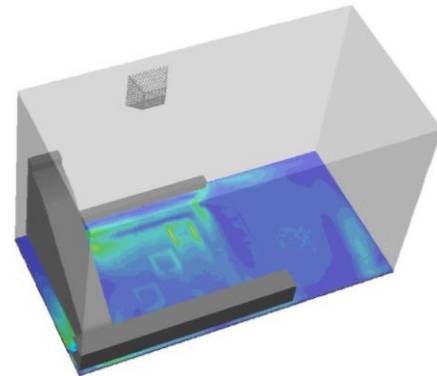
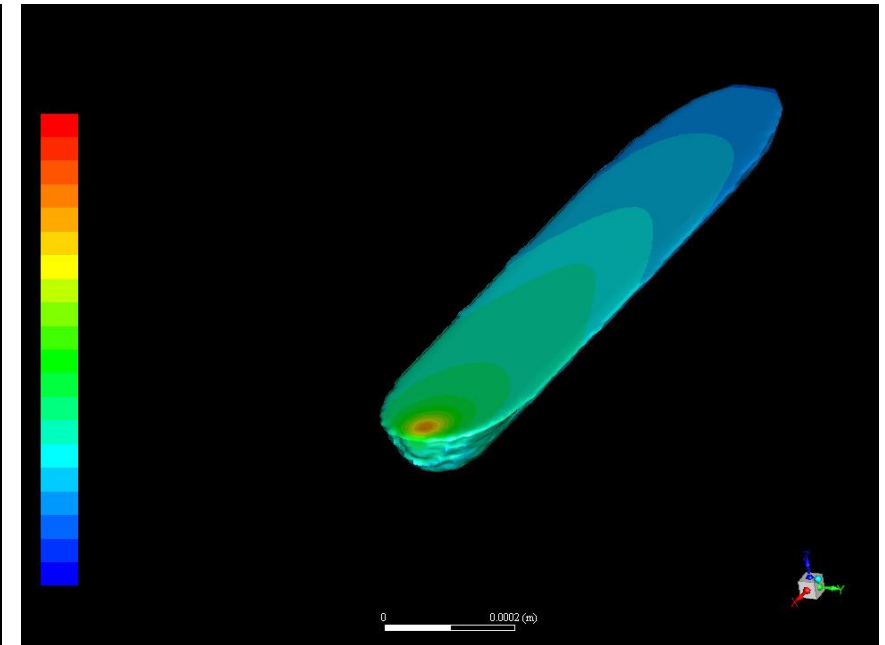
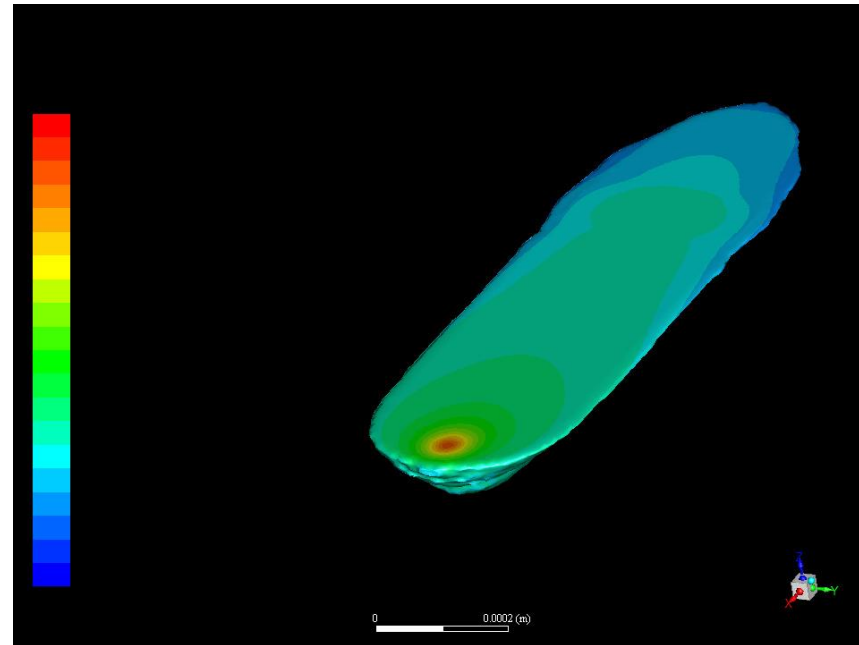
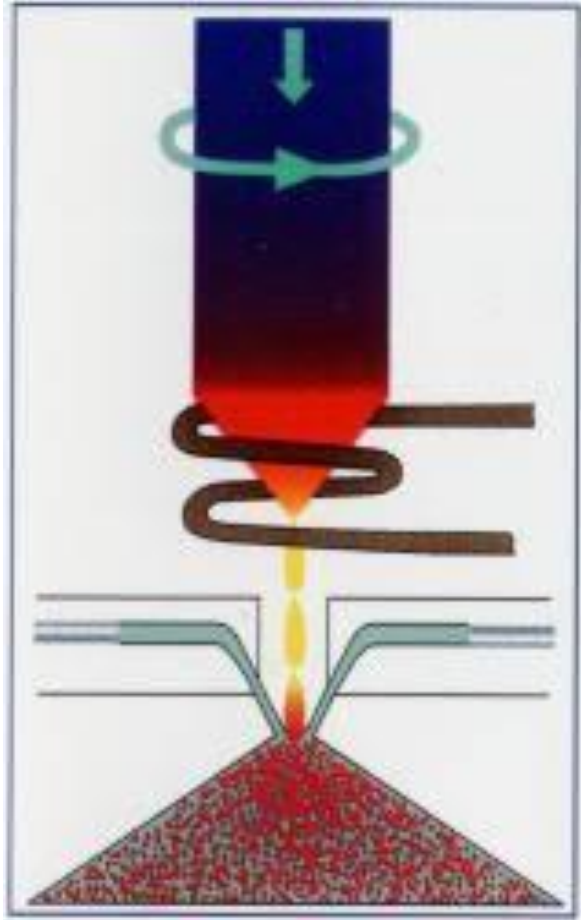


	Direct part replacement	Adapt for AM	Design for AM	
Changes	Process	Form Process	Function Fit	Form Process
Effects	✓ 4.6kg	✓ 78% weight saving (1kg)	✓ 91% weight saving (0.4kg) ✓ Improved fluid flow ✓ Easier assembly	



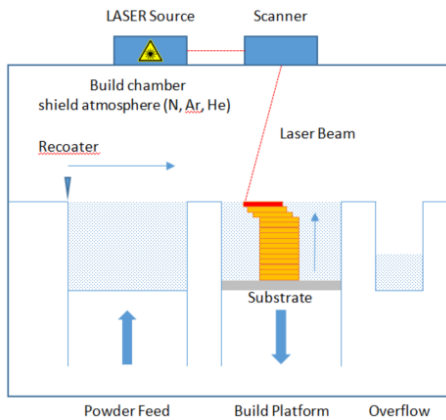
Argon

Helium





Laser Powder Bed Fusion (L-PBF)



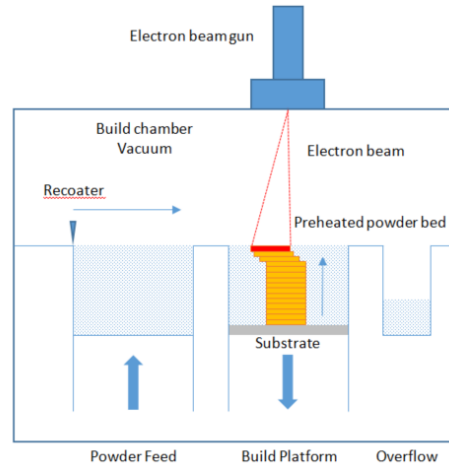
Advantages

- High freedom in design, resolution and details
- High bulk material densities

Challenges

- High temperatures & temperature gradients
- Residual stresses
- Productivity
- Large components

Electron Beam Powder Bed Fusion (E-PBF)



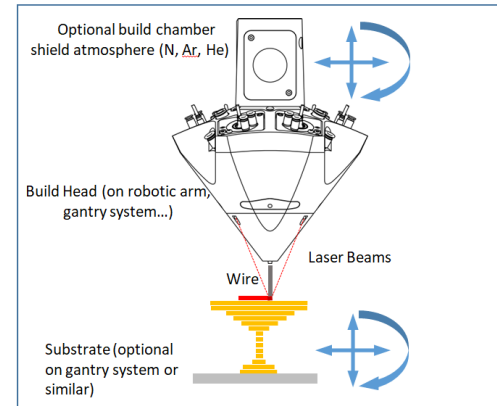
Advantages

- Vacuum chamber offers protection
- High bulk material densities
- preheating and beam splitting gives control over cooling rates and temperature gradients

Challenges

- evaporation of elements with low vapor pressure
- Max. component size

Laser Wire Additive Manufacturing (L-DED)



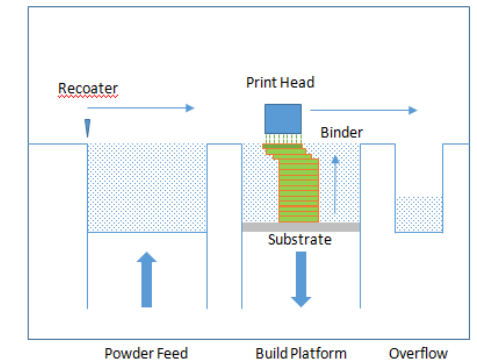
Advantages

- Large component size
- Extremely high bulk material densities
- high productivity
- Gradient/multi materials
- multiple build directions

Challenges

- Limit in detail (wire thickness)
- Surface roughness without machining

Metal Binder Jetting (MBJ)



Advantages

- No heat input in the process
- no protection chamber needed
- no support structure

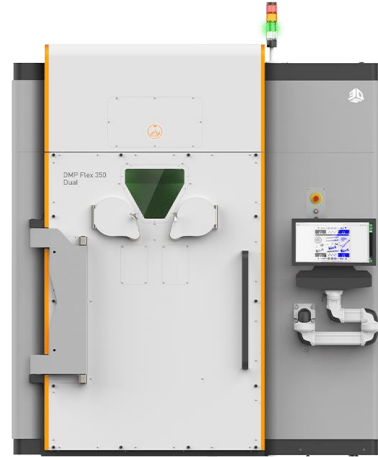
Challenges

- binder removal and sintering afterwards
- Shrinkage
- Density and mechanical properties

Additive technologies / L-PBF Systems



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© 2024 3D Systems



© 2024 3D4Mec



© 2024 3D4Mec

Trumpf TruPrint 3000

3D Systems DMP 350 Flex Dual

3D4Brass

3D4Steel

Laser	2x 700W
Build Size	∅ 300mm x 400mm

Laser	2x 500W
Build Size	275mm x 275mm x 410mm

Laser	1x 1000W
Build Size	110mm x 110mm x 220mm

Laser	1x 400W
Build Size	110mm x 110mm x 220mm

Quick facts

Quick facts

Quick facts

Quick facts

Powders can be kept under protective Atmosphere for the whole process

Exchangeable Build Modules

Internal powder cycle (sieving)

Internal powder cycle (sieving)

High Productivity

Below 25ppm O₂ due to vacuum chamber concept (lowest in class)

Specialized for copper and its alloys

Specialized for steels

Powders can be kept under protective Atmosphere for the whole process

Additive technologies / E-PBF, L-DED and Atomization Systems



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FreeMelt e-MELT-iD

Energy Source	Diode EB gun
Build Size	∅110mm x 310mm

Quick facts

- Fully open E-PBF system to use a wide selection of materials
- Build Temperatures up to 1200°C

Meltio Robot Cell

Laser	6x 200W = 1200W
Build Size	∅ 1000 mm x 1200 mm (with positioner) 2000 mm x 1000 mm x 1000 mm (only robotic arm)

Quick facts

- High Density, high build rates, large parts
- Wire & min. wall thickness: 0.8 – 1.2 mm
- Multiple/Gradient Materials possible

Ato+ Atomizer

Energy Source	Induction or Plasma Arc
Build Size	Up to 1.000 cc per batch (w IMS)

Quick facts

- Argon atmosphere for reactive materials
- Incl. passivation and sieving module
- Ultrasonic cleaning module for material changes

AtoCast

Energy Source	Induction Melting
Build Size	Up to 500 cc per batch (cast)

Quick facts

- induction vacuum casting furnace
- Possibility to create ingots for atomization





© 2024 ADDUP



© 2024 HP

ADDUP Formup 350 Evolution	
Laser	4 x 500W
Build Size	350mm x 350mm x 1000mm
Quick facts	
Automatic clamping and referencing	
Automatic powder handling under Argon	
Exchangeable powder modules	

HP Metal BJ S100	
Energy Source	Sintering
Build Size	430mm x 309mm x 140mm
Quick facts	
Resolution: 1200 x 1900 Dpi	
Including powder preparation, unpacking and sintering modules	



Al

Aluminum Alloys

AlSi10Mg, AlSi10 recycled, 2000 series, Scalmetalloy, *more*

Fe

Steels

316L, MS1, MS1 + additives, 17-4 PH, Duplex and Super Duplex, Maraging, advanced stainless steels, *more*

Ti

Titanium and its Alloys

Cp Ti, Ti6Al4V, Ti6Al7Nb, Ti5553, TiMo15, TiAl (Intermetal), *more*

Ni

Nickel and its Alloys

Inconel 718, Inconel 625, Ni, NiTi (Shape memory alloy), *more*

Cu

Copper and its Alloys

Pure Cu, GrGop42, CuCrZr, CuZn, *more*

X

Others

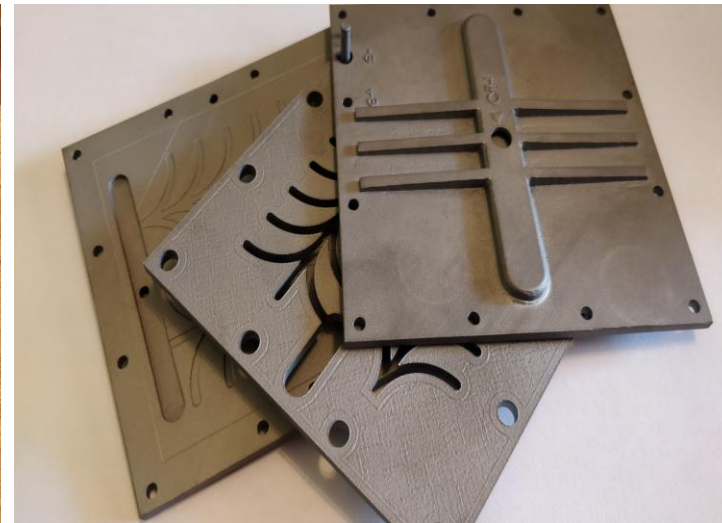
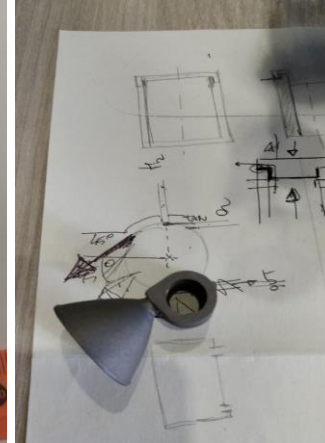
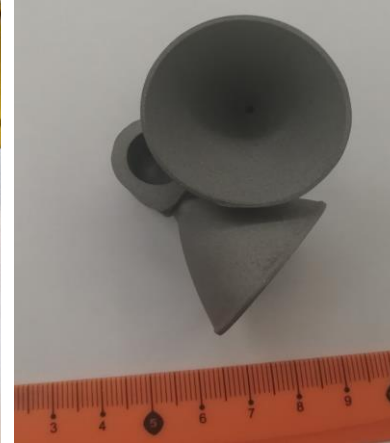
SMM/HMM (FeSi6.5%, NdFeB), Metallic glasses, Tantalum, Niobium, Tungsten, High Entropy Alloy, New Materials

Example of integrated Value Chain



Critical components and tailored materials

Courtesy: MIPRONS



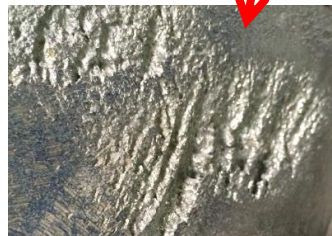
Example of integrated Value Chain



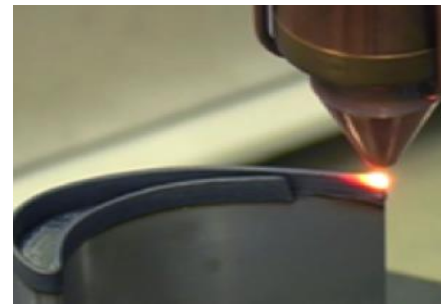
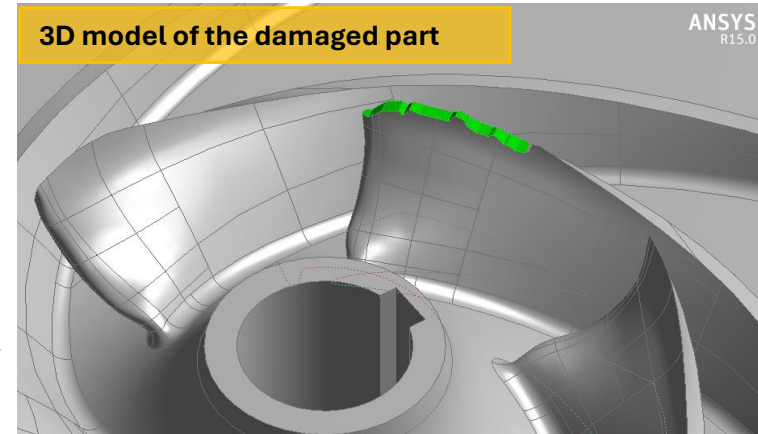
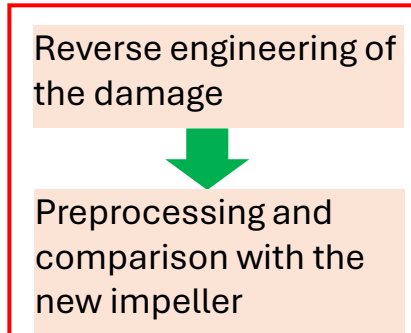
Courtesy: ENEL

Components Repairing and Reconstruction

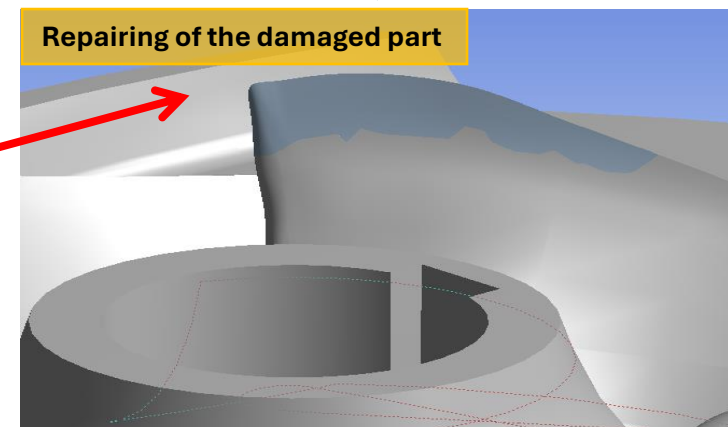
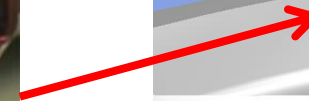
A very important characteristics of AM technology is its capability to **repair/rebuilt** a part of the worn equipment.



Erosion/corrosion damage



Reconstruction phase of the damaged part

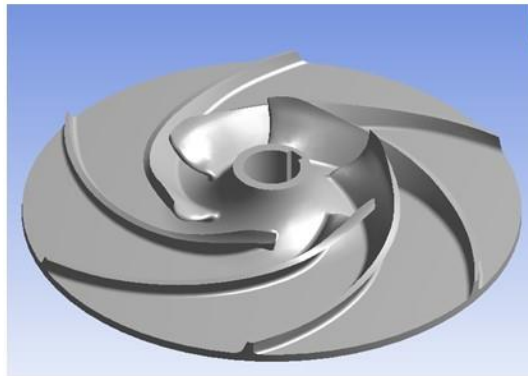


Example of integrated Value Chain

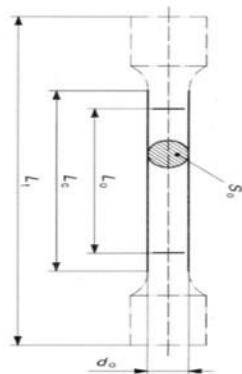


Components Repairing and Reconstruction

Courtesy: ENEL



3D model



Mechanical Test



- Component: pump impeller for USC thermal plant auxiliary system
- Material: Inconel 718 modified
- Technology: EOS M290
- Operational conditions: medium temperature and aggressive environment
- Client: ENEL Produzione Torre Valdaliga Nord (RM)
- Present situation: still running in Torrevaldaliga Nord TPP (Civitavecchia, Rome), no repair, maintenance or substitution since late 2019
- Reference impeller: substitution after max 10 months

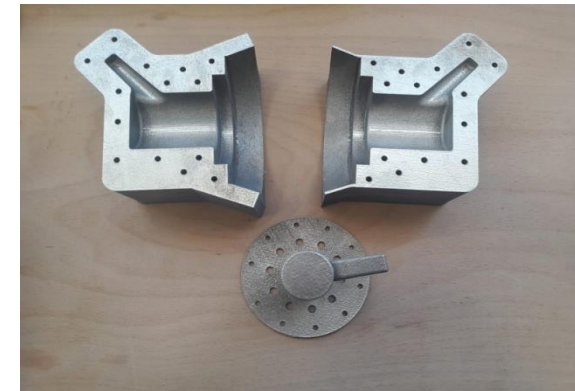
• Evidences: >10 times prior lifetime

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Example of integrated Value Chain



Special applications and finishing



Characterization and qualification @ Weaream



At its “low-TRL” operation site located within the AQM Campus (*large third-party testing lab*), Weaream Srl has direct access to many test facilities, including:



Mechanical and technological testing

Incl. tensile, Charpy impact toughness, fatigue, creep, corrosion



Chemical characterization

of powders and bulk material



Metallurgy

Microstructure investigation, incl. SEM/EDS, EBSD, HR-TEM, XRD



Metrology

Optical (scanning), contact and non-contact measurement equipment



Thermo-physical properties, geometric features

Density, rheology, morphology, size distribution, weight, thermal expansion coefficients, etc.



Post-Processing @ Weaream



At its “high-TRL” operation site located within BLUETECHHUB® @BUFFOLI Industries in Brescia, Weaream Srl has full access to post-processing facilities, including:

- Heat Treatments (e.g., annealing, Q&T, stress relief, sintering ...)
- HIP
- Surface treatments (e.g., polishing, finishing, puppet, PVD, CVD, laser cladding, coatings ...)
- Machining





Weaream Srl has skilled operators, researchers and manufacturing specialists, and a staff of expert managers covering any aspects of Quality Assurance and Control, Sales and Marketing, Logistics, Financials, Administration, HR, R&D, in strict cooperation with Seamthesis Srl (private international RTO, main company's shareholder and holding leader) and partners. Main collaborations:

- National Universities and RTO: POLITO, POLIMI, POLIBA, UNIUD, UNIBS, UNIPI, UNIPG, UNIROMA1, UNIROMA2, UNINA-FEDERICO II, UNIME; CNR, INFN, ENEA, IIT, AREA, CSMT, MARE; Ministry of University and Research (MUR), Ministry of Industrial Activities (MIMIT); Ministry of Environment and Energy Safety (MASE); BUREAU VERITAS ITALY; Competence Centre (CIM4.0, MADE, START);
- EU Universities and RTO: TU Graz (AU), JR (AU), TUD (DK), Chalmers U (SW), KTH (SW), CEA (FR), AIMEN (ES), CEIT (ES), Munchen U (DE), Free University of Bruxelles (BE), KU Leuven (BE), DELFT U (NL), Nottingham U (UK)
- Shareholders
- Selected suppliers: technology (e.g., Freemelt, TRUMPF, 3D4MEC, 3DLab, ADDUP, HP) and services (
- Selected clients



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