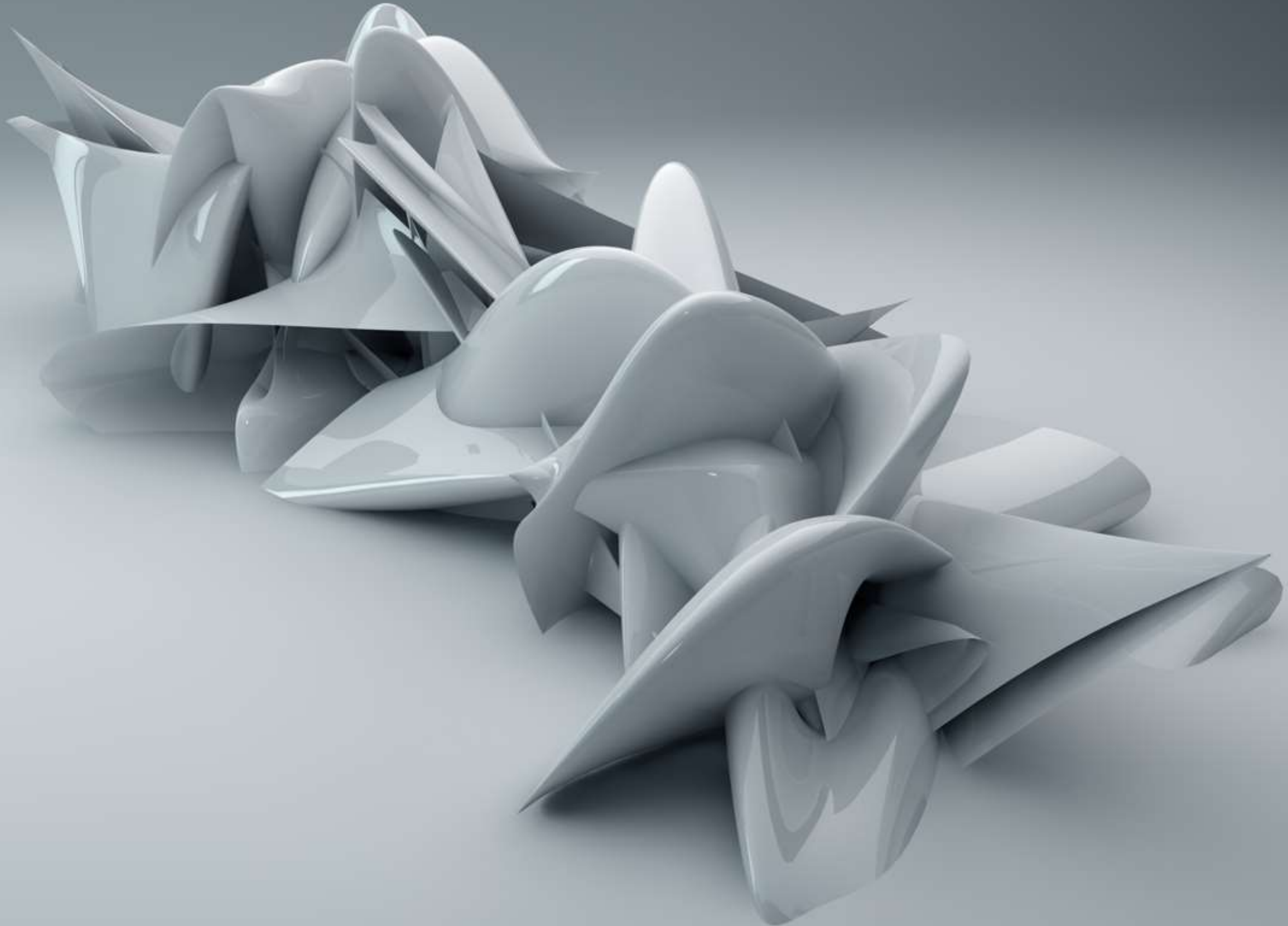
POLITECNICO
DI TORINO

IAM
Integrated Additive
Manufacturing@PoliTo



POLITECNICO DI TORINO

GENESIS of SKILLS

At **Politecnico di Torino**, the **first studies** related to **AM** were carried out by the DIGEP research group of **Prof. Ippolito** and **Prof. Iuliano** in the **early 90's**, when layer-by-layer technologies were renowned as **Rapid Prototyping (RP)**...

1991 – **European project on Rapid Prototyping Program** BRITE – EURAM

1995 – **First paper of AM in the International Journal**[1]

1996 – **First paper of AM Metal**[2]

2004 – **First paper on DFAM in the International Conference**[3]

2005 – Start **collaboration** with the **materials research group** (**Prof. Fino**)

TECNOGRANDA innovazione tecnologica e servizi alle imprese

1. R. Ippolito, L. Iuliano, A. Gatto. Benchmarking of Rapid Prototyping Techniques in Terms of Dimensional Accuracy and Surface Finish. CIRP Annals Elsevier
2. R. Ippolito, L. Iuliano, A. Gatto. EDM tooling by solid freeform fabrication and electroplating techniques Proceeding of 7th Solid Freeform Fabrication Symposium, Austin 12-14 August, Texas, USA
3. E. Bassoli, A. Gatto, L. Iuliano, F. Leali. Design for manufacturing of AN ergonomic joystick handgrip TSI Press Proceedings of the Sixth Biannual World Automation Congress, Seville (Spain)

POLITECNICO DI TORINO

AM@PoliTo

AMTech Research Group

Politecnico di Torino
Department of Management and Production Engineering

Prof. Luca Iuliano
Full Professor

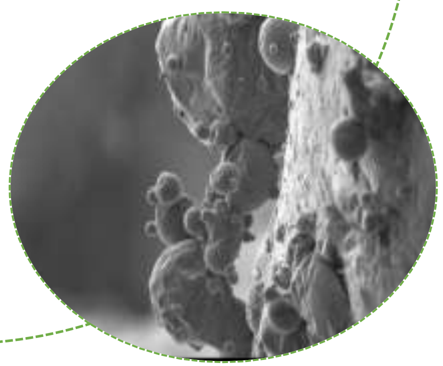
CAD/CAE/CAM
3D scanning systems
Advanced CNC machining
Additive manufacturing

DiSAT

Politecnico di Torino
Applied Science and Technology Department

Prof. Paolo Fino
Full Professor

Material Science
and Technology



COLLABORATIVE ACTIVITIES WITH iit @PoliTo
ISTITUTO ITALIANO DI TECNOLOGIA

Research group
13 Researchers
9 PhD students
10 Research fellows
Over 30 Master's candidate/years

AM@Politecnico di Torino

POLITECNICO DI TORINO

TECNOGRANDA
innovazione tecnologica e servizi alle imprese

EOSINT M250
(EOS GmbH)

2005

2007

Regional research project
Collaboration with Avio Aero in the development of EBM production of Titanium Alluminide blades.

Avio Aero
A GE Aviation Business

ISTITUTO ITALIANO DI TECNOLOGIA

Start of collaborative activities with IIT

EOSINT M270
(EOS GmbH)

2010

2015

Partnership
Prima Industrie – PoliTo
European research project
(**E-Break, Amaze, Helmet, Borealis,** etc)

PRIMA INDUSTRIE

POLITECNICO DI TORINO

RESEARCH RESULTS

ARTICLES

Over 200 articles on International Conferences /Journals

Over 300 articles on National Conferences /Journals

PATENT 2012

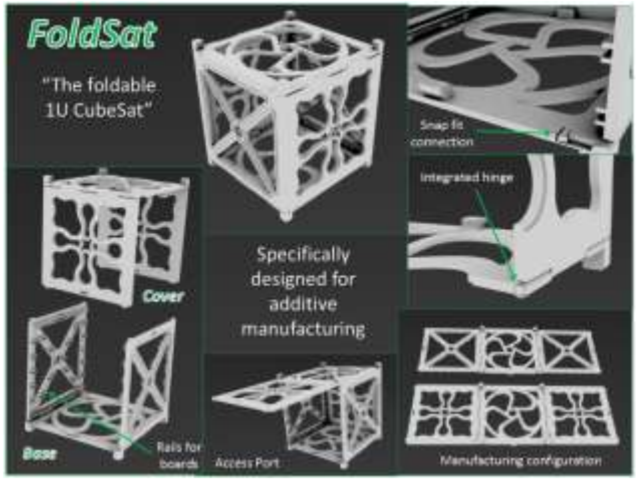
HAND EXOSKELETON

Lightweight, Integrated joints

ISTITUTO ITALIANO DI TECNOLOGIA

Inventors:
Eleonora ATZENI, Enrico BRUNO, Flaviana CALIGNANO, Diego MANFREDI, Elisa AMBROSIO

1ST PLACE CUBESAT CHALLENGE WINNER 2015



FOLDSAT *By Paolo MINETOLA, Giovanni MARCHIANDI*

3^{rd} PRIZE

within Award for the best project from Partners and Consortia - 2017

JTI Clean Sky project GETREADY

Sara BIAMINO, Daniele UGUES

POLITECNICO DI TORINO

iit @PoliTo
ISTITUTO ITALIANO DI TECNOLOGIA

THE ACQUIRED KNOWLEDGE OF THE INDIVIDUAL GROUPS INVOLVED IN THE IAM@POLITO CENTRE REPRESENTS AN OPTIMAL STARTING POINT TO BEGIN A NEW, MORE AMBITIOUS AND COMPLICATED ROUTE THAT CAN ONLY BE FACED THANKS TO THE SKILLS OF THE VARIOUS INDIVIDUALS THAT ARE INVOLVED

20 RESEARCHERS
20 RESEARCH FELLOWS / PHD STUDENTS

IAM
Integrated Additive Manufacturing@PoliTo

DIGEP
DEPARTMENT OF MANAGEMENT AND PRODUCTION ENGINEERING

PROF. LUCA IULIANO
PROJECT MANAGER IAM@POLITO

DAUIN
DEPARTMENT OF CONTROL AND COMPUTER ENGINEERING

PROF. ENRICO MACII
PERSONS IN CHARGE

DISAT
DEPARTMENT OF APPLIED SCIENCE AND TECHNOLOGY

PROF. PAOLO FINO
PERSONS IN CHARGE

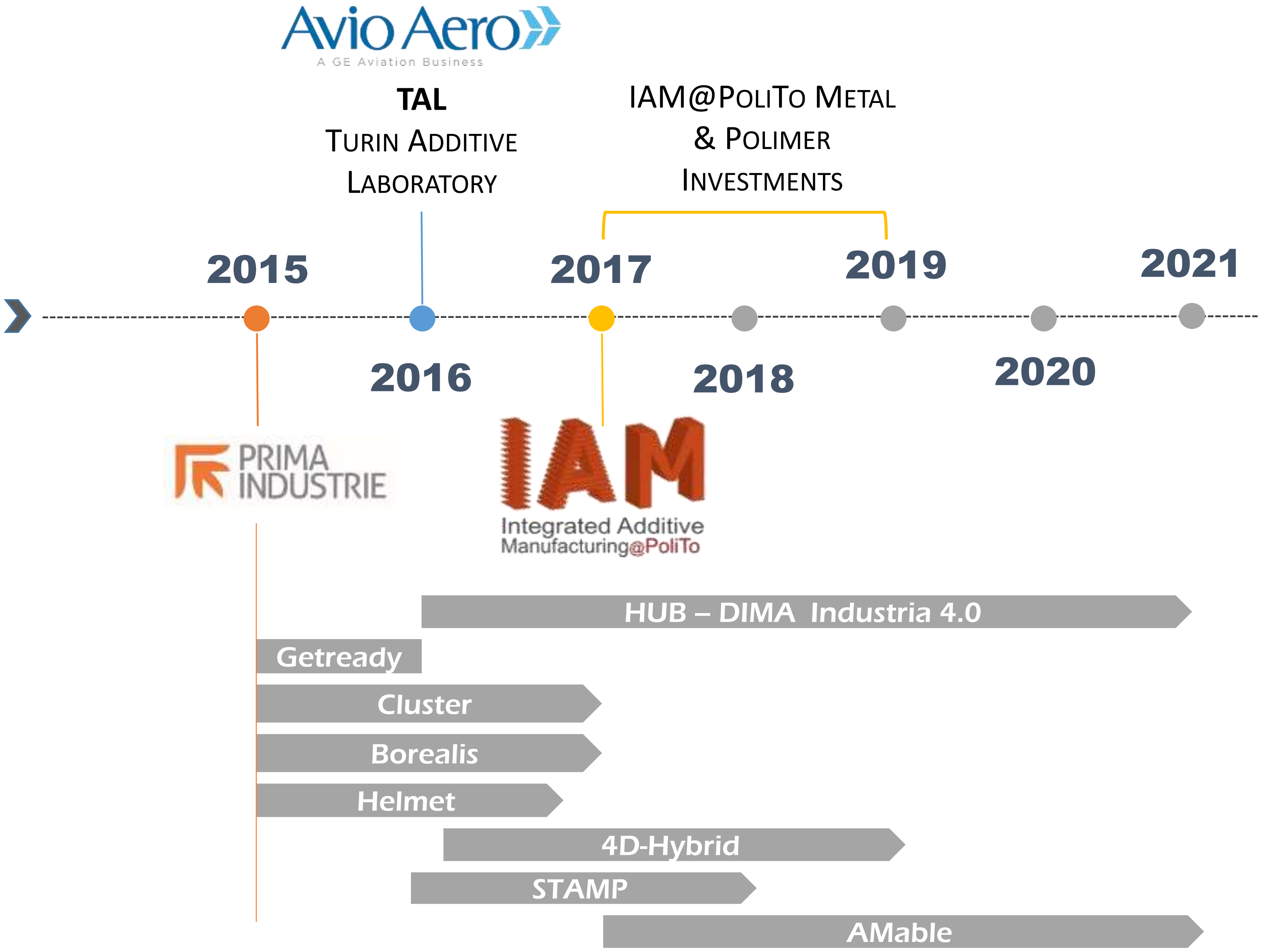
DET
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATIONS

PROF. GUIDO PERRONE
PERSONS IN CHARGE

DIMEAS
DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

PROF. MASSIMO ROSSETTO E PROF. TERENZIANO RAPARELLI
PERSONS IN CHARGE

POLITECNICO DI TORINO



METAL INVESTMENTS

2017 · 2018 · 2019 · 2020 · 2021

Laser Powder Bed Fusion
EOSINT M270 @IIT

Hot Isostatic Pressing

Computer Tomography

2nd Laser Powder Bed Fusion (<u>in order phase</u>)
Infra-P – Pilot line

Electron Powder Bed Fusion
Arcam A2x

3rd Laser Powder Bed Fusion (<u>in order phase</u>)
Materials development

Gas Atomizer
Metal powders production

Polymer

Investments

Fused Deposition Modeling
3ntr A4

Fused Deposition Modeling
Dimension Elite

Fused Deposition Modeling
F370

Materials
ABS M30
ABS ASA
PC-ABS
PLA
HIPS
Nylon Carbon
PA66 GF
PETG
TPU

2017 | 2018

Fused Deposition Modeling
Markforged Mark Two

Materials
Nylon
Onyx
Carbon fiber
Fiberglass
Kevlar

Stereolithography
(<u>in order phase</u>)
Materials development

Selective Laser Sintering
EOS Sintratec KIT
EOS Formiga

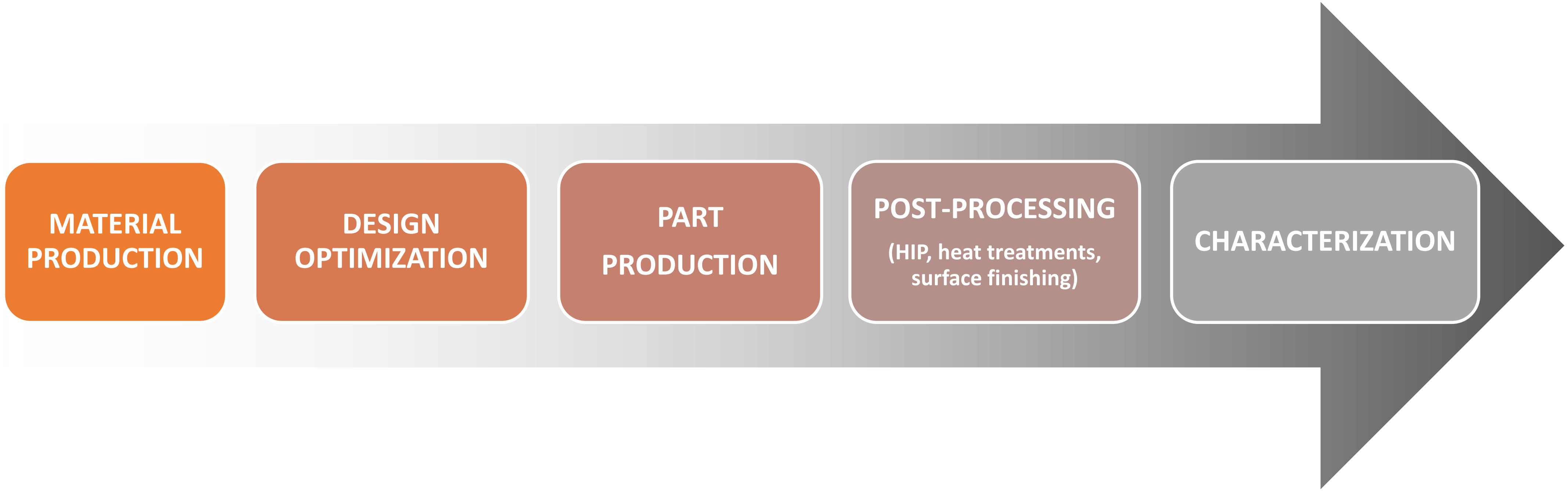
Materials
Nylon
Nylon glass filled
Nylon Al filled
Nylon carbon filled

POLITECNICO DI TORINO

Integrated Additive Manufacturing@PoliTo

METAL POLYMER

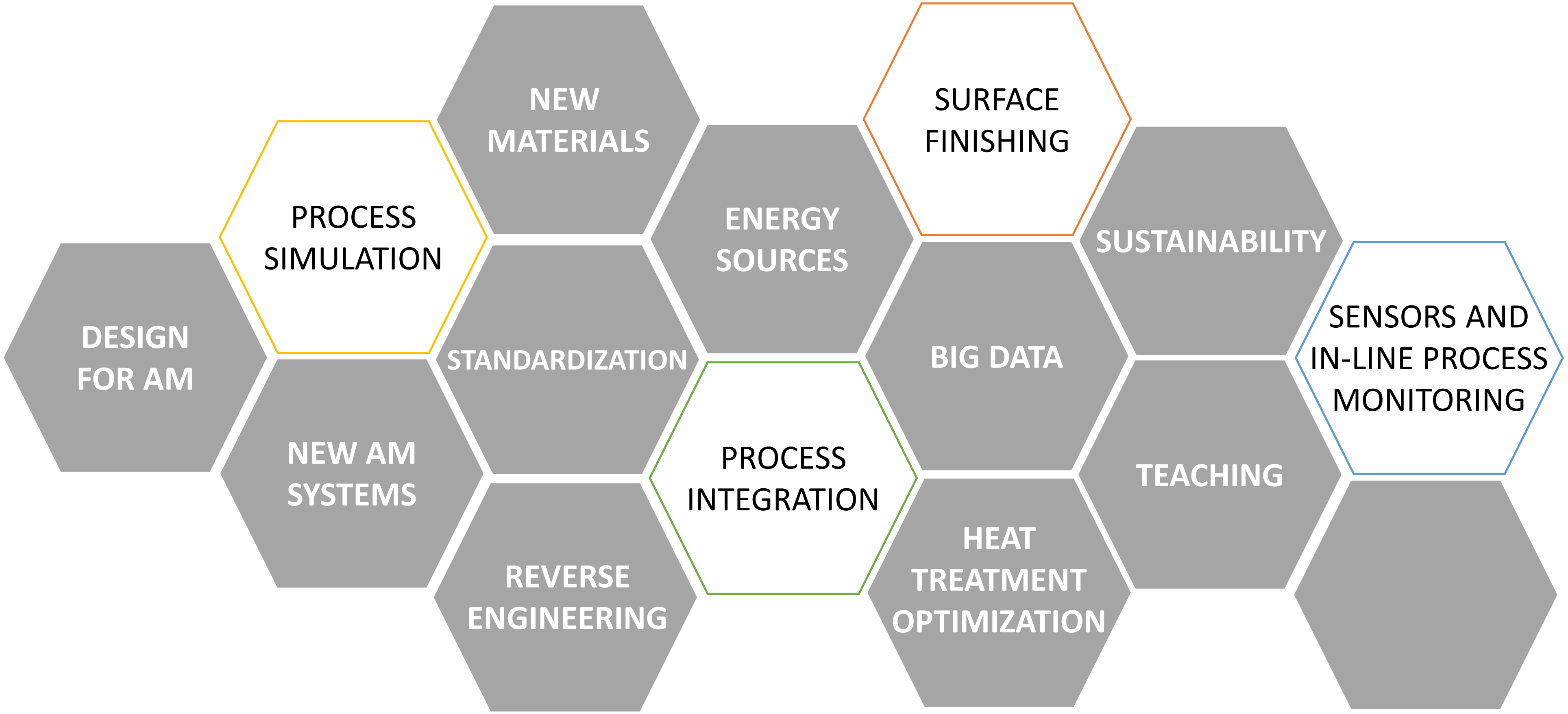
SUPPLY CHAIN



POLITECNICO DI TORINO

Integrated Additive Manufacturing@PoliTo

ACTIVITIES

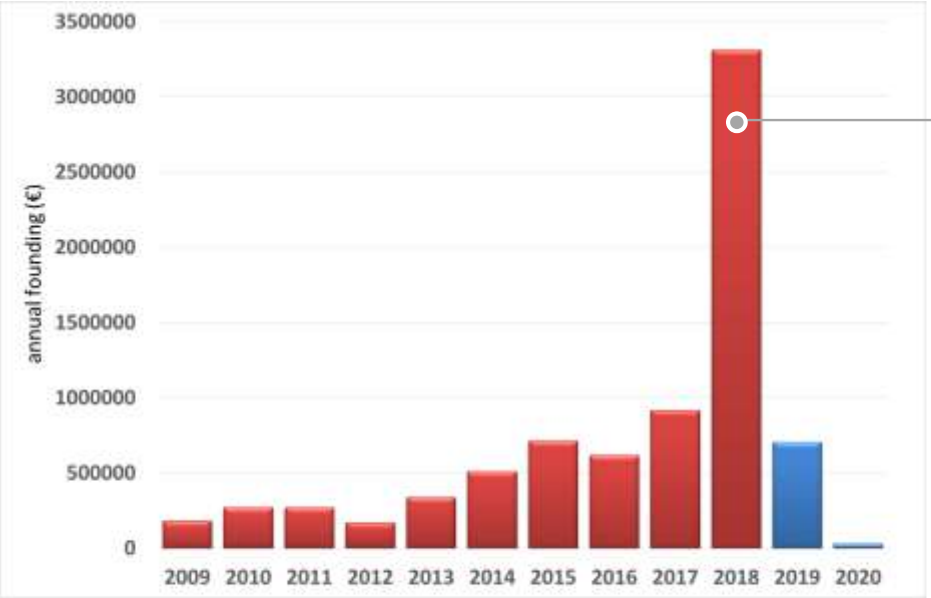


POLITECNICO DI TORINO

FUNDING

SOME EXAMPLES

4D HYBRID – Horizon 2020 (EU)
Novel hybrid approaches for additive and subtractive manufacturing machines
Budget 10M€, IAM 1M€



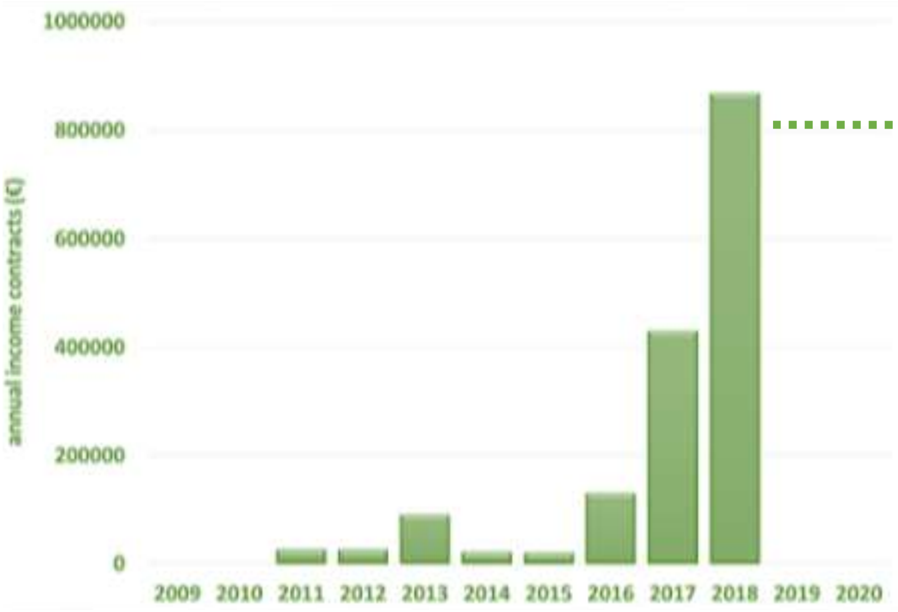
INFRA-P Call: 2 M€

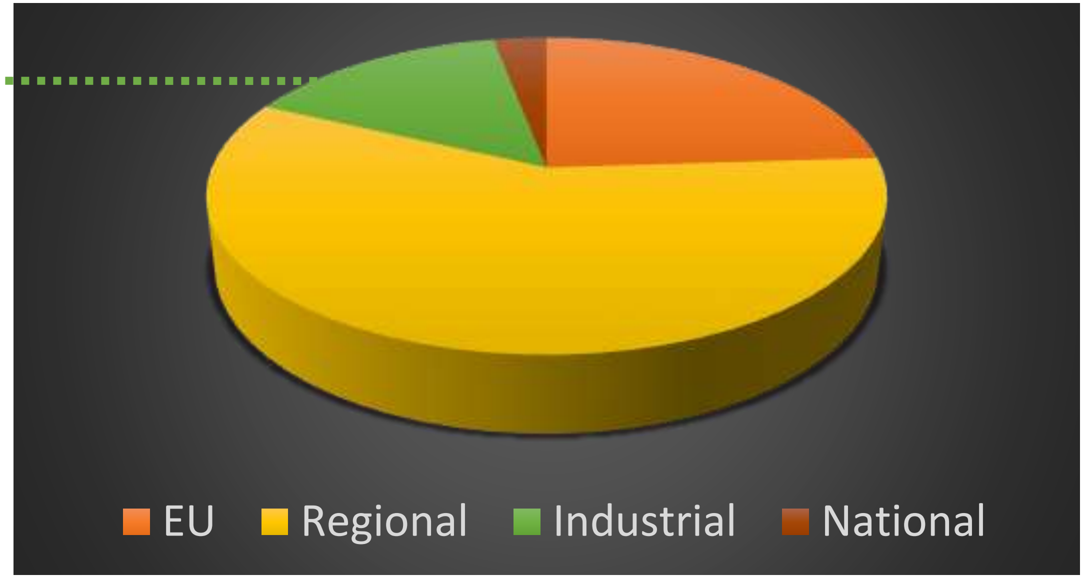
Support for projects for the construction, strengthening and expansion of public research infrastructures

Cumulative amount from 2009
External resources € 10.749.500,00
Internal resources for facilities € 3.000.000,00

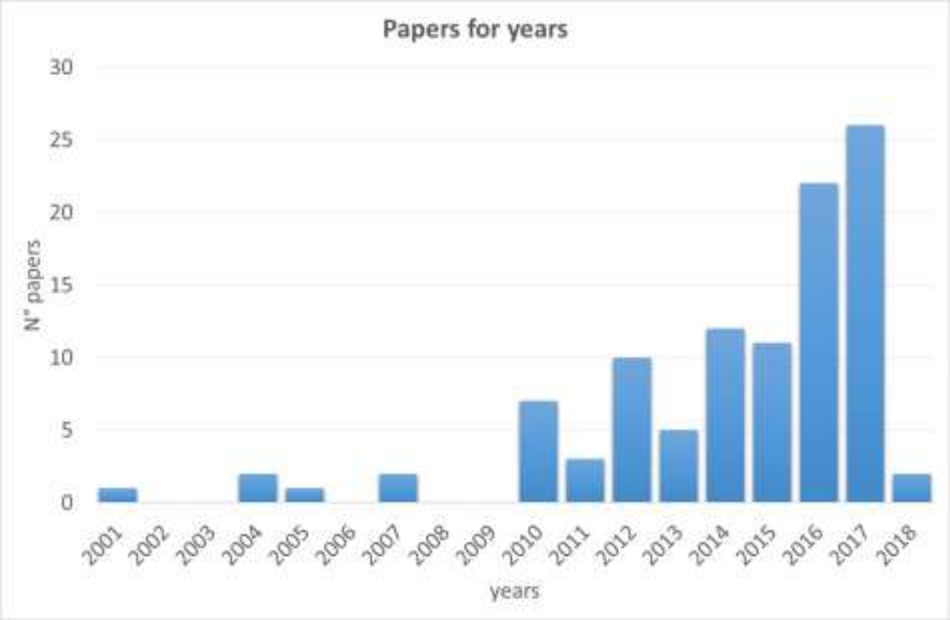
STAMP (Regional)
Development of AM Technology in Piemonte
Budget 12M€, IAM 1.5M€

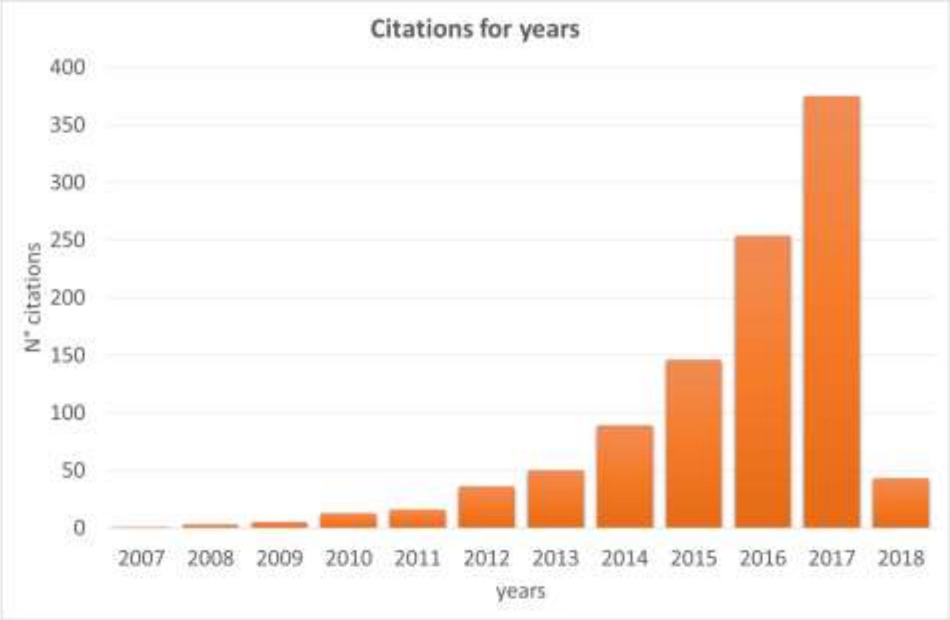
AVIONICA
Design for AM
Budget IAM 0.5M€





POLITECNICO DI TORINO





104 papers on AM topics

1031 citations in the last 10 years

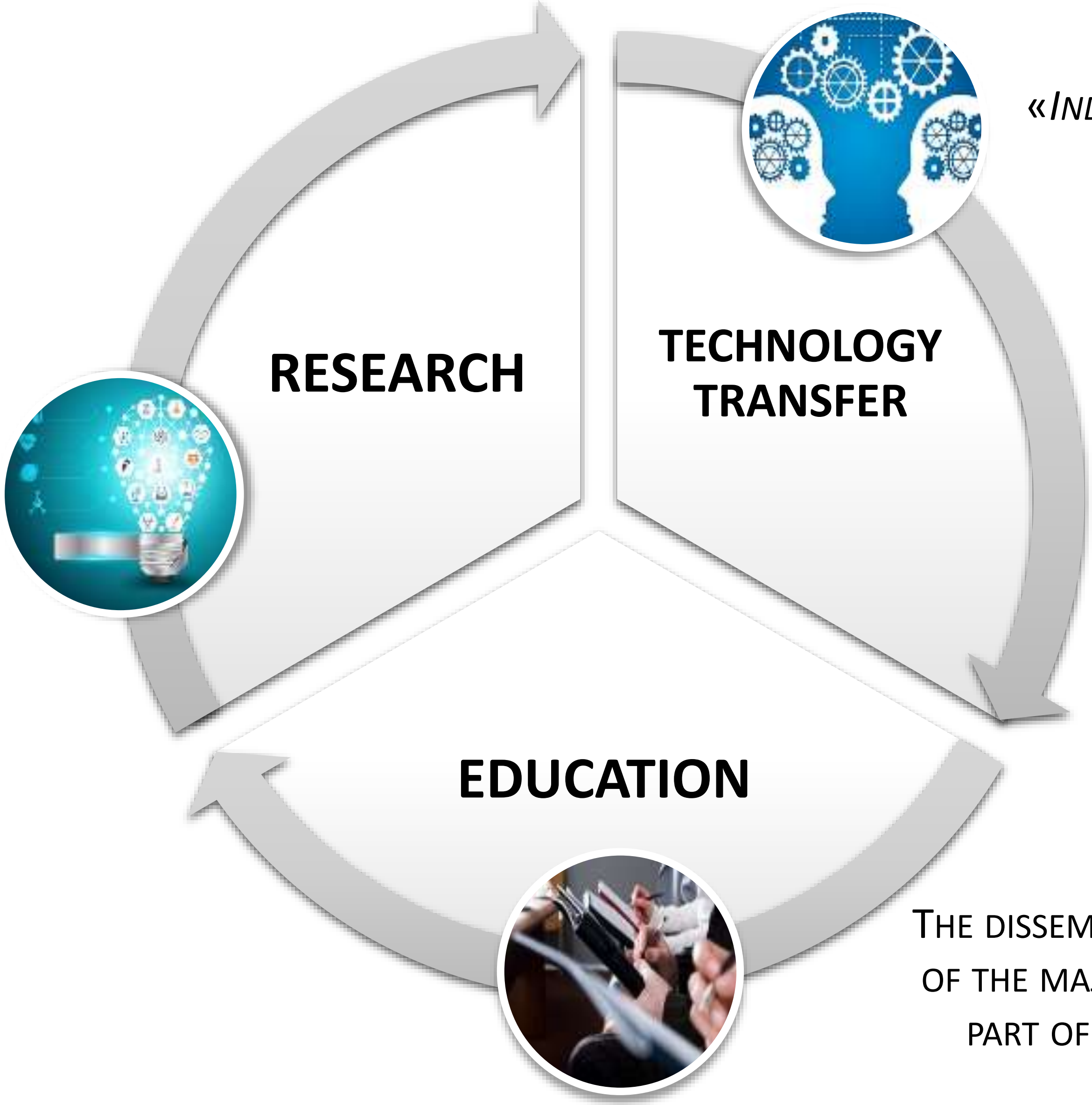
Most cited papers:

2012 International Journal of Advanced Manufacturing Technology	**125 citations**
2011 Intermetallics	**119 citations**
2007 Rapid Prototyping Journal	**107 citations**
2013 Materials	**93 citations**

POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

Research with the involvement of companies such as FCA, GE Avio, Prima Industrie,…



«Industry-funded academic inventions boost innovation»
Nature Comment,
Brian D. Wrigh et al.

The dissemination of knowledge is one of the major focuses and an integral part of the Center IAM@PoliTo

POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

Research with the involvement of companies such as FCA, GE Avio, Prima Industrie,…

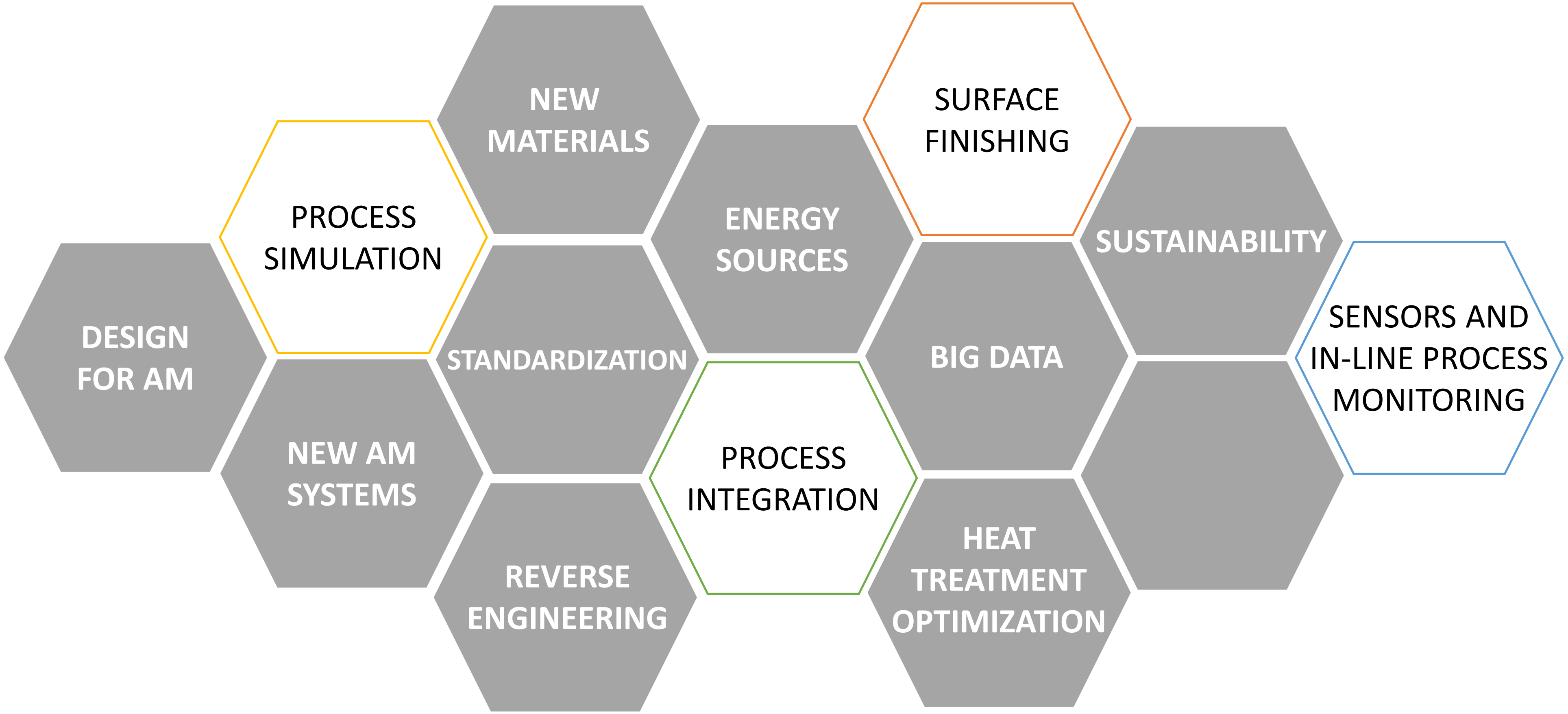
RESEARCH

- **SCOUTING** and **TECHNOLOGICAL ASSESSMENT**
- **INVESTMENTS** in **INFRASTRUCTURE**
- **SUPPLY CHAIN PROJECTS**
- **PILOT LINE** for **RESEARCH**

Field for interest:

- Metal
- Polymer
- Reverse Engineering

Research ACTIVITIES



POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

RESEARCH METAL

EBM

HT Mat

TiAl 4822
TiAl Hi Nb
Superalloys

SLM

Lightweight

Al Alloys
MMC (Ti,Al,Mg)

Smart

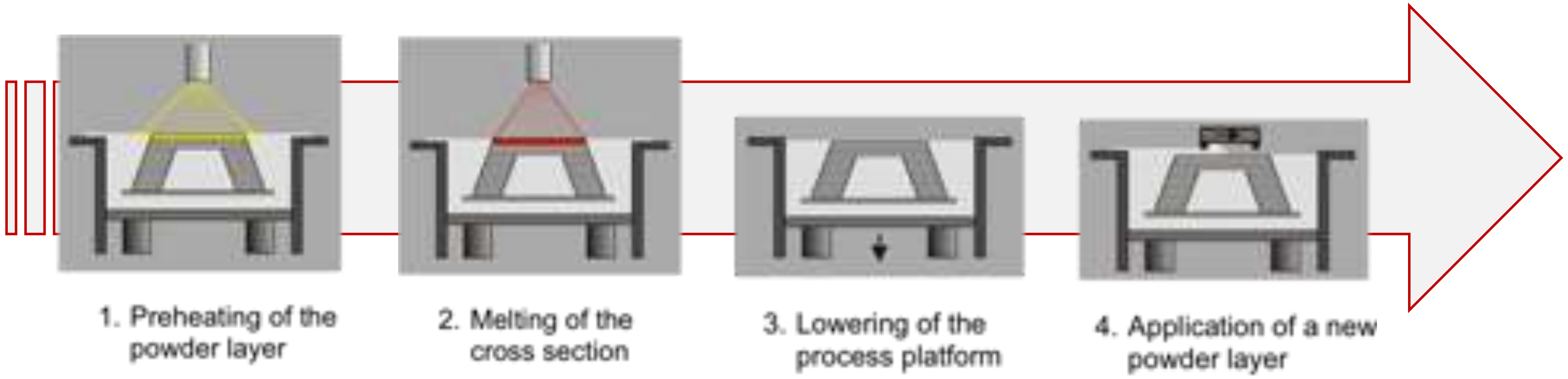
SMA
MMC + Piezo

Avio Aero A GE Aviation Business

ThalesAlenia A Thales / Finmeccanica Company Space

RESEARCH METAL

EBM



Strong interaction with GE-AvioAero

TiAl 4822 / TiAl Hi Nb

- **Powder evaluation** (composition/morphology/behavior in process)
- Sample evaluation and support in the **optimization process**
- **Heat treatment** setup/correlation microstructure-properties
- **Failure analysis/mechanism**

Renè 80

- **Powder evaluation** (composition/morphology)
- Sample evaluation and first indications for the **optimization process**
- **Heat treatment** setup

POLITECNICO DI TORINO

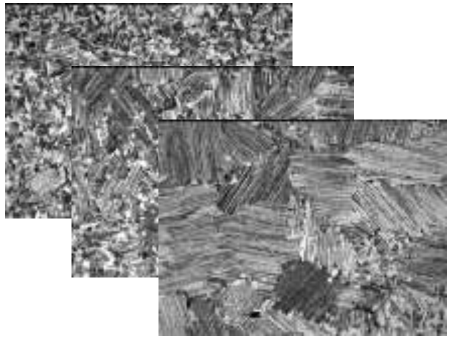
IAM Integrated Additive Manufacturing@PoliTo

RESEARCH METAL

EBM Approach

Production → Alloy selection → Process optimization

Heat treatment setup → Microstructure selection → Optimal microstructure definition



Mechanical and thermal properties tests

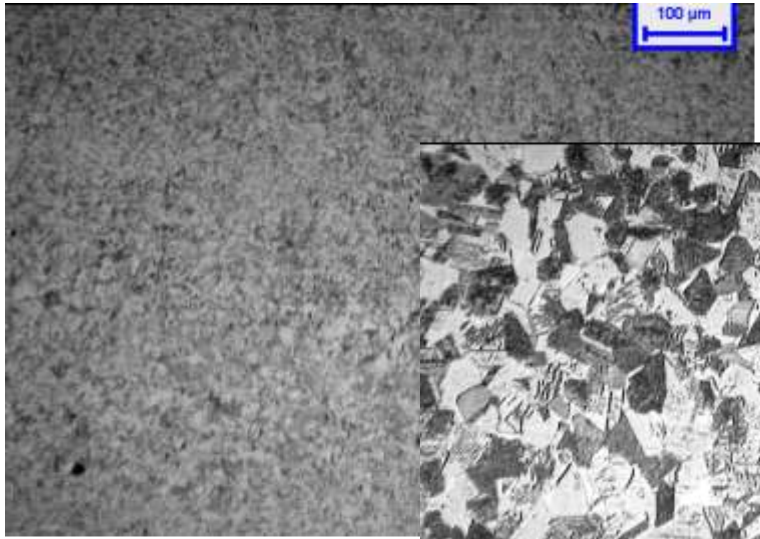
POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

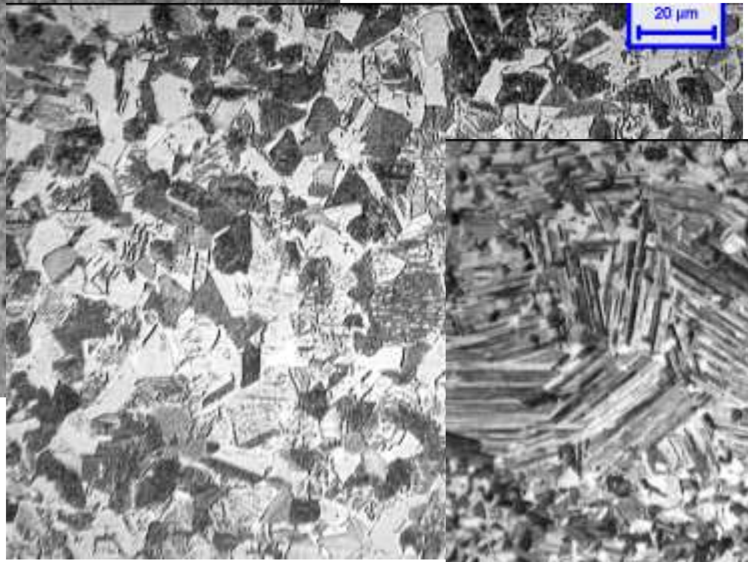
RESEARCH METAL

EBM
Approach

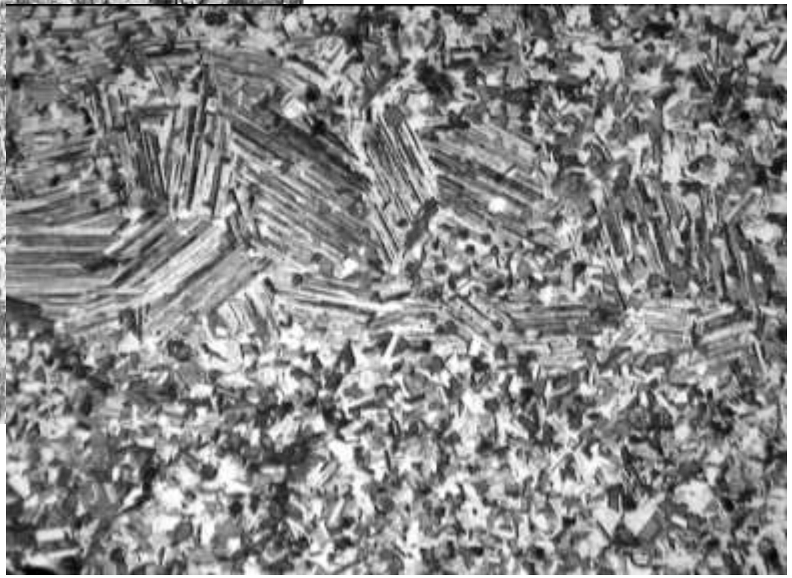
EBM Ti-48Al-2Cr-2Nb Microstructures



As-built by EBM

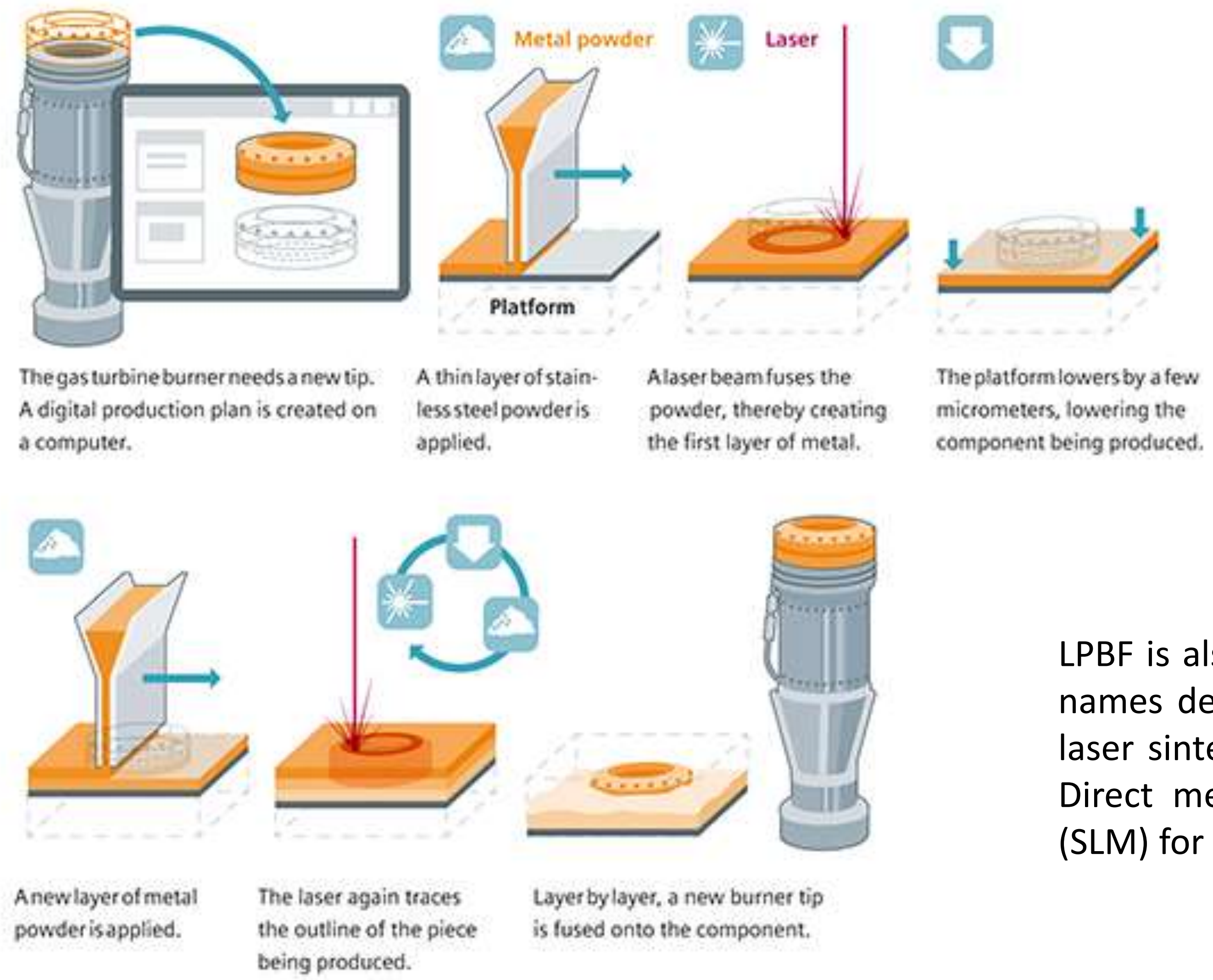


HIP
Fully equiaxed
Grain size <50 µm



Heat Treatment
Duplex structure
Lamellar colonies ~150 µm
Lamellar phase fraction ~ 40%

SLM

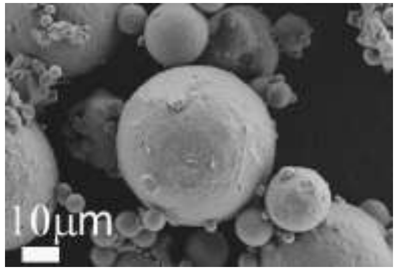


It is a net-shape process, producing parts with very high mechanical properties due to **the very fine microstructure** typical of this process.

When metallic powders are used for the production of parts, this process is generally known as **Selective Laser Melting (SLM),** now called **Laser Powder Bed Fusion (L-PBF)** according to ISO/ASTM 52900.

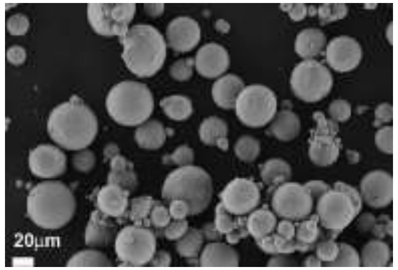
LPBF is also known and present in literature with different commercial names depending on the machine manufacturer, such as direct metal laser sintering (DMLS) for EOS Gmbh, LaserCUSING for Concept Laser, Direct metal printing (DMP) for 3D System, Selective Laser Melting (SLM) for SLM Solutions, Realizer, Matsuura and Renishaw

Al Alloy and composites



- **Powder evaluation** (composition/morphology/behavior in process)
- **Powder mixing** (If necessary)
- Study of the **process parameter** influence on mechanical properties
- **Post treatment** setup
- **Mechanical and microstructural tests**

Ti Alloy



- **Powder evaluation** (composition/morphology)
- Study of the **process parameter** influence on mechanical properties
- **Heat treatment** setup
- **Post treatment** setup

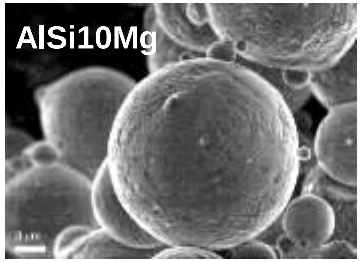
POLITECNICO DI TORINO
IAM Integrated Additive Manufacturing@PoliTo

RESEARCH METAL

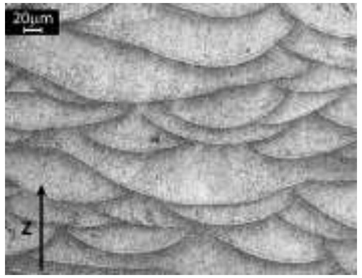
SLM Approach

IIT @PoliTo ISTITUTO ITALIANO DI TECNOLOGIA

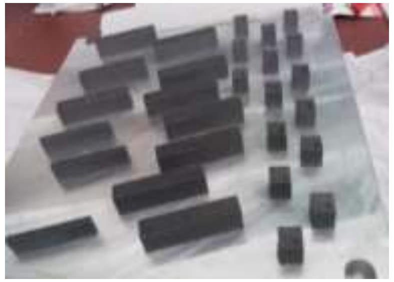
Design and production → Alloy selection and design → Process optimization



Heat treatmet setup and surf. finishing → Microstr. selection → Optimal Microstructure definition



Mechanical and thermal properties tests



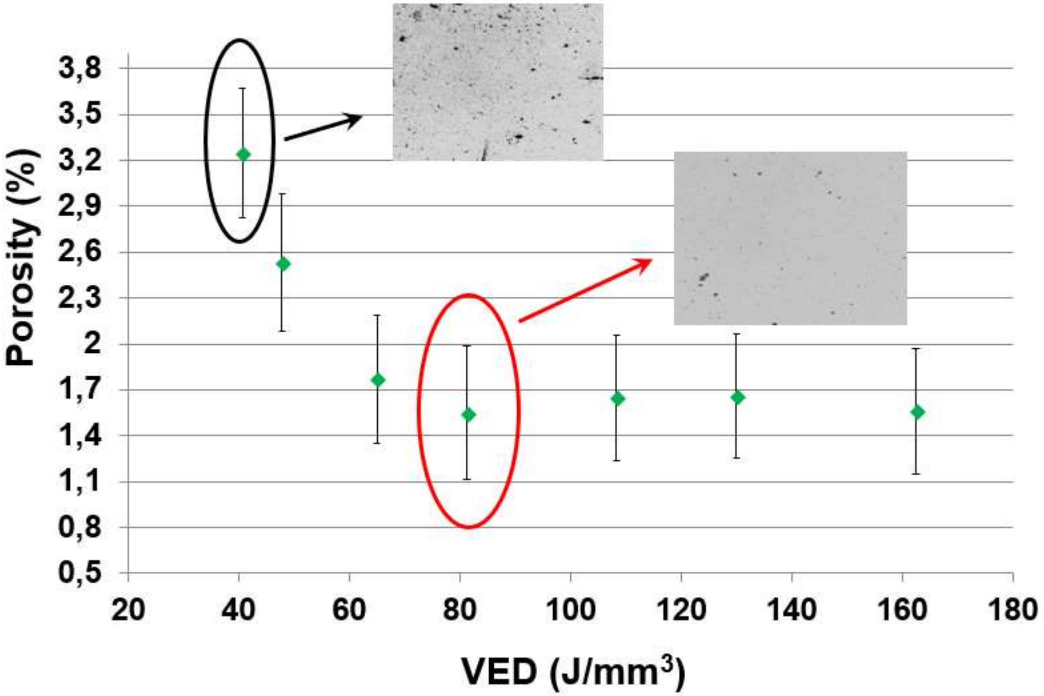
SLM

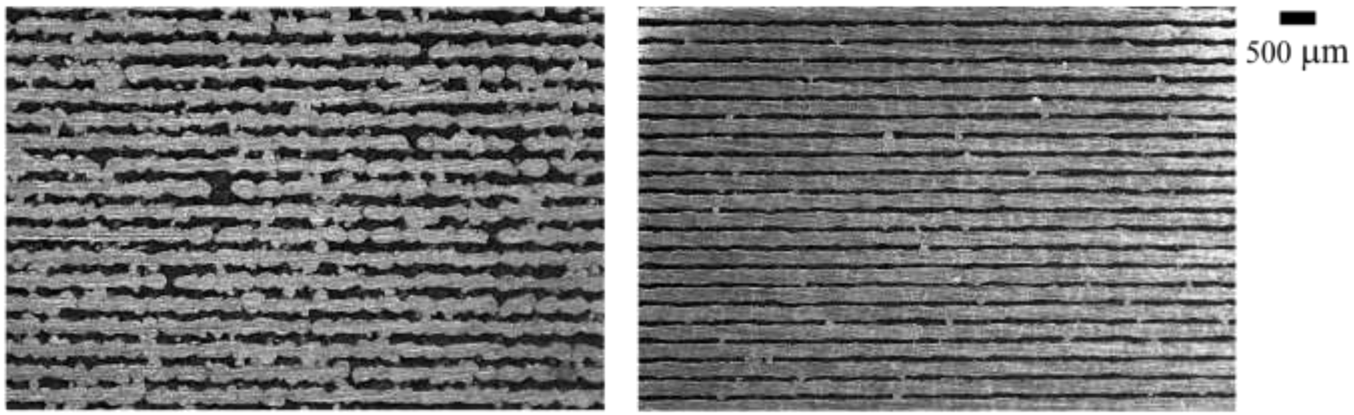
Process optimization

ISTITUTO ITALIANO DI TECNOLOGIA iit @PoliTo

It is possible to read in the literature “**Fundamental to find the best process window**”…. **but it is not correct….**

Laser power and scanning speed have a significant influence on the stability of the scan tracks. However, their ratio expressed as a linear energy (P/v), as well as a volumetric energy density (VED) does not capture the kinetics of the melt pool and therefore fails to accurately describe many other properties such as track shape (height and depth) and the resulting melting mode.





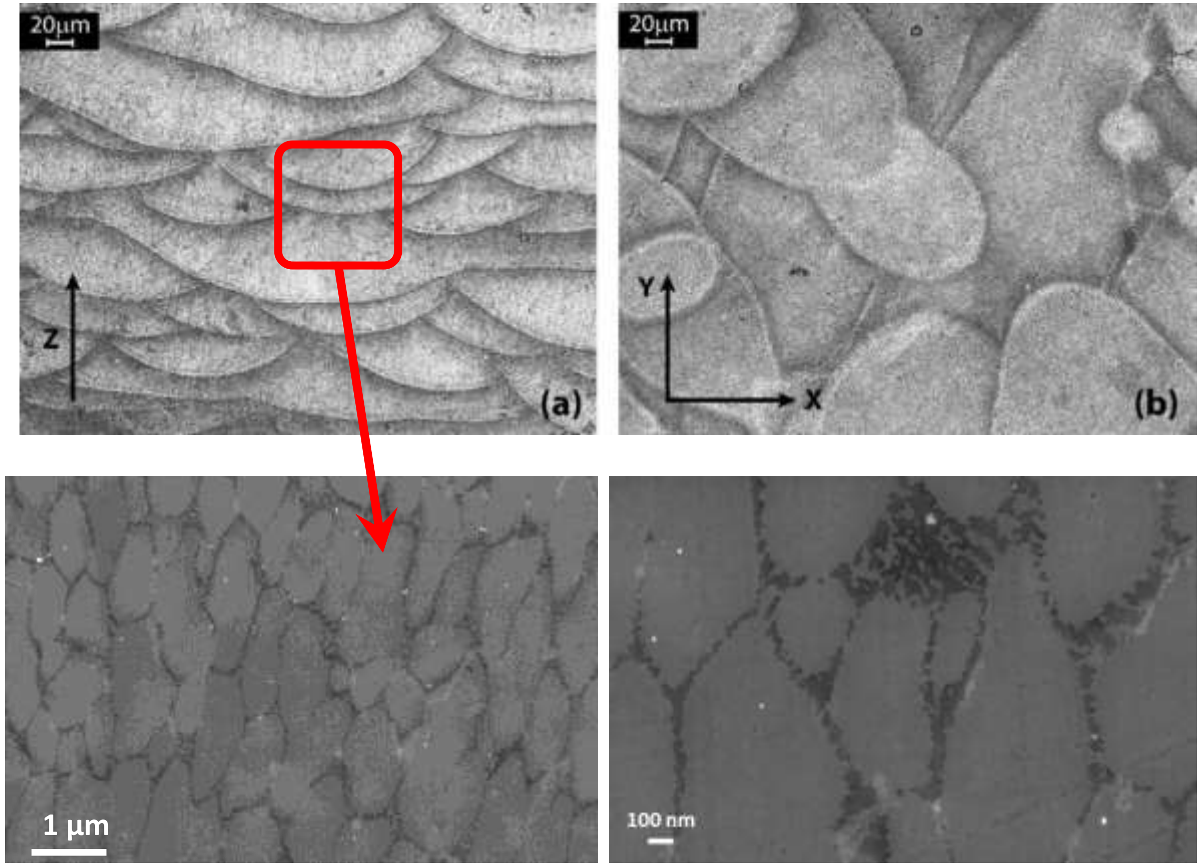
$P = 60$ W, $v = 100$ mm/s $P = 180$ W, $v = 300$ mm/s

$E = 50$ J/mm^3

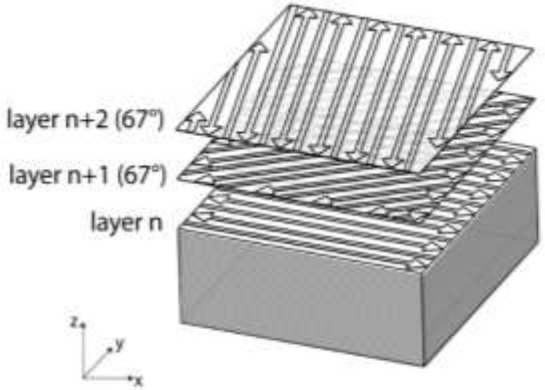
Samples with same VED, but they have different track morphologies.

Calignano F., Cattano G., Manfredi D, 2018. Manufacturing of thin wall structures in AlSi10Mg alloy by laser powder bed fusion through process parameters. Journal of Materials Processing Tech. 255, 773–783

SLM
Microstructures



Typical microstructural details of the Al alloy by DMLS highlighted by chemical etching:
(a) scan tracks signs, **melt pools** (along z axis)
(b) melt pools on xy section



Darker areas → Si rich
Grey areas → Al euctectic zones

EXTREMLY FINE

POLITECNICO DI TORINO

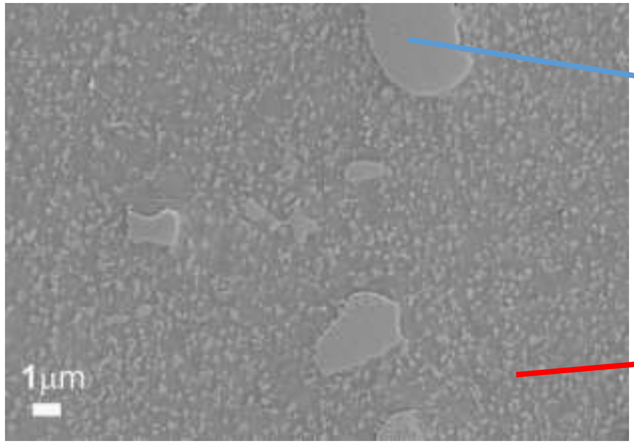
IAM Integrated Additive Manufacturing@PoliTo

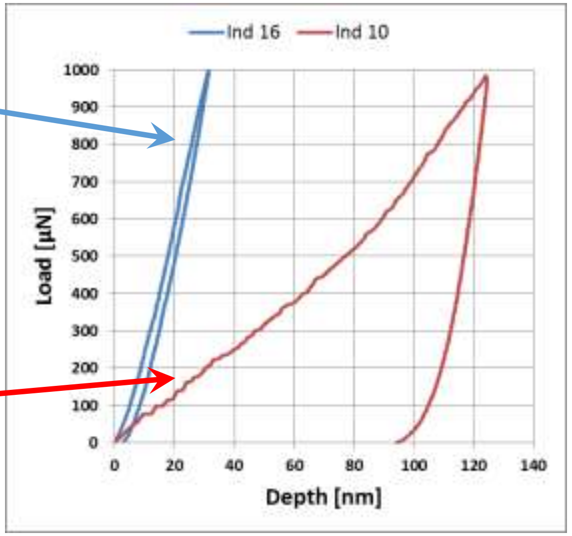
RESEARCH METAL

SLM

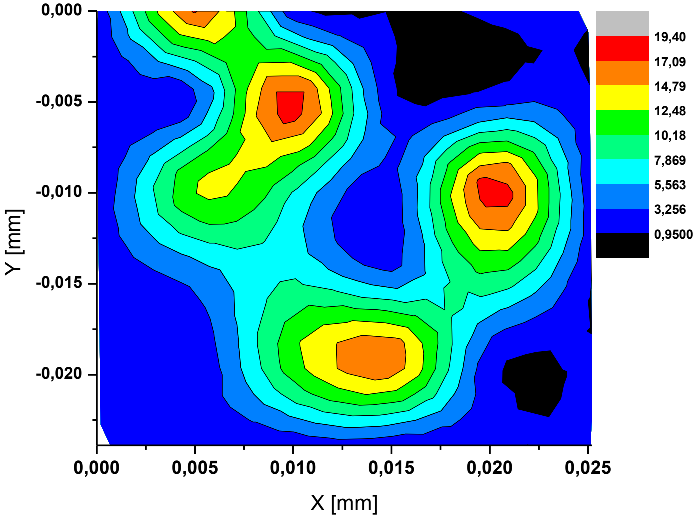
Characterization at the nanoscale

ISTITUTO ITALIANO DI TECNOLOGIA



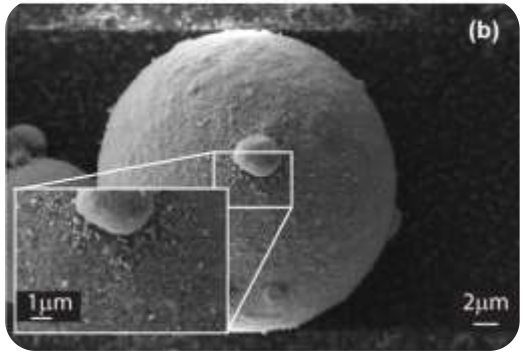


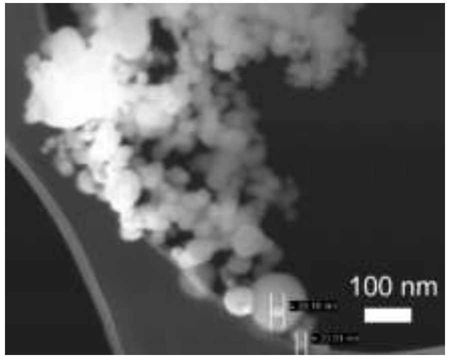
Nanoindentation technique



Study of micro ceramic-reinforced (TiB_2) in Aluminium alloy matrix

SEM & TEM:
from the micrometer to the nanometer level.





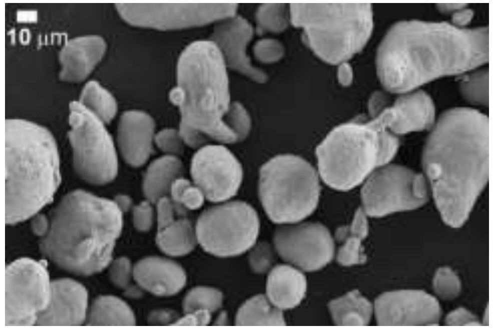
POLITECNICO DI TORINO
IAM Integrated Additive Manufacturing@PoliTo

RESEARCH METAL

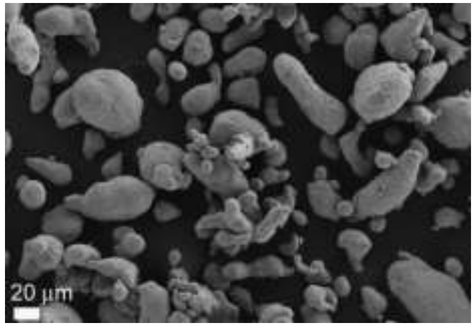
SLM
Materials developed

ISTITUTO ITALIANO DI TECNOLOGIA @PoliTo

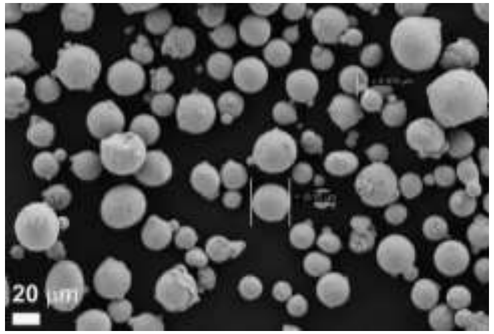
A357



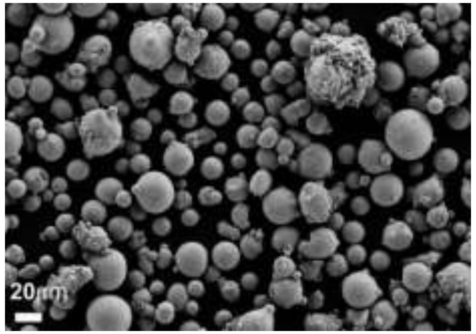
7075



In718



In625

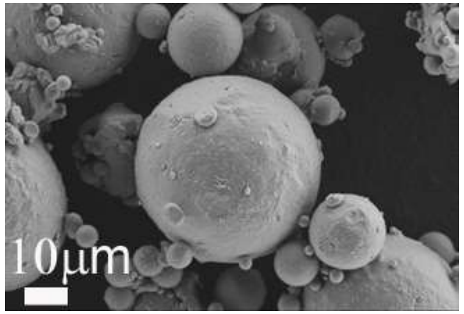


MATERIALS TO BE DEVELOPED

- Other Al alloys for aerospace (2xxx, 6xxx, etc)
- Other Al based Composites
- Ti based Composites
- Cu and Cu based alloys
- Functional materials (e.g. SMA)

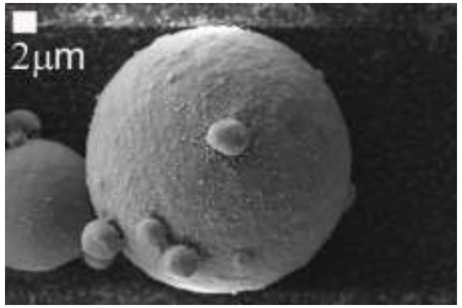
SLM
Way to composites

Aluminum powder	+	Reactive ceramic powder	= ?	Homogeneity
				Stability
				Flowability
		Inert ceramic powder		Densification parameter
				Reactivity control

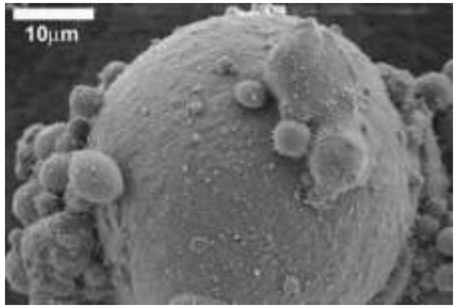


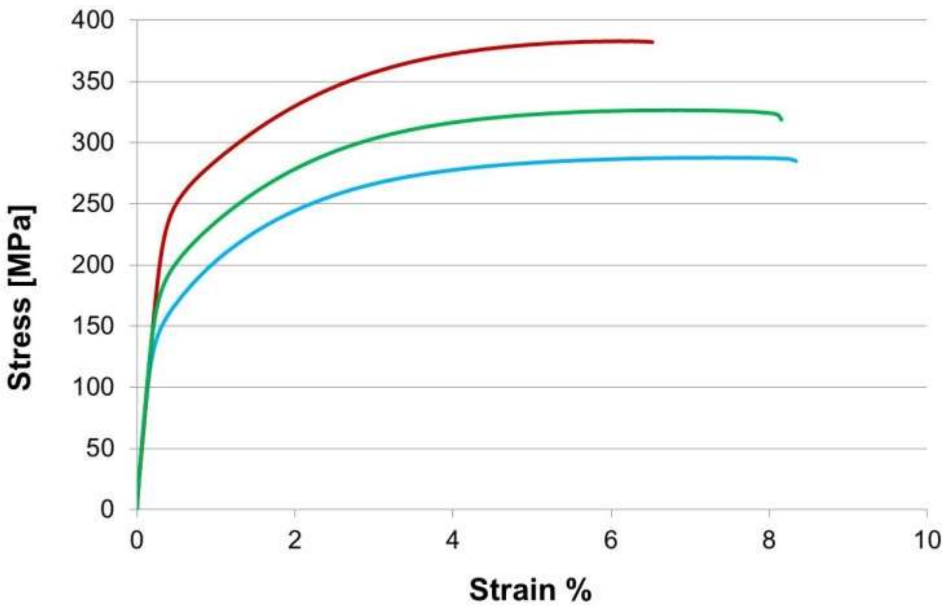
AlSi10Mg

AlSiMg / nano$MgAl_2O_4$



AlSiMg / nanoTiB_2





SLM

Way to composites

With DMLS : ***ex situ*** and ***in situ*** composites

Gu et al., Int Mat Reviews, vol 57 n.3 (2012)

- Ceramic reinforcing phases are added exteriorly into the metal matrix
- Normally obtained by mechanically alloying a mixture of different powder components → "**simple**" approach

⇓

- ➢ Micro and nano $MgAl_2O_4$ reinforced AlSi10Mg alloy
- ➢ Micro and nano TiB_2 reinforced AlSi10Mg alloy

Dadbakhsh et al., J. Alloys and Compound, 541 (2012)

- The constituents are synthesised by chemical reaction between elements during rapid solidification → a sort of "bottom up approach"
- There is still **little understanding** on the consolidation behaviour and in situ formed microstructure

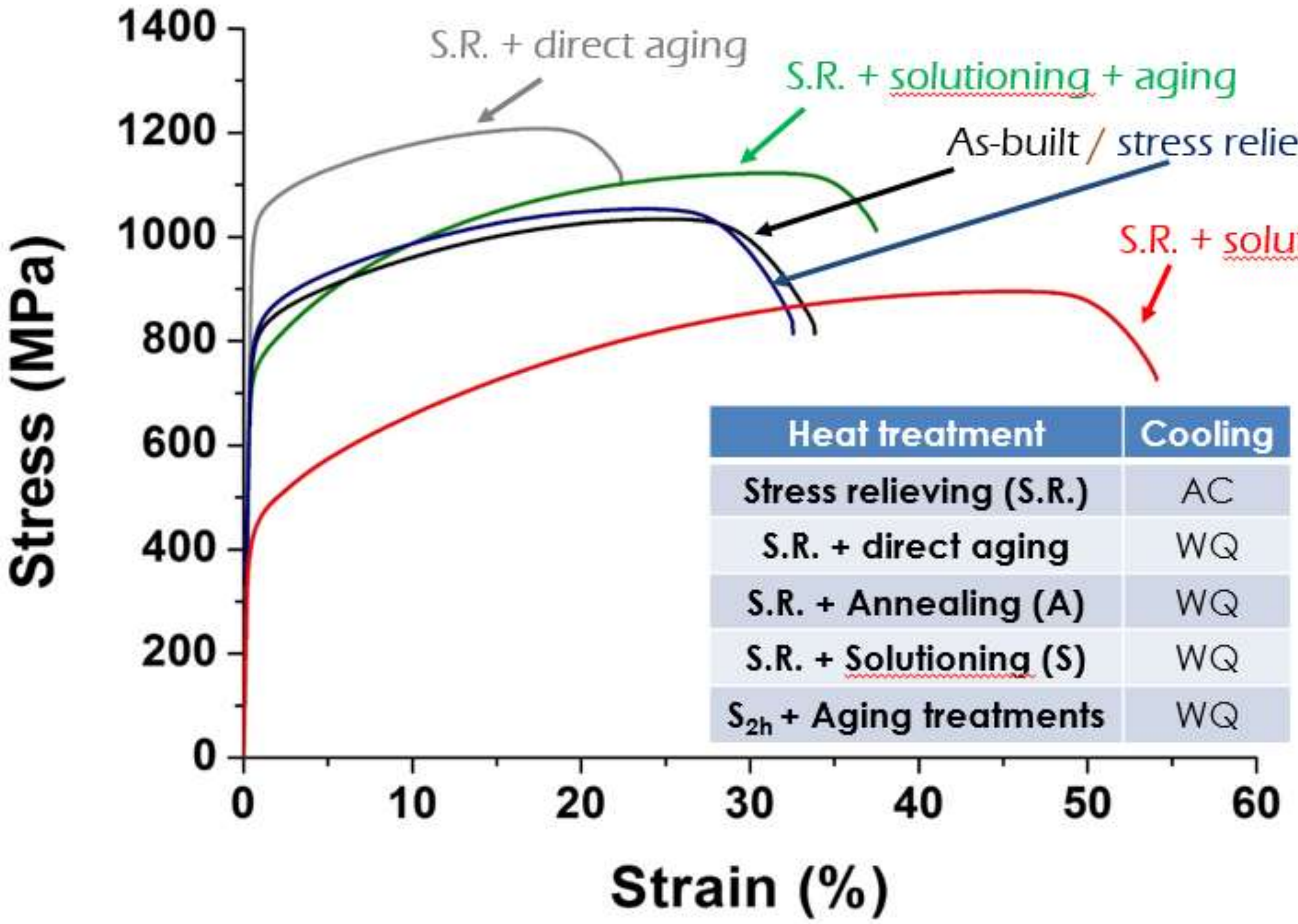
⇓

- ➢ nano SiO_2 reinforced AlSi10Mg alloy → → should produce Al-Al_2O_3

SLM

Thermal treatments

Study of the effect of thermal treatments on tensile behaviour



Heat treatment	Cooling
Stress relieving (S.R.)	AC
S.R. + direct aging	WQ
S.R. + Annealing (A)	WQ
S.R. + Solutioning (S)	WQ
S_{2h} + Aging treatments	WQ

AC = Air cooled

WQ = Water quenched

POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

RESEARCH METAL

EBM

Simulation of the process

Thermal Model of the EBM Process

Heat Transfer Analysis

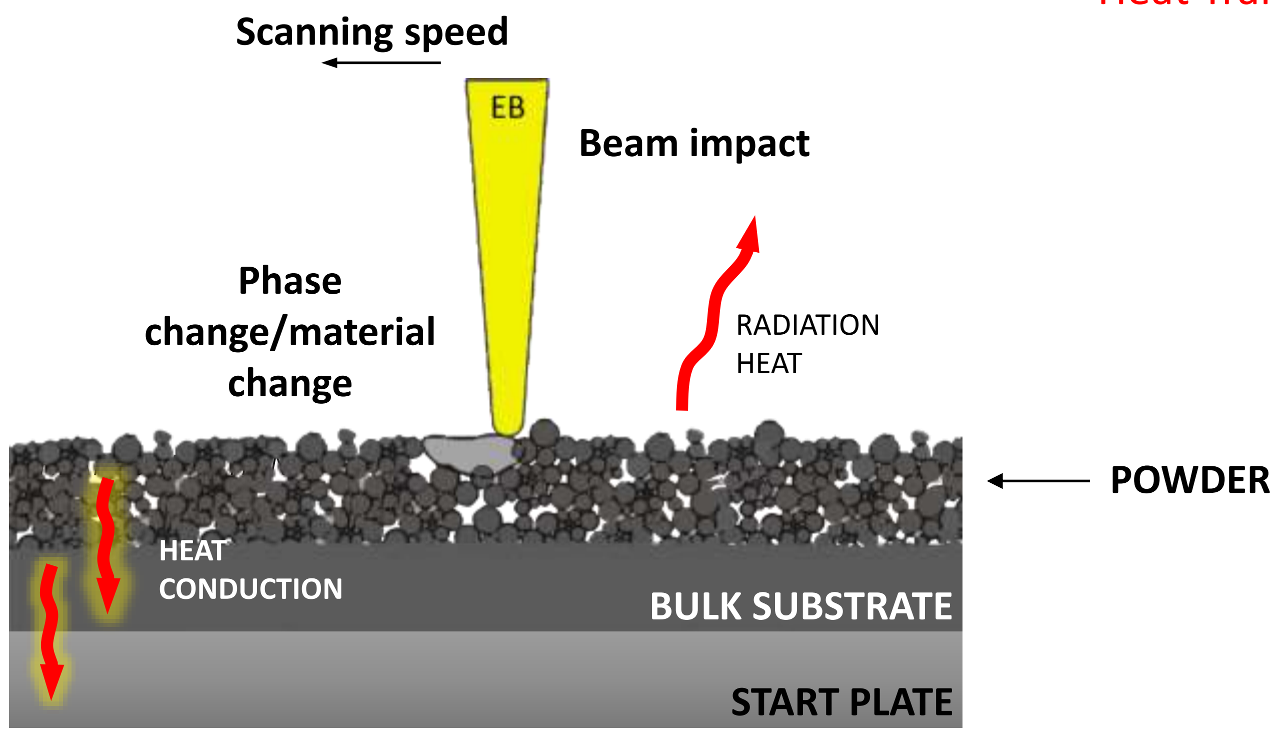
$$-\nabla \cdot \mathbf{q} = \rho \frac{De}{Dt}$$

$$e = c\,T + \Delta h$$

$$\Delta h = \begin{cases} L & T \geq T_l \\ f_s L = \dfrac{T - T_s}{T_l - T_s} L & T_s < T < T_l \\ 0 & T \leq T_s \end{cases}$$

$$\mathbf{q} = -\lambda \nabla T$$

$$T = T\,(x_1, x_2, x_3)$$



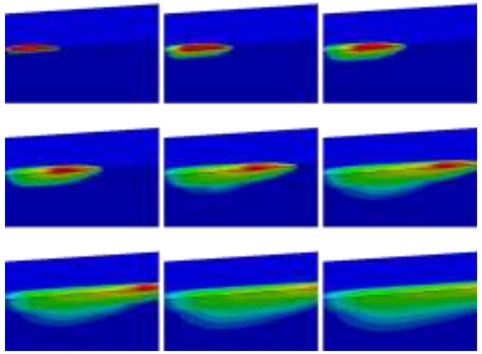
EBM

Simulation of the process

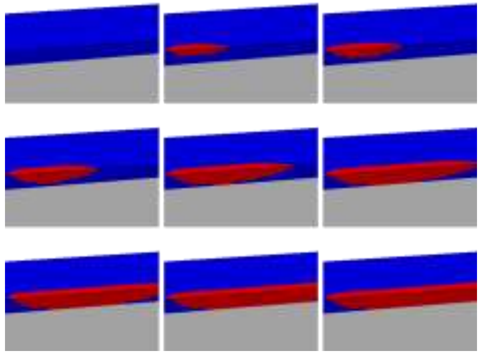
Thermal Model of the EBM Process

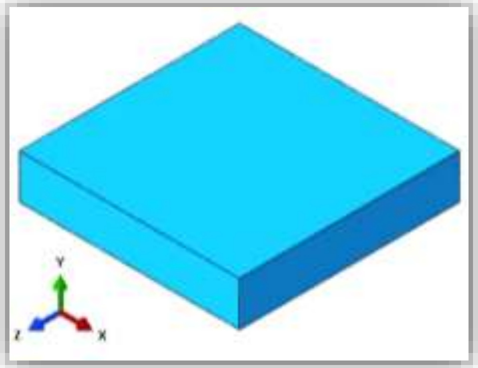
Work Flow

Temperature distribution



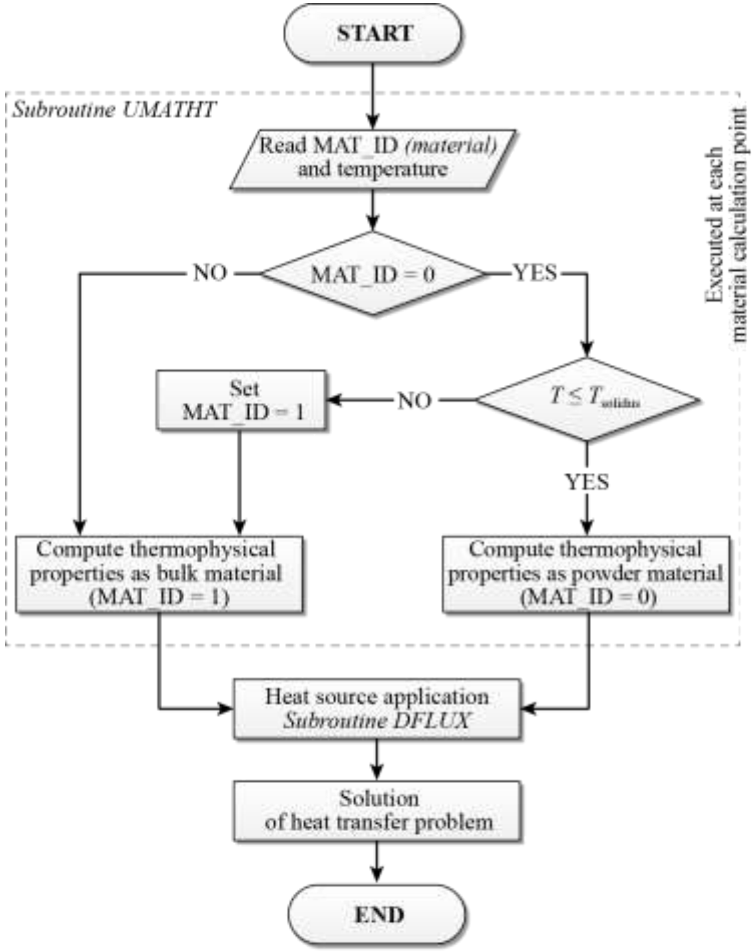
MAT_ID

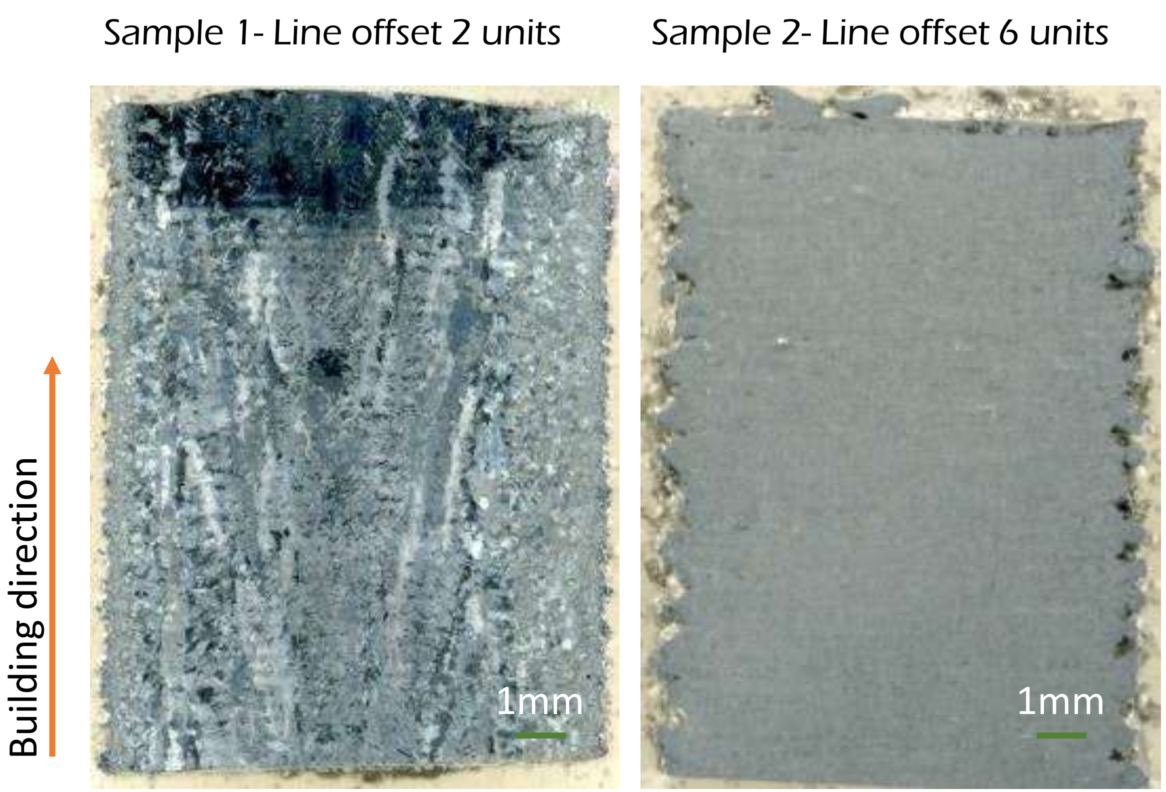




$$q(x_1, x_2, x_3, v, t) = \eta \frac{UI}{S}$$

For each increment...





Effects of line offset:

- Microstructure
- Aluminum content

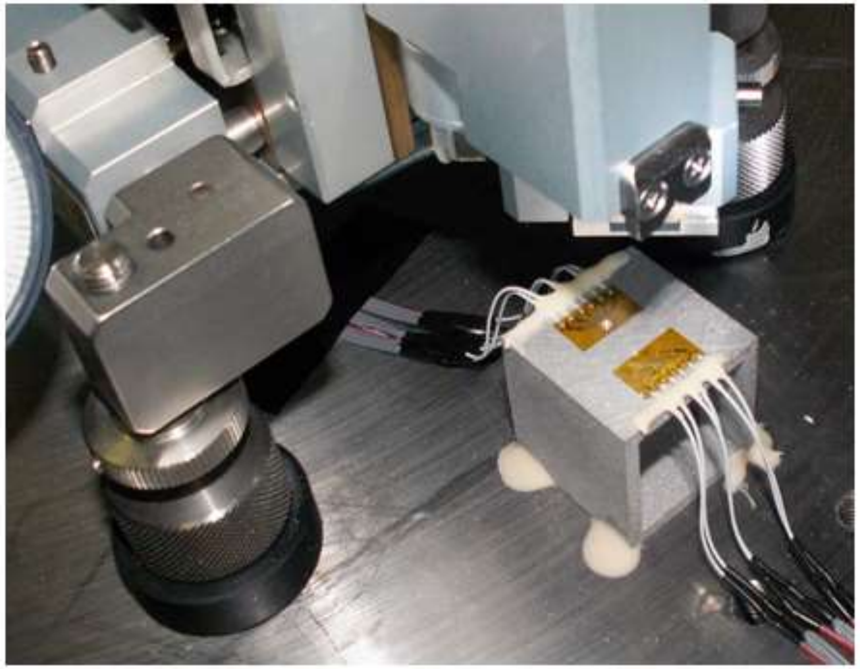
RESEARCH METAL

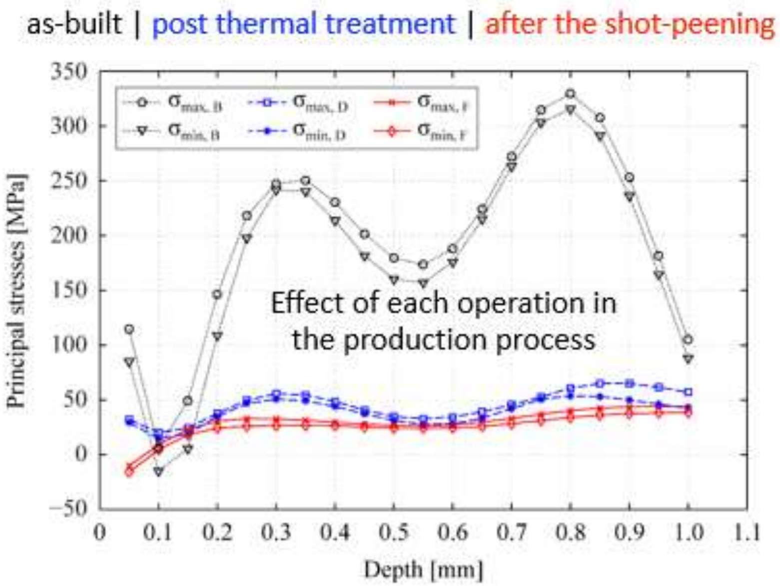
SLM

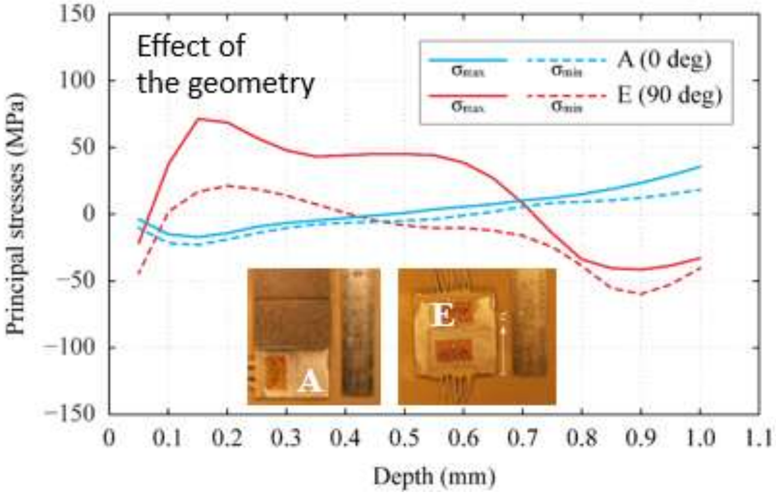
Residual stresses

ISTITUTO ITALIANO DI TECNOLOGIA

Evaluation of residual stresses at the macro-scale
By hole drilling strain gauge method



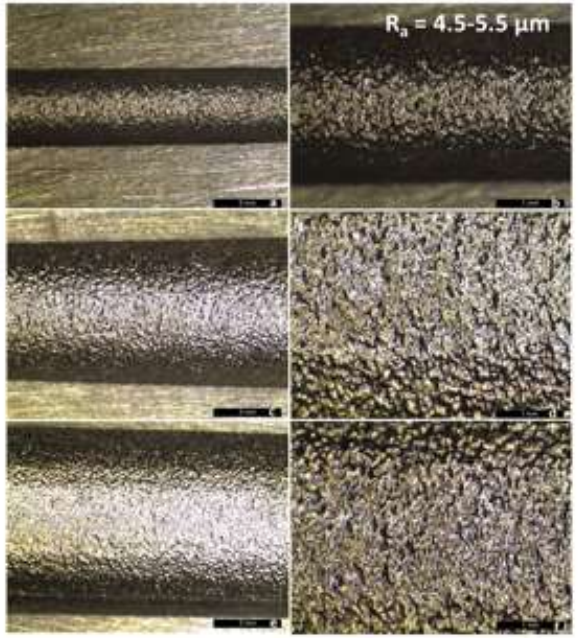




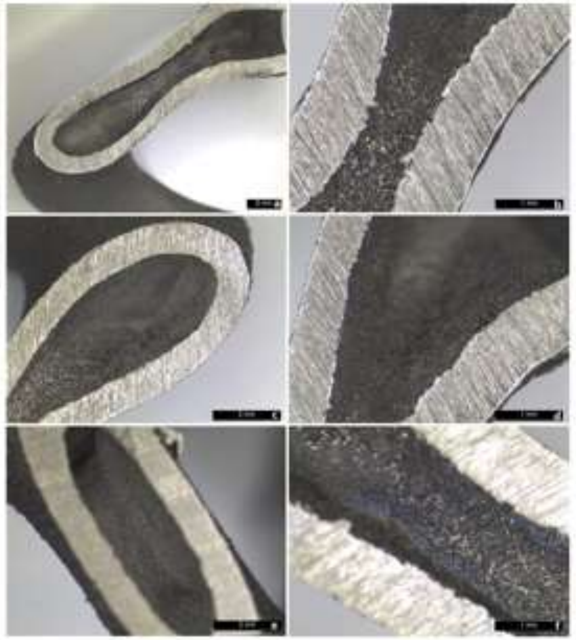
RESEARCH METAL

SLM

Surface finishing



Chemical and electrochemical polishing of screening sample



Chemical and electrochemical polishing of the final testing sample

ISTITUTO ITALIANO DI TECNOLOGIA

ALTA SCUOLA POLITECNICA

POLITECNICO DI MILANO | POLITECNICO DI TORINO

FIAMME - ASP Project
Finishing processes for additive manufactured metal components

Finishing to improve:

- Aesthetic features
- Dimensional tolerances
- Roughness
- Specific functionalities
- Fatigue resistance

Set-up of conditions for traditional and not traditional methods

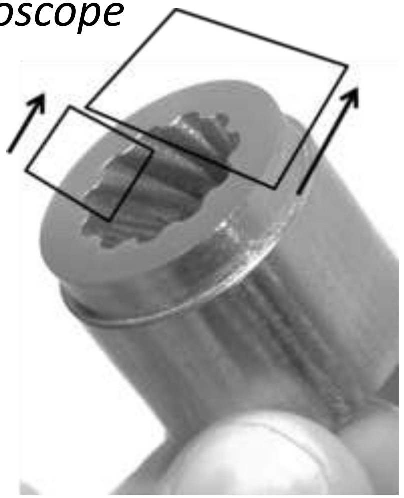
SLM

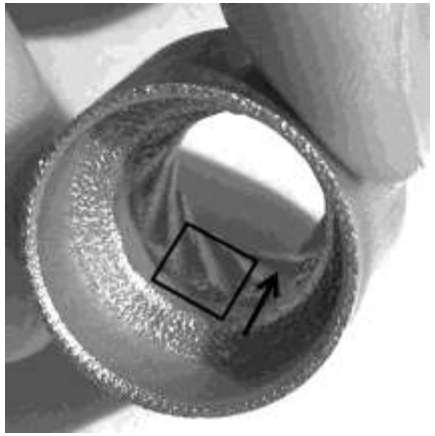
Surface finishing

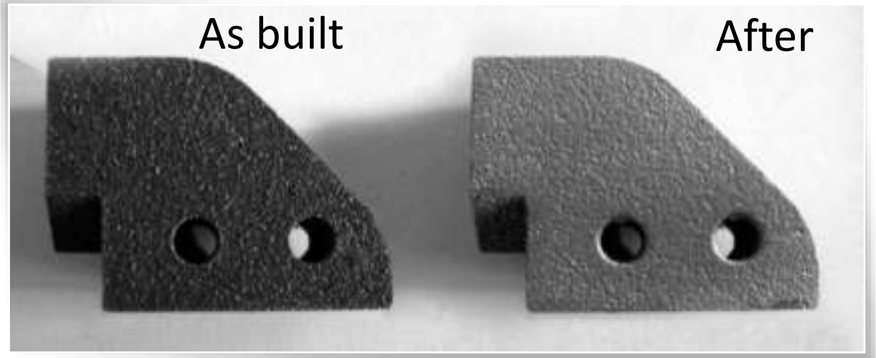
ISTITUTO ITALIANO DI TECNOLOGIA

Combination of mechanical and electrochemical polishing, abrasive flow machining

Surface post processing → and subsequent stereomicroscope analysis and 3D scanning







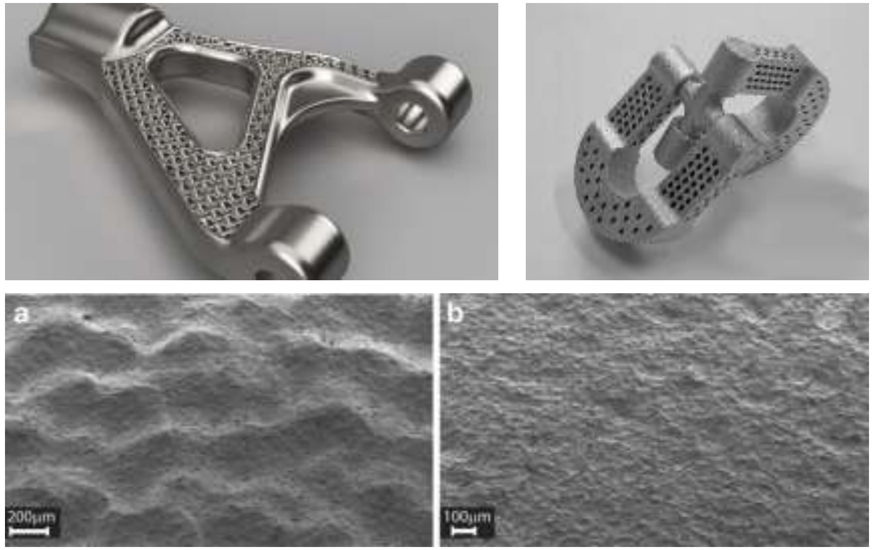
Shot peening with glass microspheres (200µm) at 8 bar

R_a: from 17 µm to 5 µm

SLM
Surface finishing

Finishing required for improving

- Aesthetics
- Dimensional accuracy
- Superficial roughness
- Mating surfaces and features
- Part functionality
- Tribological properties
- Fatigue life



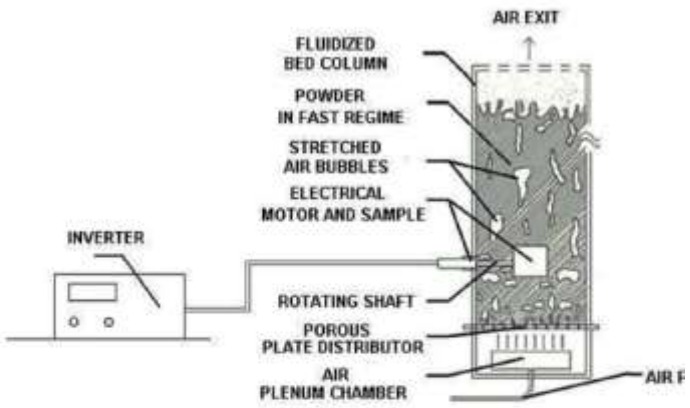
Current activities: conventional processes (polishing, etc.) and unconventional processes (abrasive flow machining, etc.)

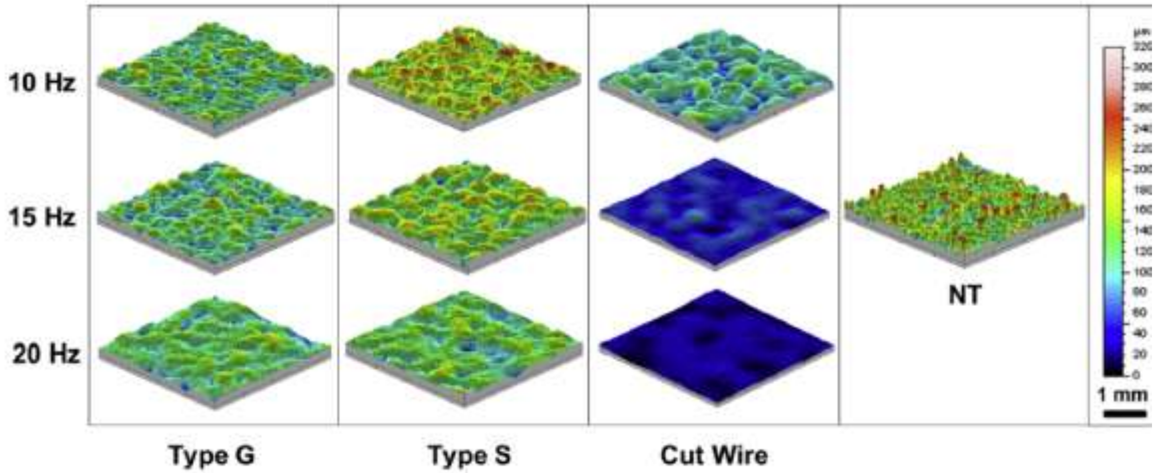
RESEARCH METAL

SLM

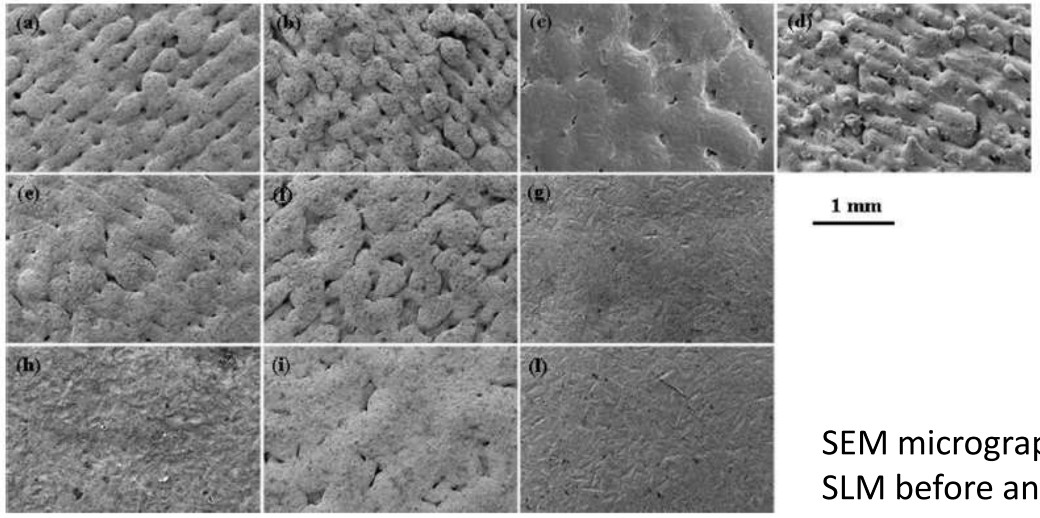
Surface finishing

Abrasive Fluidized Bed





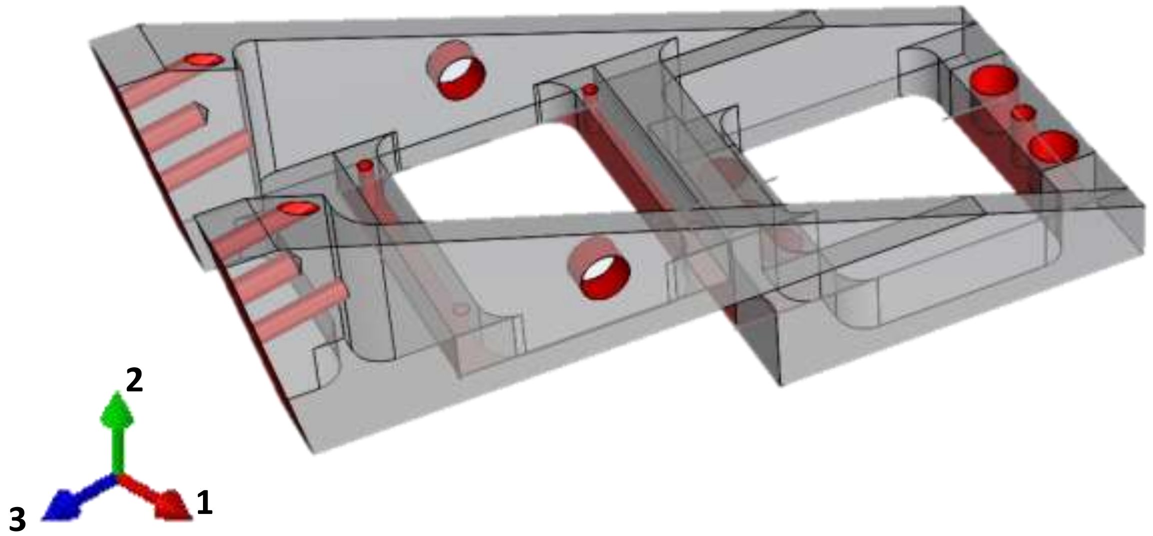
3D morphological maps of the AlSi10Mg substrates manufactured by SLM before and after AFB finishing.



SEM micrographs of the AlSi10Mg substrates manufactured by SLM before and after AFB finishing

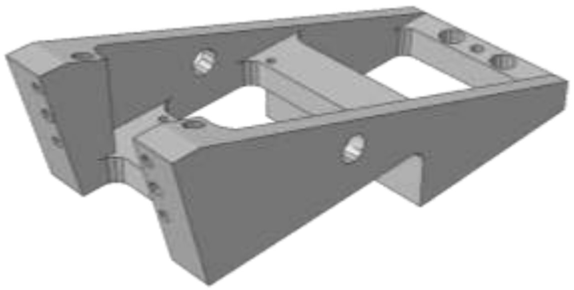
Design constraints

- Mating surfaces
- Centering holes
- Fixturing holes



SLM

Topology Optimization



Original design

Initial weight = 200 g

Result

–50% weight

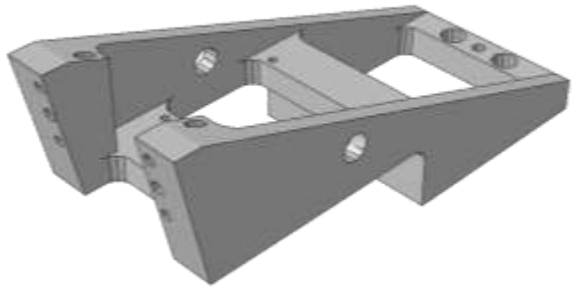
Weight Reduction

POLITECNICO DI TORINO | IAM Integrated Additive Manufacturing@PoliTo

RESEARCH | METAL

SLM

Topology Optimization



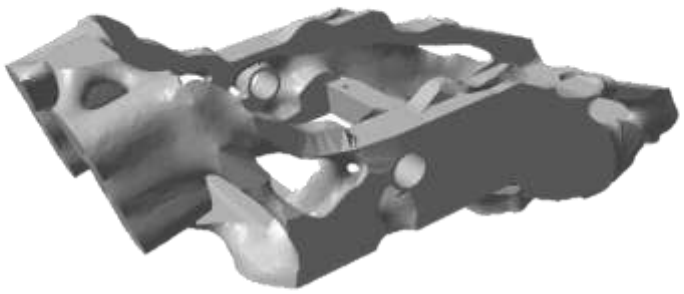
Original design

Initial weight = 200 g

Result

+30% compliance

–10% weight



Maximization of compliance

RESEARCH METAL

SLM

Topology Optimization

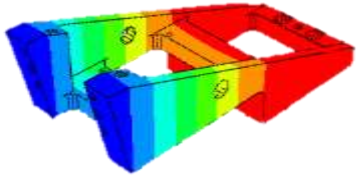
Approach

- Reduced manufacturing constraints
- Fabrication of the part with controlled density and complex surfaces
- The STL model resulting from topology optimization might be directly used for AM fabrication

CAE Analysis

Static analysis

Dynamic analysis



Weight = 200 g
Max displacement = 31 µm

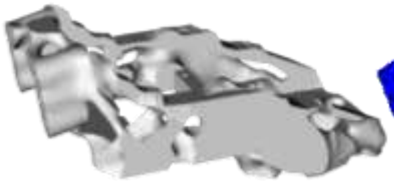
Topology Optimization

Identification of design goals

Definition of constraints

Selection of AM material and process

Topology optimization

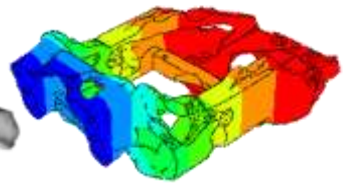


Material AlSi10Mg

Post Processing

CAD modelling and geometry optimization

Validation through CAE analysis



Weight = 184 g (-10%)
Max displacement = 18 µm

Conceptual prototype

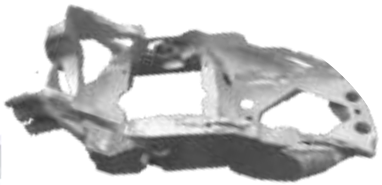
Design evaluation

Material ABS
FDM

Manufacturing

Additional material as allowance for finishing

Fabrication of the part



Material AlSi10Mg
SLM

POLITECNICO DI TORINO

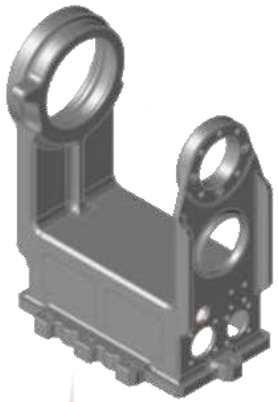
IAM Integrated Additive Manufacturing@PoliTo

RESEARCH METAL

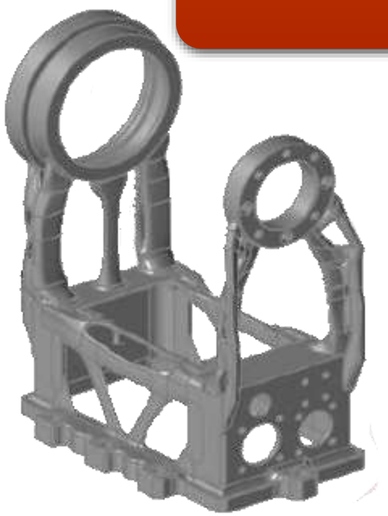
SLM

Topology Optimization

INSPIRE solidThinking / WHERE IDEAS TAKE SHAPE



Original design



Result

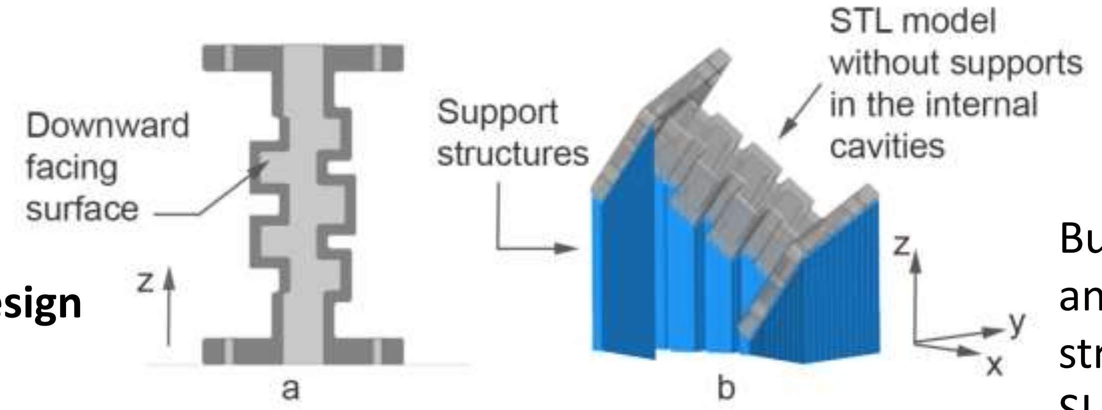
–27 % weight

SLM

Design, building orientation & support structures' optimization

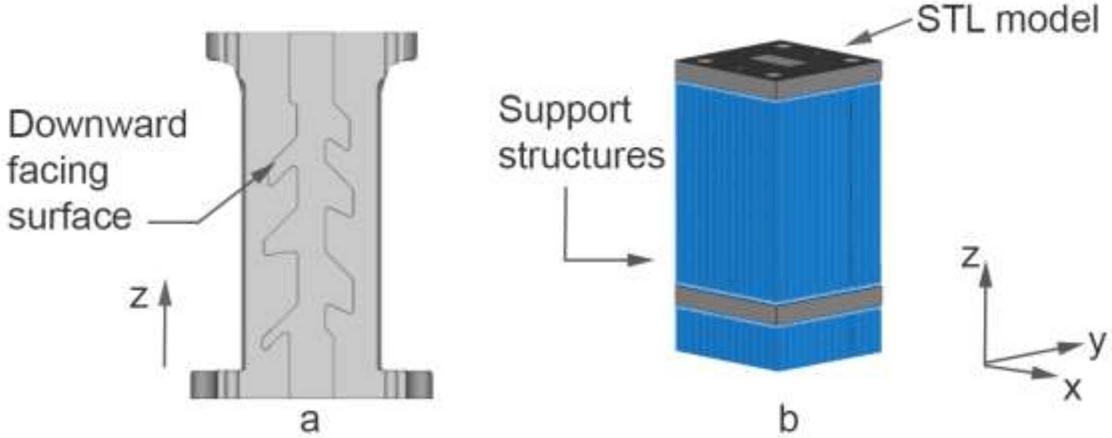
KU/K BAND WAVEGUIDE FILTERS

Fifth-order Ku/K-band low-pass filter: **typical design**



Building orientation and support structures for the SLM process.

Sixth-order Ku/K-band low-pass filter: **design, building orientation and support structures for the SLM process**.



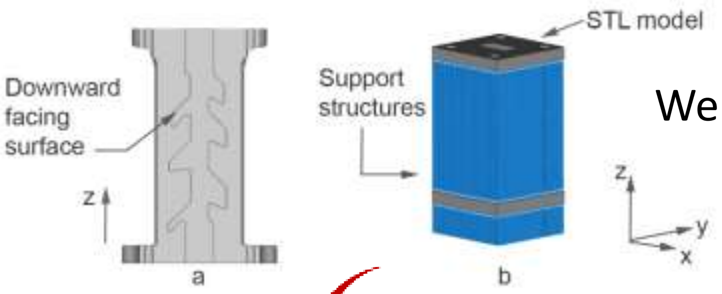
POLITECNICO DI TORINO | IAM Integrated Additive Manufacturing@PoliTo

RESEARCH METAL

SLM

Design, building orientation & support structures' optimization

KU/K BAND WAVEGUIDE FILTERS

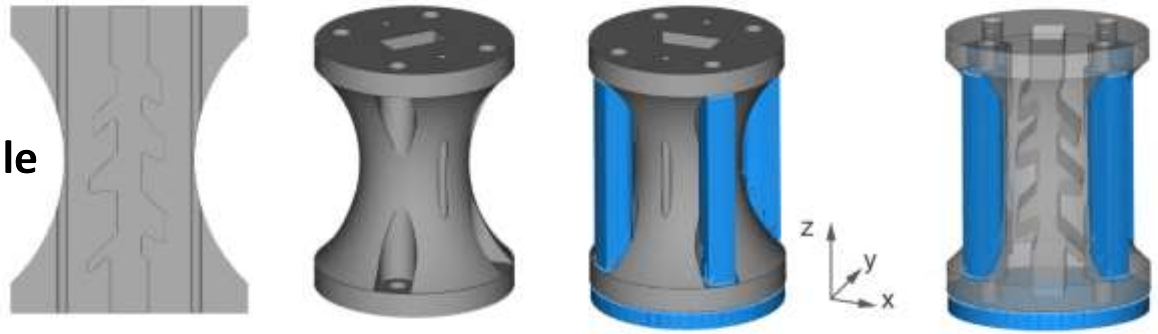


Weight: 27 g

In order to reduce the support structures also for the external profile

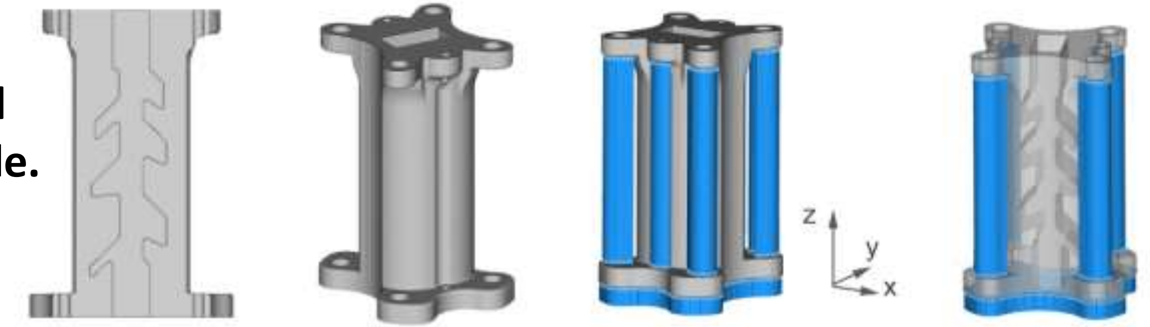
a

First external optimized profile
Weight: 76 g



b

Second external optimized profile.
Weight: **- 50 %**



iit @PoliTo ISTITUTO ITALIANO DI TECNOLOGIA

CNR IEIIT

SLM

Design for AM of a non-assembly robotic mechanism

Lattice structures
Non-assembly mechanisms

Hydraulic Manifolds for HyQ (Hydraulically Actuated Quadruped Robot)

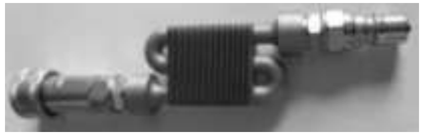


Photo courtesy Oak Ridge National Laboratory's Manufacturing Demonstration Facility

iit @PoliTo
ISTITUTO ITALIANO DI TECNOLOGIA

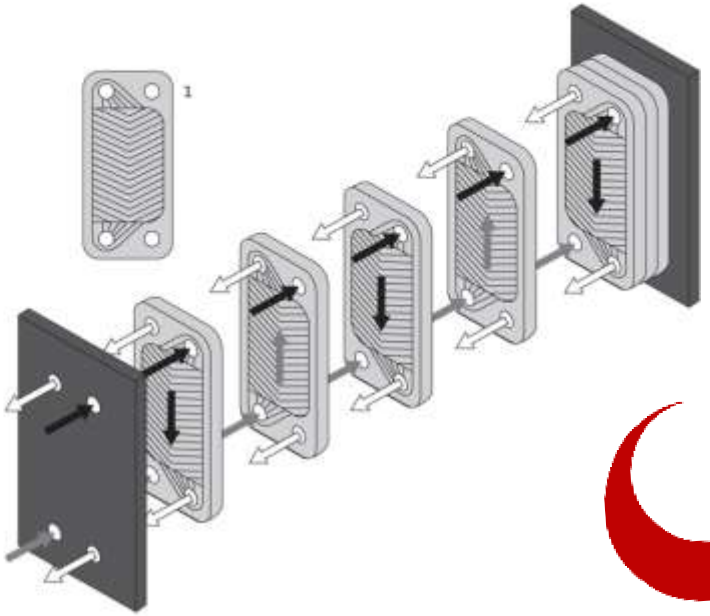
POLITECNICO DI TORINO IAM Integrated Additive Manufacturing@PoliTo

RESEARCH METAL

SLM

Design for AM of a heat exchangers

Traditional design process



New concept

New design structures to increase compactness and effectiveness

- *Compact design → no assembly*
- *Scalable design*
- *Maximum heat transfer*

iit @PoliTo ISTITUTO ITALIANO DI TECNOLOGIA

POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

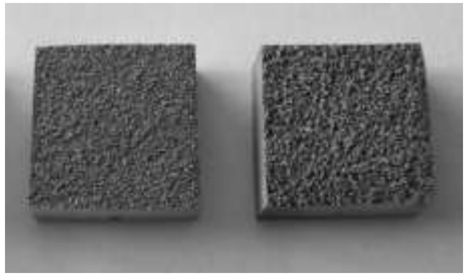
RESEARCH METAL

SLM

Design for Additive Manufacturing of a heat exchangers

AlSi10Mg

From single module to scale up



Microstructured Roughness

High R_a → increase efficiency

160 mm x 160 mm x 170 mm

For each layer 6320 ellyptical fins

iit @PoliTo ISTITUTO ITALIANO DI TECNOLOGIA

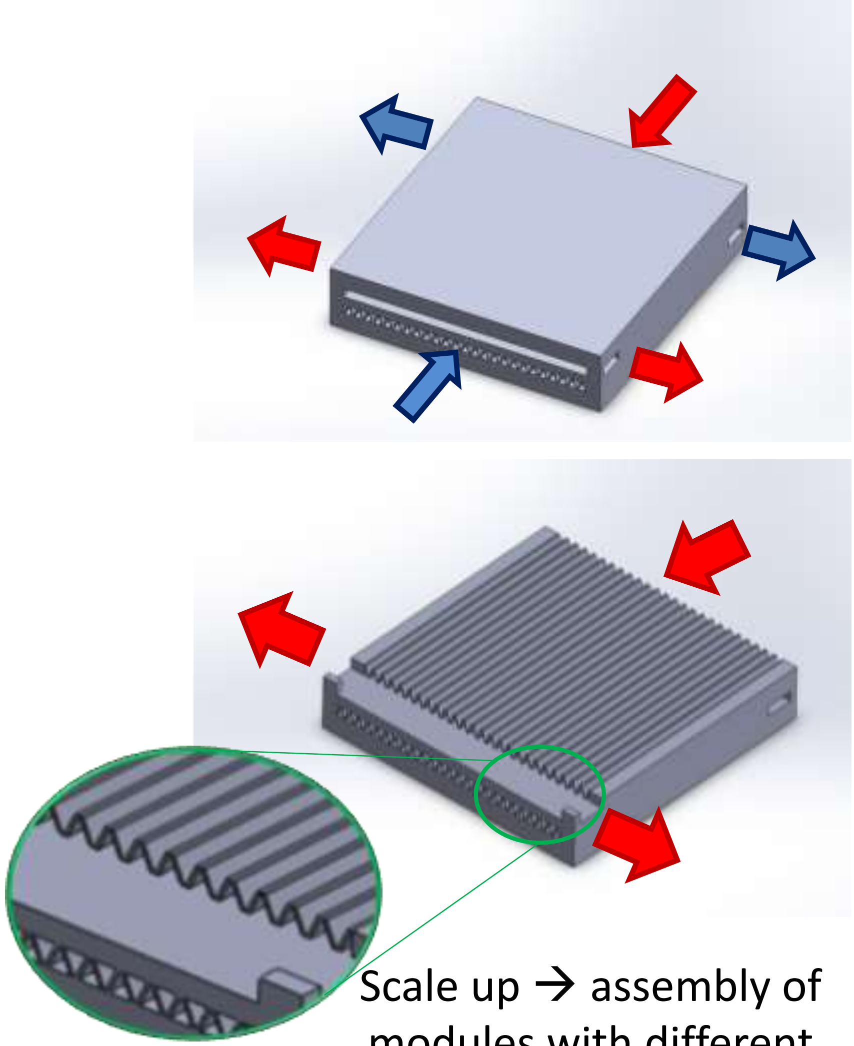
ASTRA

POLITECNICO DI TORINO | IAM Integrated Additive Manufacturing@PoliTo

RESEARCH | METAL

SLM

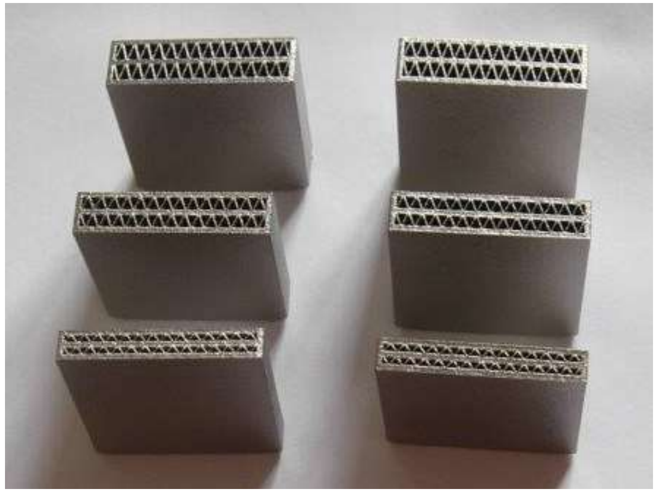
Design for Additive Manufacturing of a heat exchangers



Complex shapes and hollow structures to work

- at high T (800 °C) and
- in a corrosive gas environment (H_2)

Scale up → assembly of modules with different heights



In718

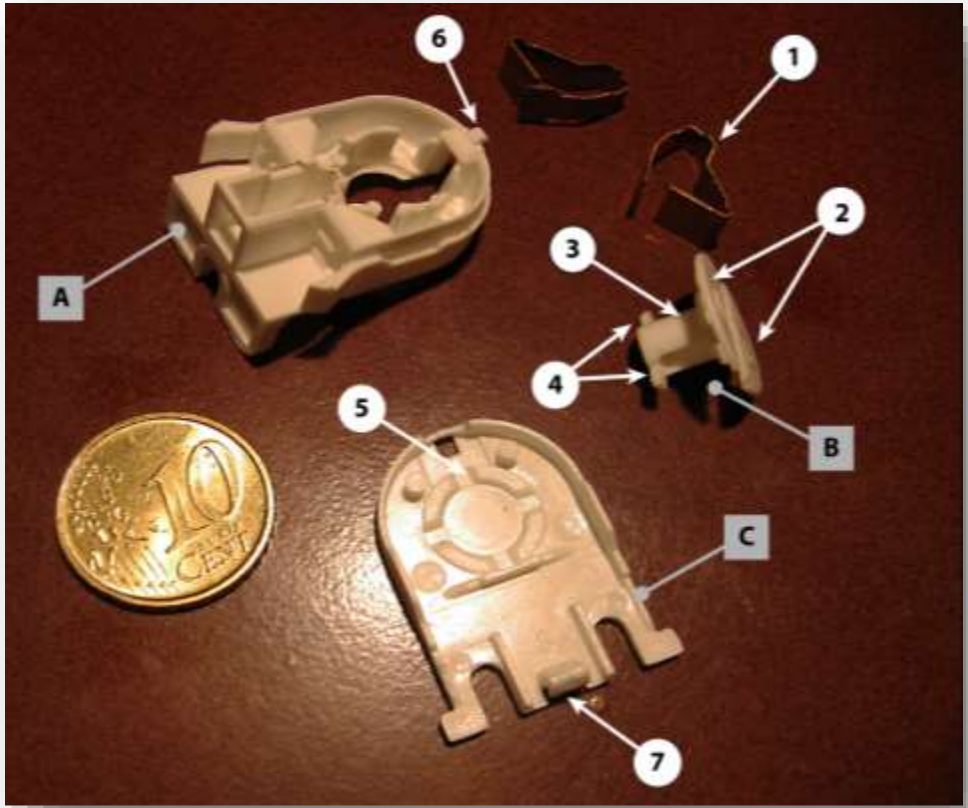
The corrugated structure acts as support for the overlying layer helping the SLM sintering

iit @PoliTo ISTITUTO ITALIANO DI TECNOLOGIA

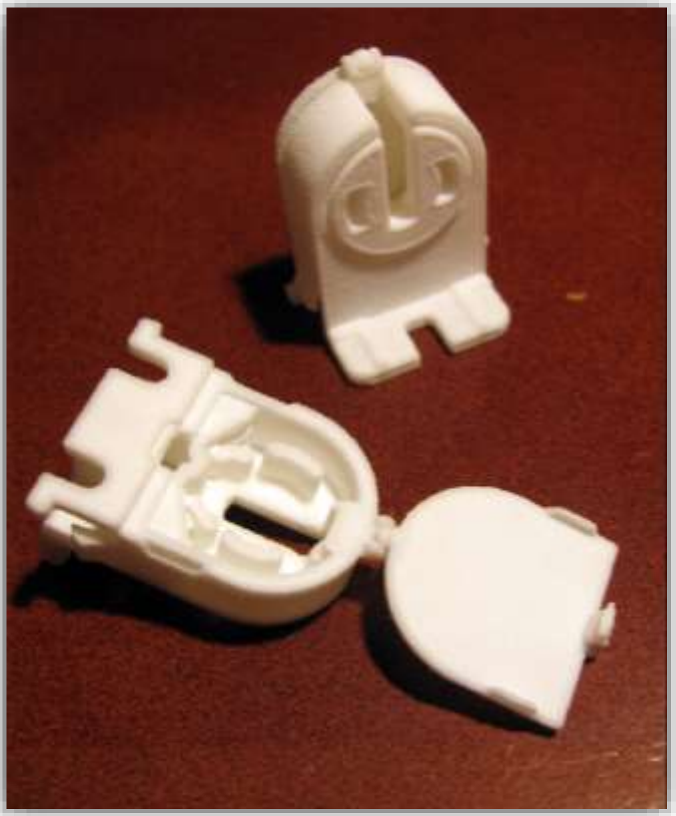
HELMETH

EU Project FPVII - Integrated High-Temperature Electrolysis and Methanation for Effective Power to Gas Conversion

Case study of a polymeric component

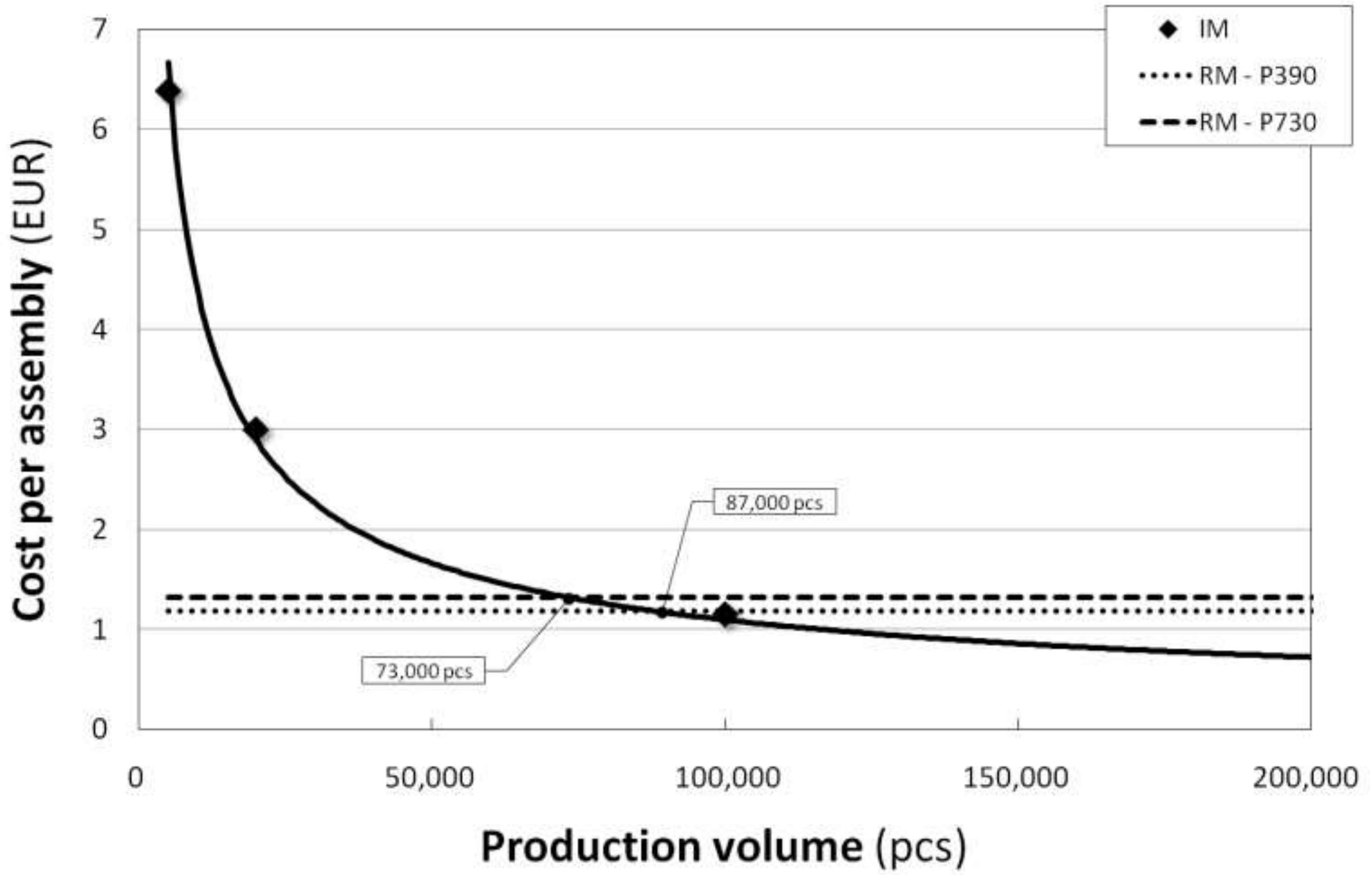


Injection Moulding (IM)



Additive Manufacturing (AM)

Case study of a polymeric component



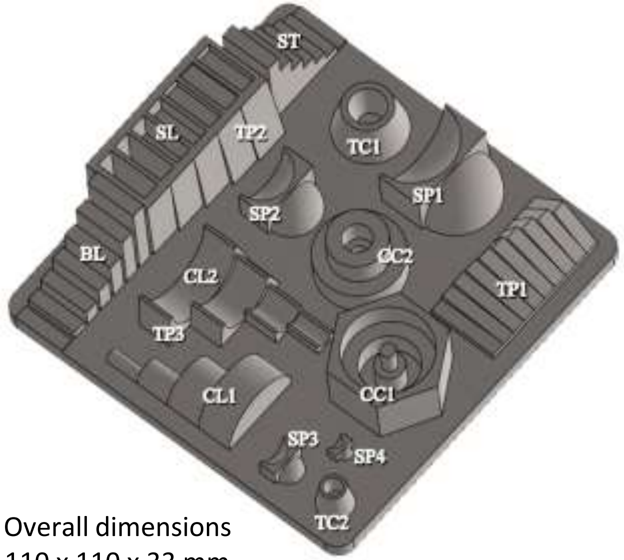
Break-even analysis

POLITECNICO DI TORINO

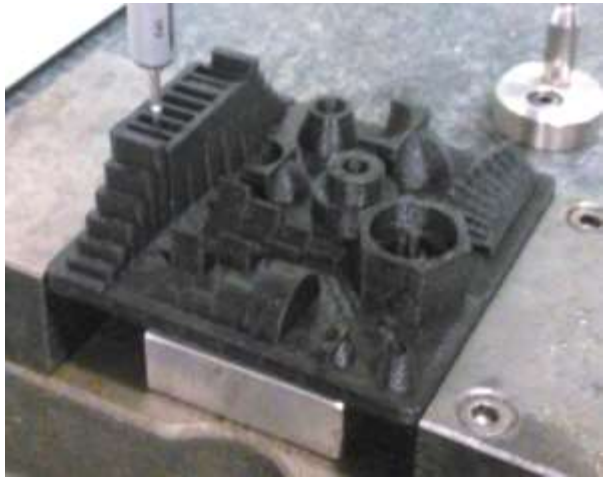
IAM Integrated Additive Manufacturing@PoliTo

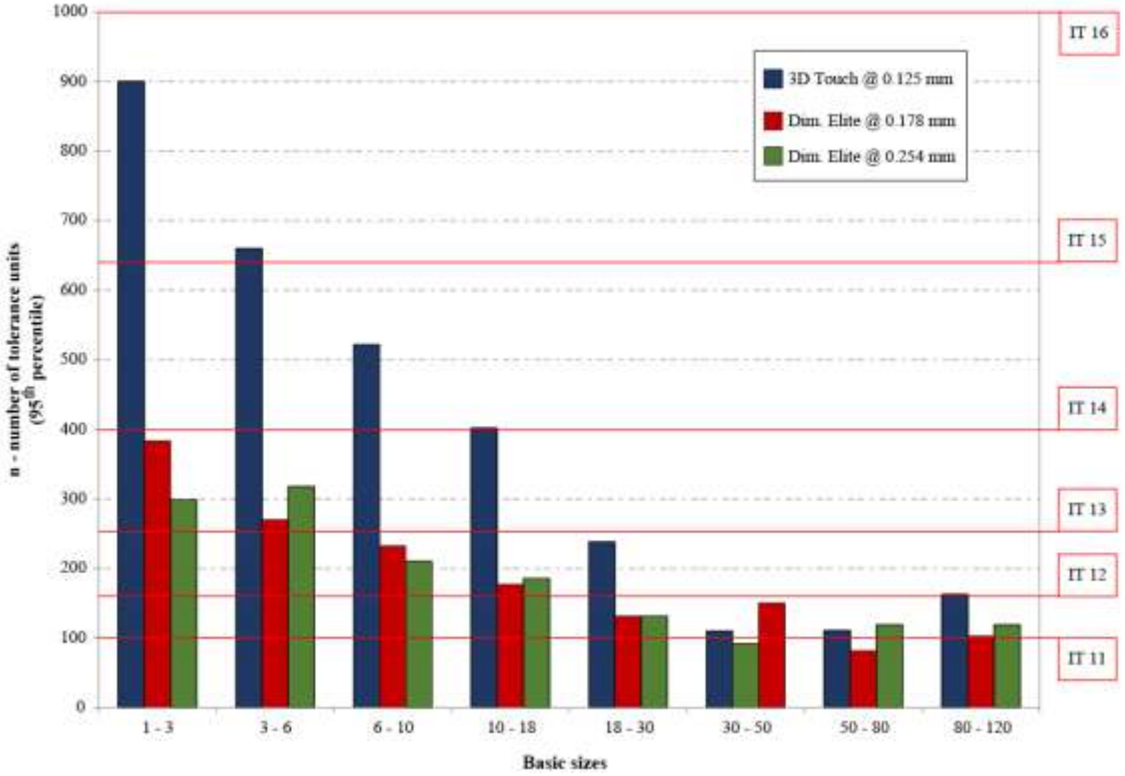
RESEARCH POLYMER

Dimensional characterization of AM systems



Overall dimensions
110 x 110 x 33 mm





Inspection by CMM

POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

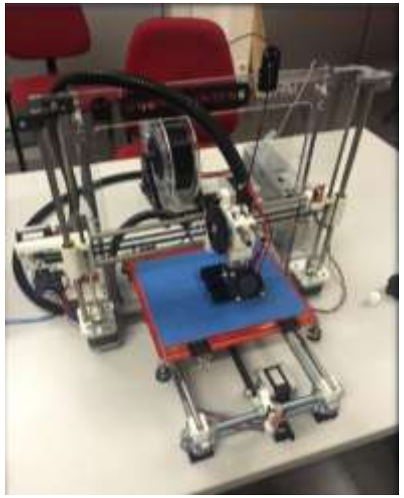
RESEARCH POLYMER

Characterization of 3D printers

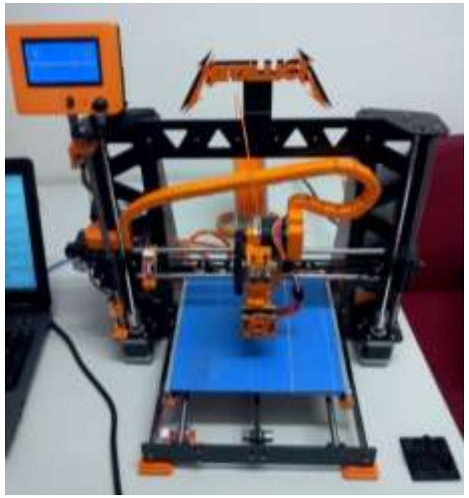
in COMAU within the Specializing Master in Industrial Automation

Fluo

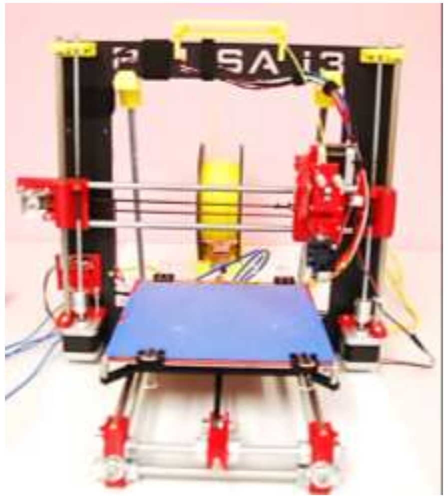
Ghost

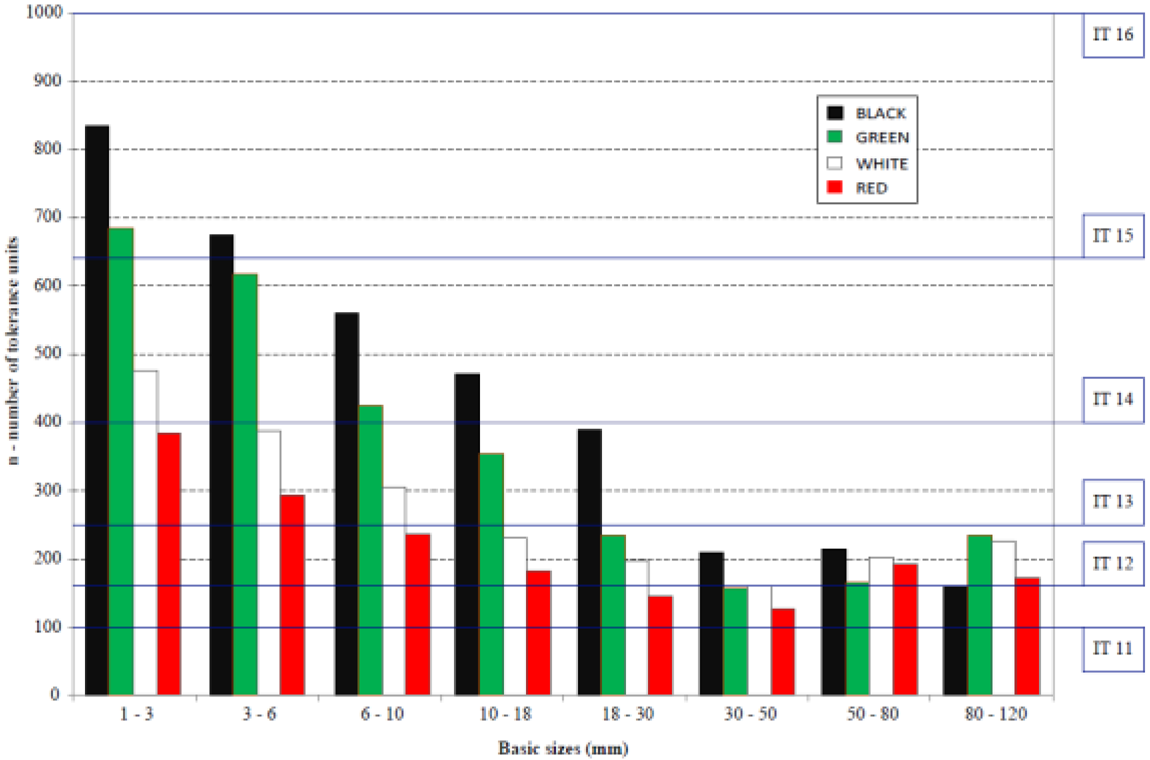


Metallica

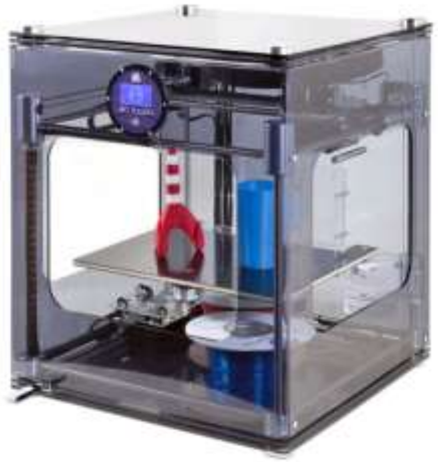


Print-Doh

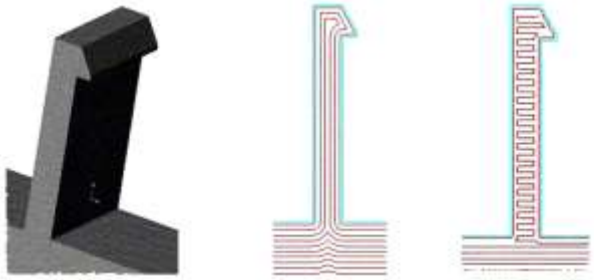




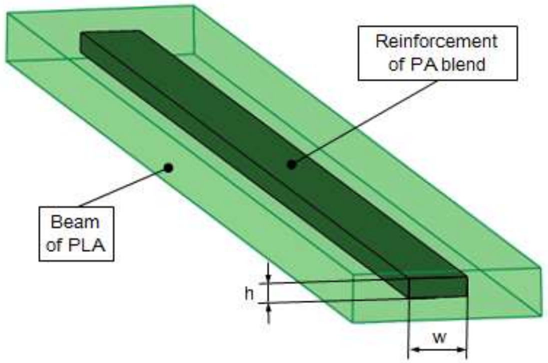
Performances of AM polymeric parts with fillers
(Graphene, Carbon fibres, …)

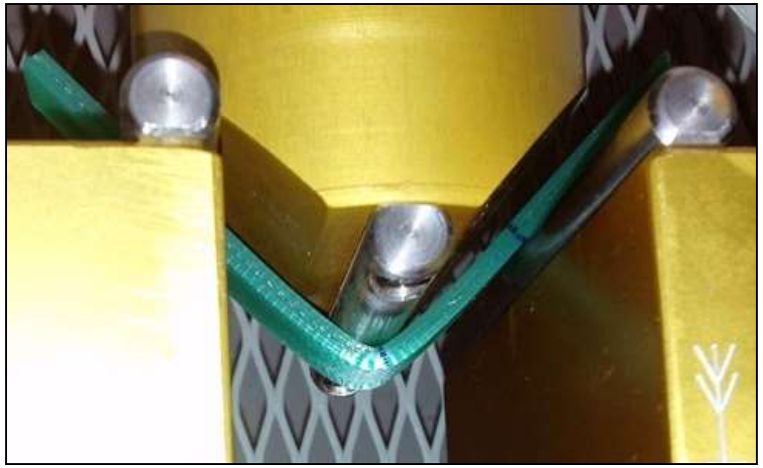


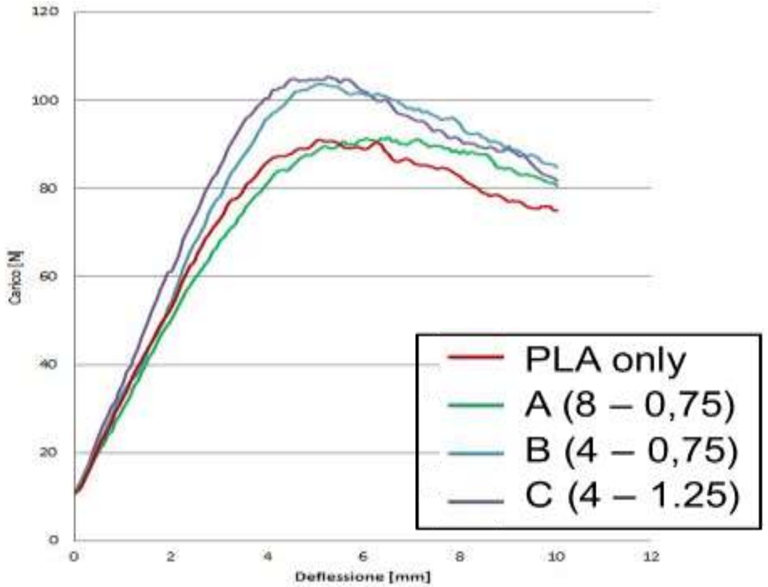
FDM machine with 3 extruder heads



Different strategies for deposition of the graphite filled filament







Sustainability

Additive Manufacturing improves the economic and environmental sustainability:

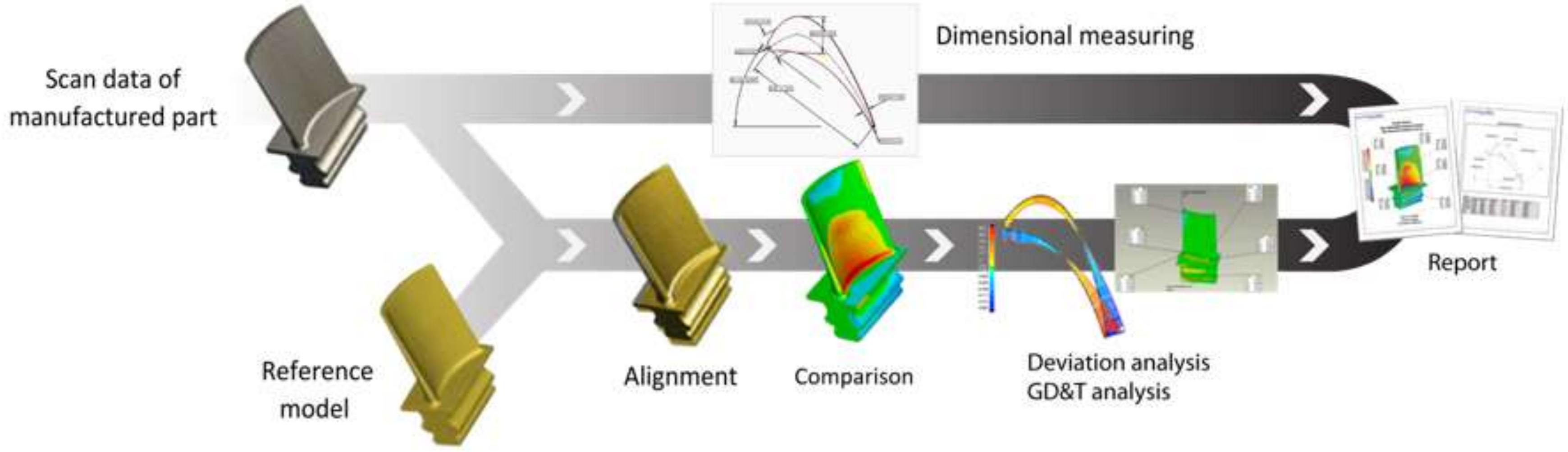
- Less consumption of raw materials;
- Optimized product efficiency;
- Light-weight components;
- Reduced need for tools and dies;
- Reduced investments and less stocks;
- *Supply chain* efficiency and new models of retail (Simplified chains and reduced delivery times)

POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

RESEARCH

REVERSE ENGINEERING



Computer Aided Inspection (CAI) and Reverse Engineering (RE)

When a part exists but not the drawing the CAD model can be generated using data from 3D-digitising (non-contact scanner system) and the RE methodology

INSTITUTIONAL

«*INDUSTRY-FUNDED ACADEMIC INVENTIONS BOOST INNOVATION*»
NATURE COMMENT,
BRIAN D. WRIGH ET AL.

WITH THE INVOLVEMENT OF BUSINESSES

RESEARCH WITH THE INVOLVEMENT OF COMPANIES SUCH AS FCA, GE AVIO, PRIMA INDUSTRIE,...

RESEARCH

TECHNOLOGY TRANSFER

EDUCATION

THE DISSEMINATION OF KNOWLEDGE IS ONE OF THE MAJOR FOCUSES AND AN INTEGRAL PART OF THE CENTER IAM@POLITO

Since 1994 Layer Manufacturing is taught at the Politecnico di Torino within the course of Computer-aided production (CAP) of the MSc. Course in Mechanical Engineering and MSc. Management Engineering, Manufacturing track

Master's Degree Programs in Mechanical Engineering / Materials
CAREER: ADDITIVE MANUFACTURING

Courses

- Progettazione per la fabbricazione additiva / Design for Additive Manufacturing (10 CFU)
- Tecniche di fabbricazione additiva / Technologies for Additive Manufacturing (10 CFU)
- Materiali per fabbricazione additiva / Materials for Additive Manufacturing (8 CFU)

Specializing Master in ADDITIVE MANUFACTURING

Objective: create a new generation of high-level specialists in the Additive manufacturing process field.
Foreseen professional figures: Technical Leaders, Project Managers, Industrial Operational Leaders, Mechanical Designers, Software Designers and Spare Parts Managers.

These figures will integrate technical and managerial expertise for the use and management of Additive Manufacturing.

The Master Course offers the unique opportunity of being trained in an international environment with demonstrated mature working experience in advanced projects.

Education 

WITH THE INVOLVEMENT OF BUSINESSES

Inside training on the
ADDITIVE MANUFACTURING

It promotes continuous training and redistributes to Companies the resources dedicated, by law, to training.

Technology transfer with the involvement of the digital innovation hub and Businesses:

- Business advice
- Access and use of infrastructure
- Business network projects
- Pilot line for business case

TECHNOLOGY TRANSFER

«Industry-funded academic inventions boost innovation»
Nature Comment,
Brian D. Wrigh et al.

Research

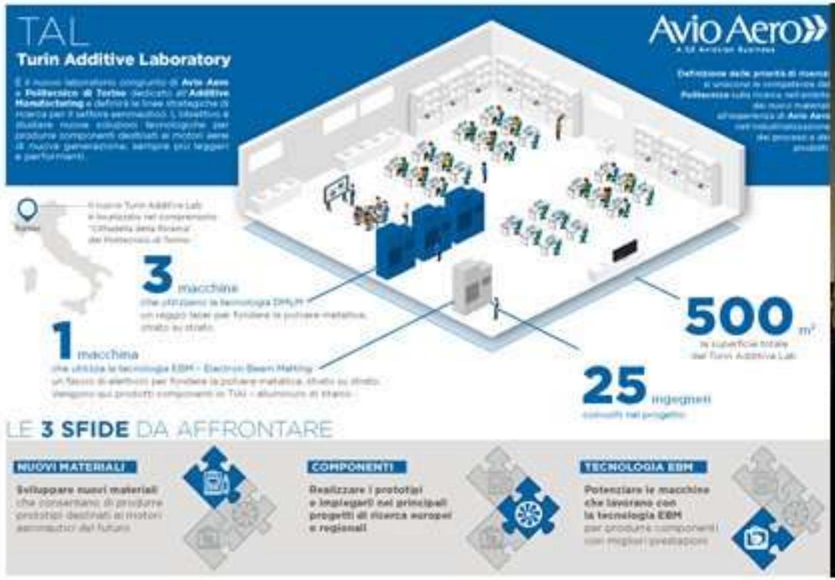
Education

The dissemination of knowledge is one of the major focuses and an integral part of the Center IAM@PoliTo

POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

TECHNOLOGY TRANSFER

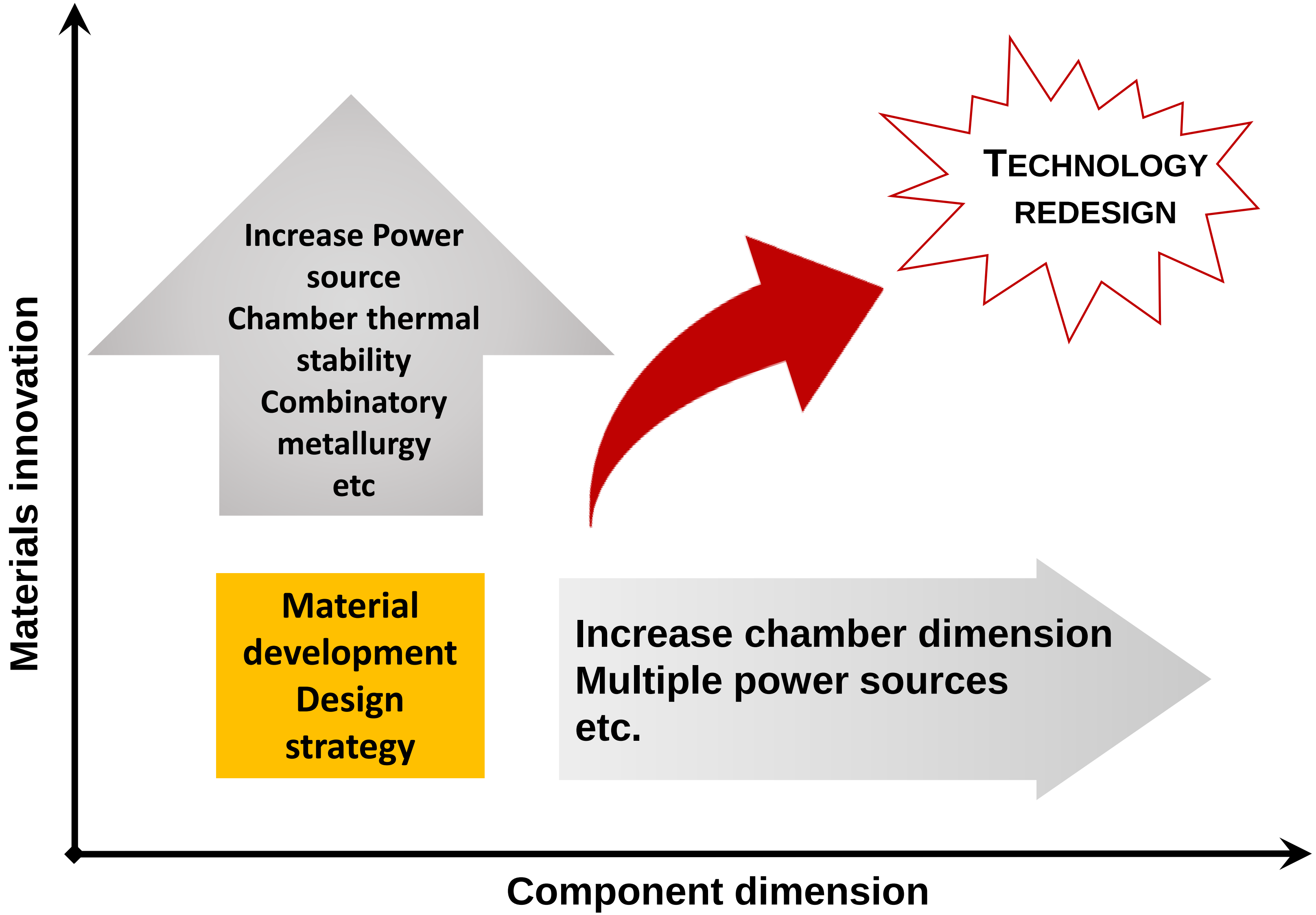


Turin Additive Lab - TAL

Together with the Politecnico di Torino, Avio Aero has created the TAL - Turin Additive Laboratory - a joint lab created to collaborate on strategic research topics for the aviation industry, such as identifying new materials for this production technology.

10% of the machine time of the EOSINT M400 (EOS GmbH) for research activities of the PoliTo

STRATEGY FOR THE GROWTH



POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

TECHNOLOGY TRANSFER

CENTRO INTERUNIVERSITARIO DI RICERCA PER L'ADDITIVE MANUFACTURING
CIRAM

Politecnico di Torino
Coordinator

Università di Napoli Federico II

Politecnico di Bari

Università di Palermo

Università di Modena e Reggio Emilia

Università di Brescia

Università di Pisa

Università di Firenze

Università di Salerno

POLITECNICO DI TORINO

IAM Integrated Additive Manufacturing@PoliTo

EVENTS

CARNEGIE MEETING G7
TORINO, 29 SEPTEMBER 2017

INAUGURAL LECTURE BY THE PRESIDENT OF THE REPUBLIC SERGIO MATTARELLA AT THE OPENING OF THE ACADEMIC YEAR 2017-2018 OF THE POLITECNICO DI TORINO 7 NOVEMBER 2017

Castle of Valentino produced by
laser powder bed fusion technology
Machine: EOSINT M270 Dual Mode
Material: AlSi10Mg alloy
Realized by IIT@PoliTo & DIGEP

POLITECNICO
DI TORINO

Integrated Additive
Manufacturing@PoliTo

EVENTS