Laboratorio di Prototipazione Avanzata

Marco FERRARI

Laboratorio di Prototipazione Avanzata (LPA)

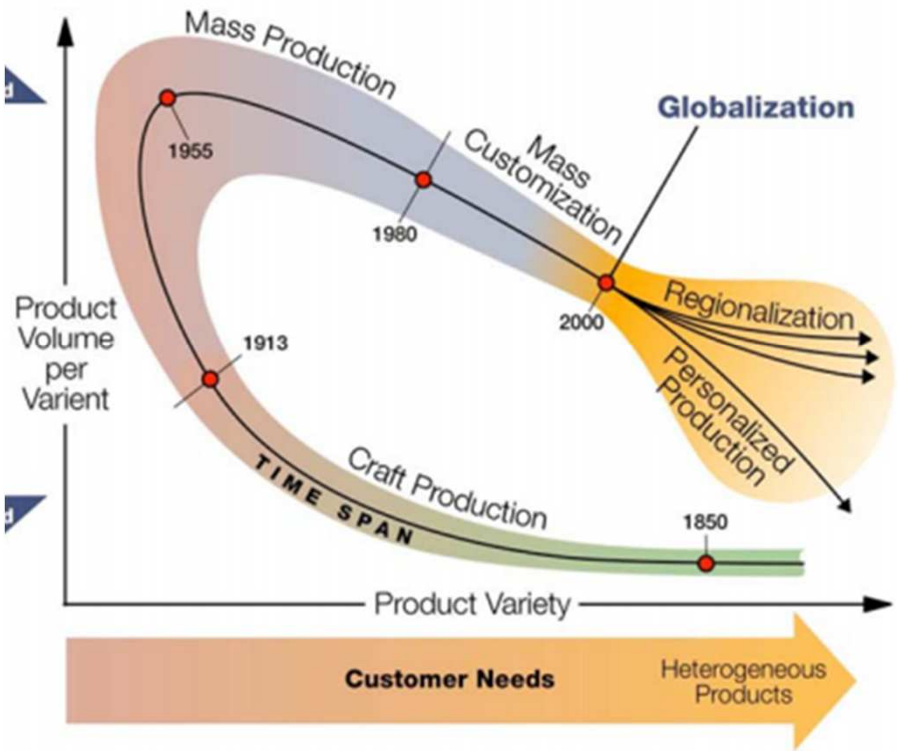
Prof. Luca Giorleo – DIMI
Prof. Daniele Alberti – DSCS
Prof. Marco Ferrari – DII
Prof. Massimiliano Granieri - DIMI

Il Laboratorio di Prototipazione Avanzata (LPA) è una struttura di Ateneo la cui funzione è quella rendere **immediatamente disponibili nuove soluzioni tecnologiche** utilizzando macchine di **produzione additiva** (AM) e software di progettazione, simulazione di processi e l'ottimizzazione di prodotti.

La **mission** del LPA sarà quella di costituire un **centro di competenza**, a sostegno dell'Università e delle aziende, avente a disposizione attrezzature ad elevate prestazioni per la realizzazione di **prototipi dalle caratteristiche avanzate**.

UNIVERSITÀ DEGLI STUDI DI BRESCIA

Additive Manufactoring (AM) Scenario

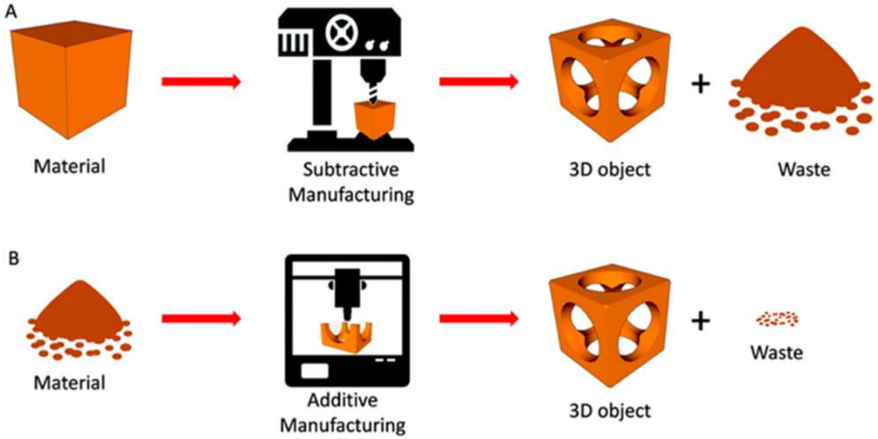


AM applications timeline

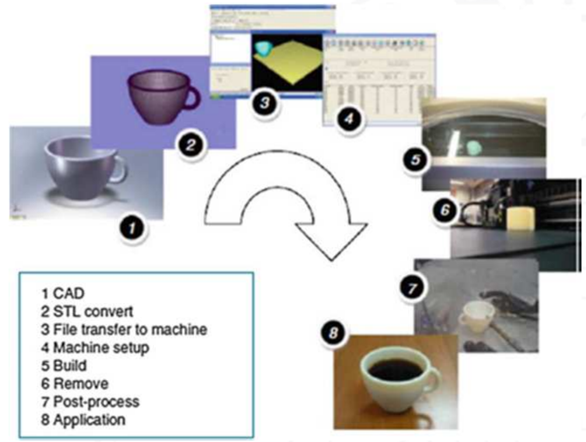
This timeline lays out past, present and potential future AM developments and applications. (courtesy of Graham Tromans)

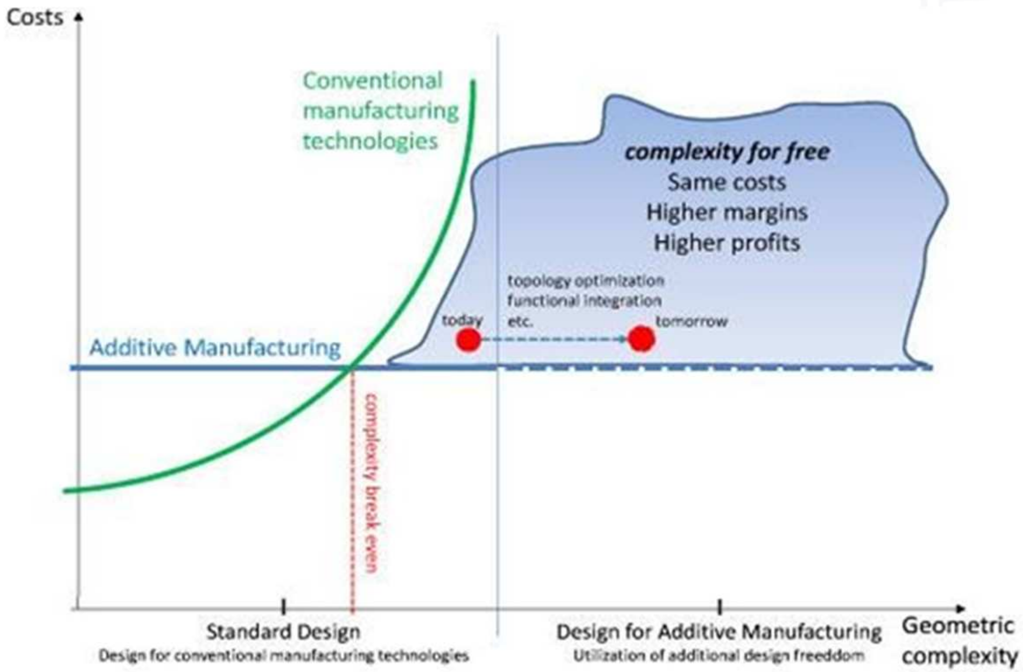
1988-1994	rapid prototyping
1994	rapid casting
1995	rapid tooling
2001	AM for automotive
2004	aerospace (polymers)
2005	medical (polymer jigs and guides)
2009	medical implants (metals)
2011	aerospace (metals)
2013-2016	nano-manufacturing
2013-2017	architecture
2013-2018	biomedical implants
2013-2022	in situ bio-manufacturing
2013-2032	full body organs

AM vs Tecnologie Tradizionali



	AM	CNC
Materiali	✓	✓
Velocità	✗	✓
Complessità	✓	✗
Accuratezza	✗	✓
Geometria	✓	✗
Programmazione	✓	✗





UNIVERSITÀ
DEGLI STUDI
DI BRESCIA

Design for AM

The **unique capabilities** of AM technologies enable new opportunities for customization, very significant improvements in product **performance**, **multifunctionality**, and **lower overall manufacturing costs**.

These unique capabilities include:

- shape complexity, in that it is possible to build virtually any shape;
- hierarchical complexity, in that hierarchical multiscale structures can be designed and fabricated from the microstructure through geometric mesostructure (sizes in the millimeter range) to the part-scale macrostructure;
- material complexity, in that material can be processed one point, or one layer, at a time;
- functional complexity, in that fully functional assemblies and mechanisms can e fabricated directly using AM processes.

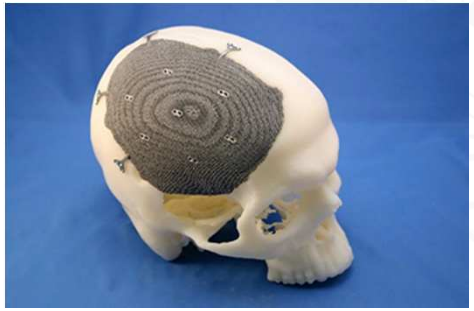
UNIVERSITÀ DEGLI STUDI DI BRESCIA

Shape Complexity

Topology Optimization

Conformal cooling

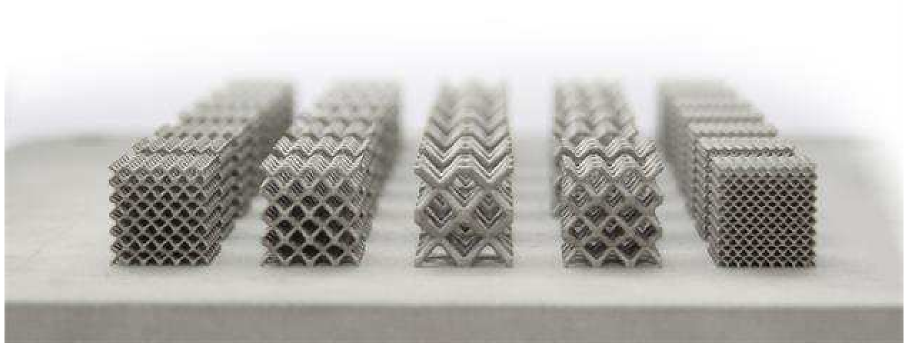
Aestetic



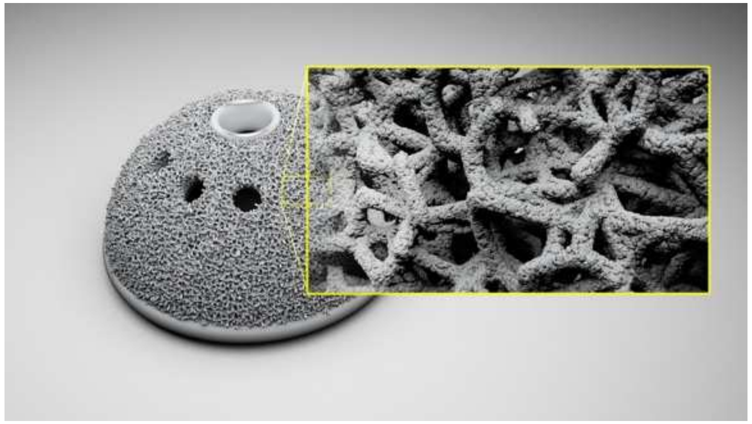
Customized product

UNIVERSITÀ DEGLI STUDI DI BRESCIA

Hierarchical Complexity



Weight reduction

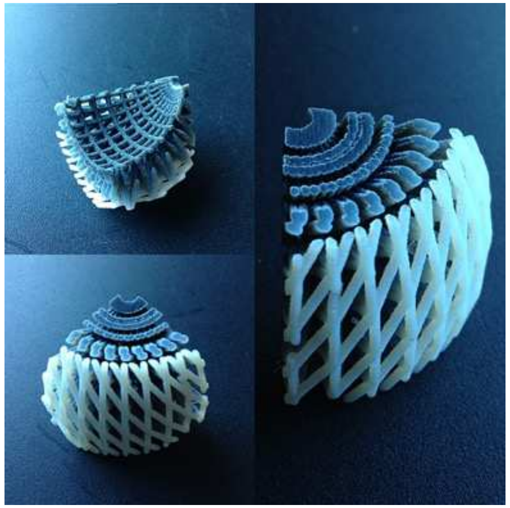


Human body integration

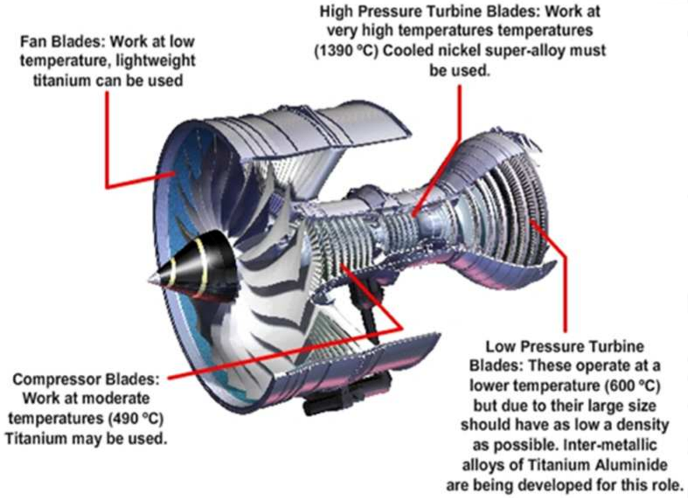
Breakable support

UNIVERSITÀ
DEGLI STUDI
DI BRESCIA

Material Complexity



Functionaly graded material



Multi material

Multi color

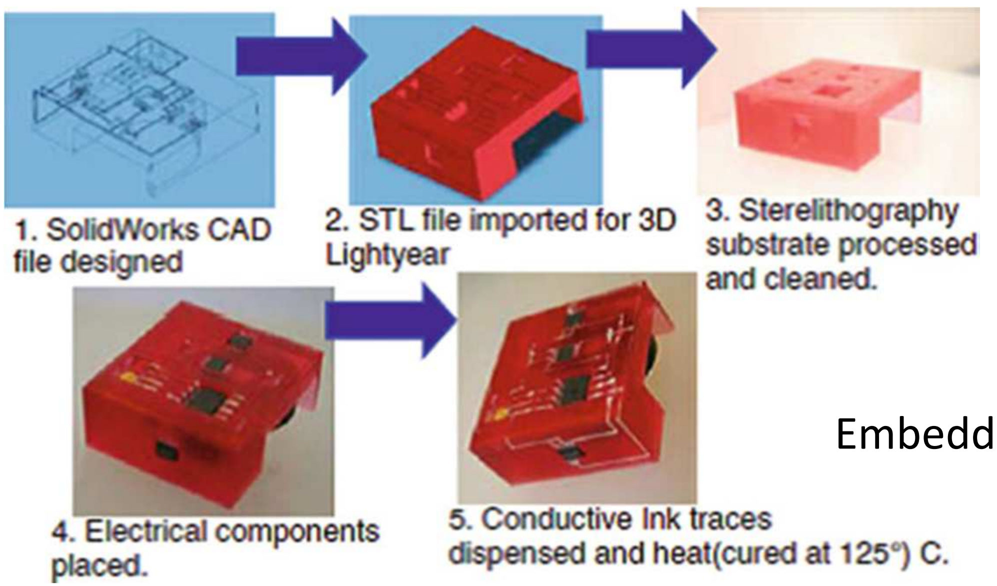
Functional Complexity

16 parts involved

1 part involved

Reduced number of parts

Re-design geometry

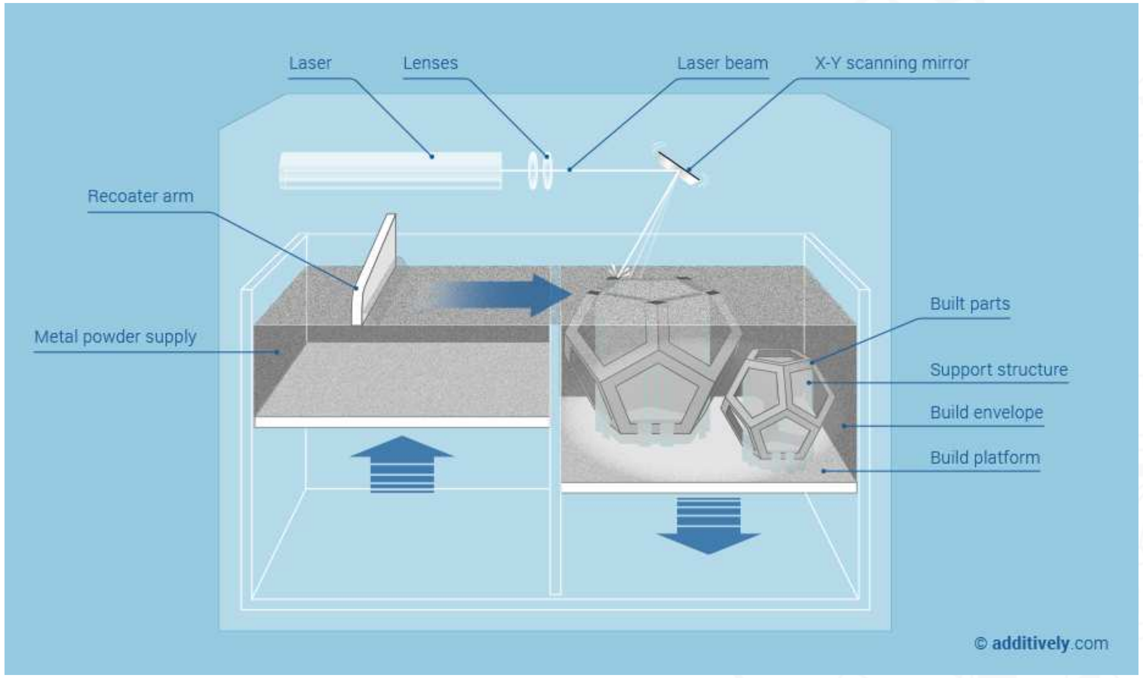


Embedded technology

UNIVERSITÀ DEGLI STUDI DI BRESCIA

Principali attrezzature disponibili

3D System - ProX 100 (Selective laser melting)



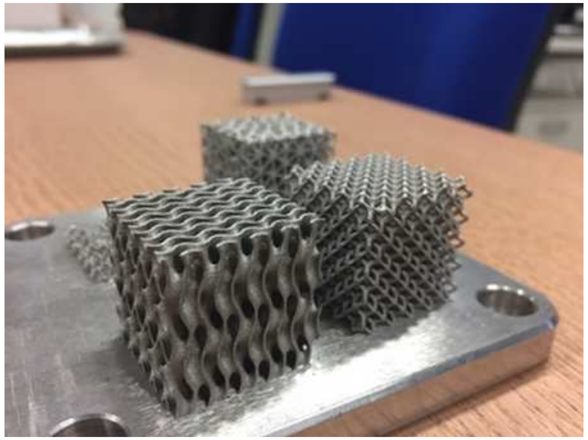
Cubo di stampa: 100x100x80 mm

Spessore singolo layer: 30-50 µm

Materiali: 17-4 Stainless Steel, CoCr

UNIVERSITÀ DEGLI STUDI DI BRESCIA

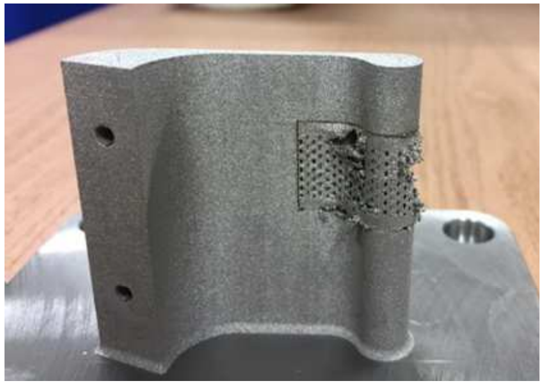
Applicazioni – Ricerche in corso



Lattice structures

Micro mechanics

Fatigue characterization

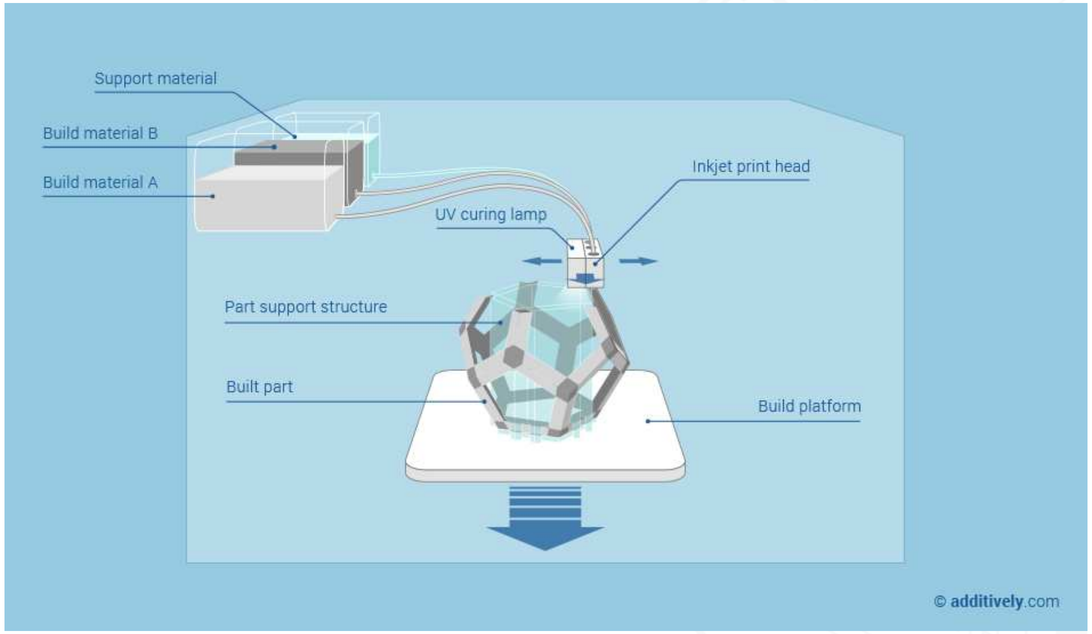


Parts production

Biomedical devices

UNIVERSITÀ DEGLI STUDI DI BRESCIA

3D System - Projet 2500 (Multi Jet)



Cubo di stampa: 294 x 211 x 144 mm

Spessore singolo layer: 32 µm

Materiali: ABS, polypropylene, elastomeric, epoxi resin

Applicazioni – Ricerche in corso

Topology optimization

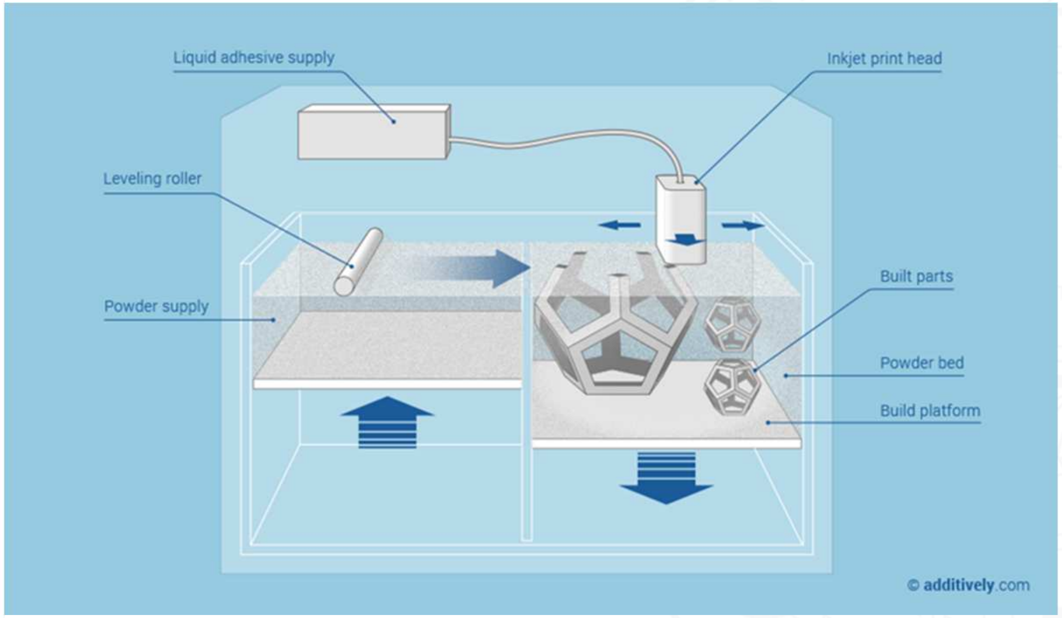
Conformal cooling

Orthopedic insole

Part reduction

Re-designed assembly

3D System - Projet 460 (Binder Jetting)

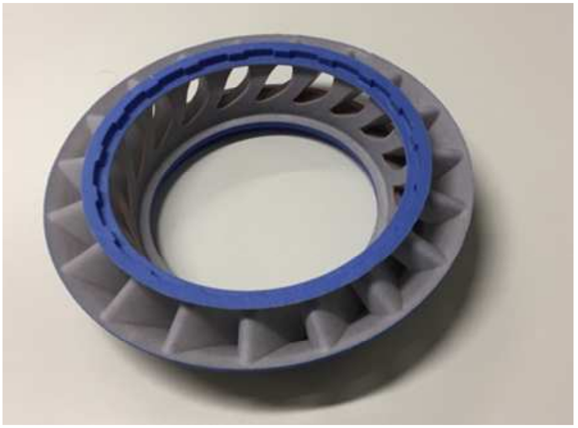


Cubo di stampa: 203x245x203 mm

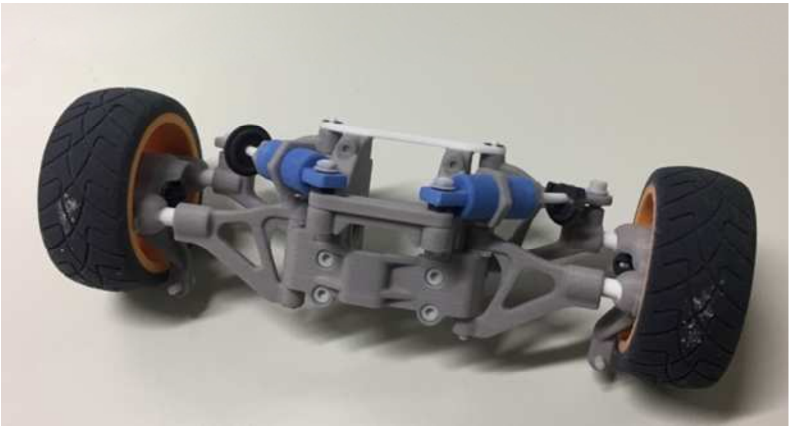
Spessore singolo layer: 100 µm

Materiali: gypsum powder

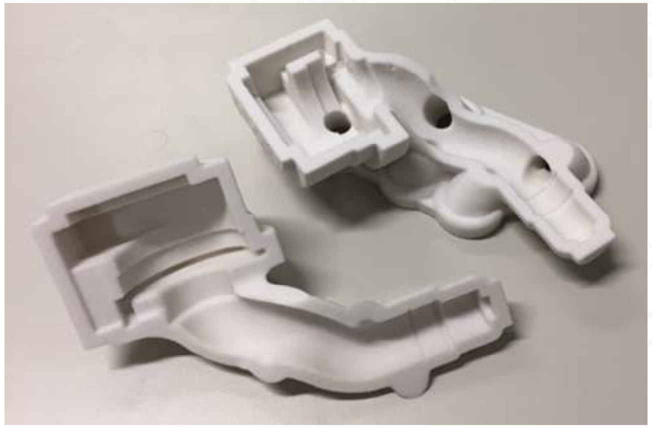
Applicazioni – Ricerche in corso



Full color parts prototype



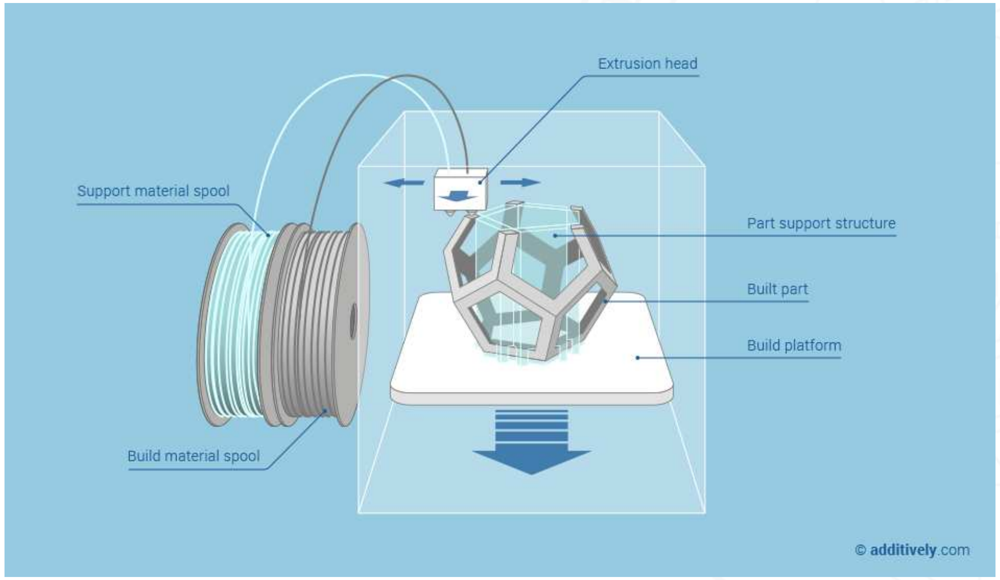
Full color assembly



Molds

UNIVERSITÀ DEGLI STUDI DI BRESCIA

Bioplotter – Envisiontec (Material Extrusion)



Cubo di stampa: 150x150x140 mm

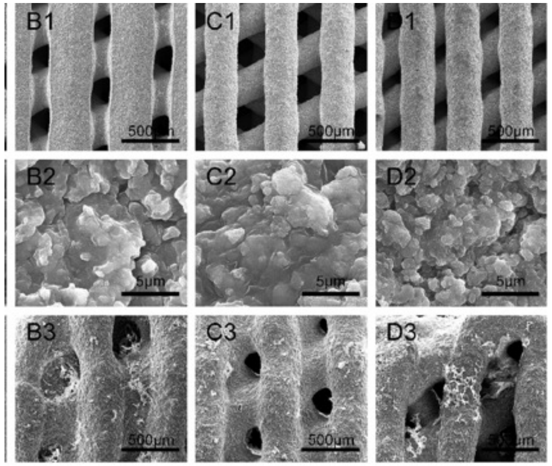
Spessore singolo layer: n.a.

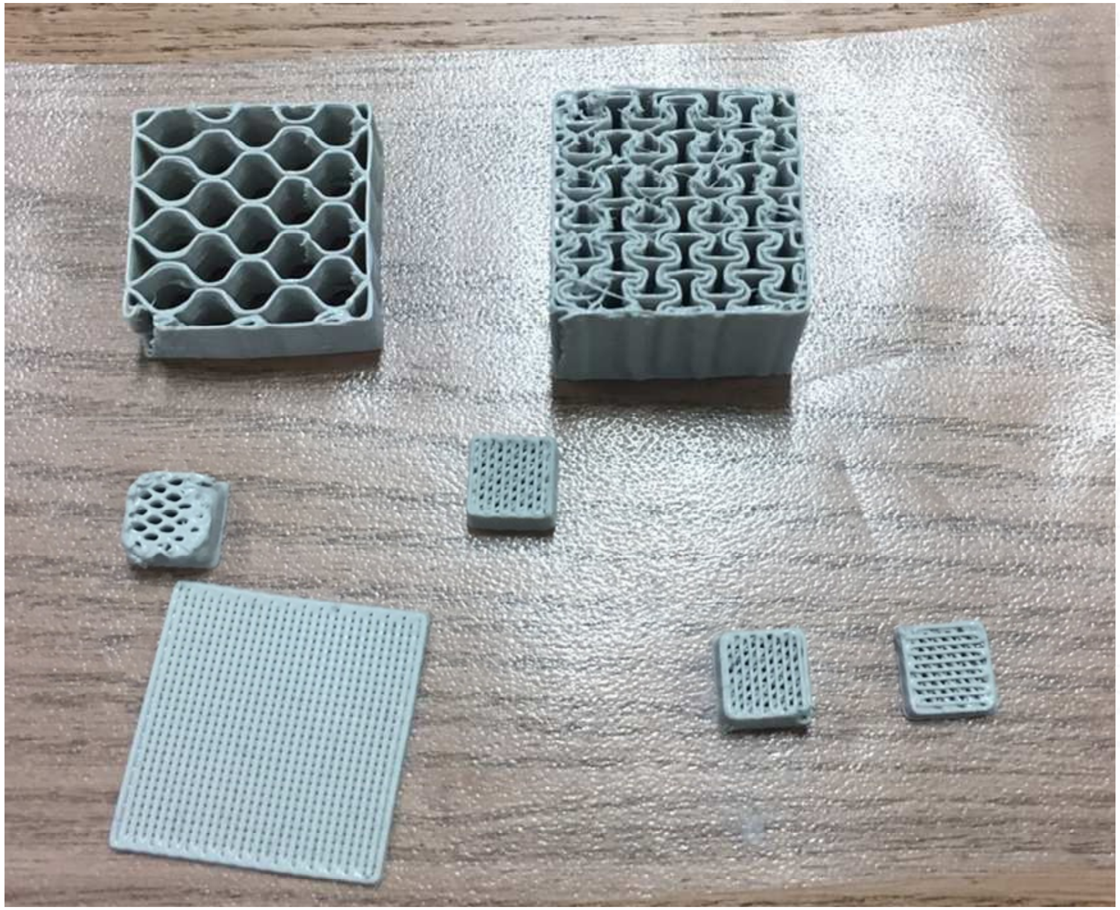
Materiali: Bone/Cartilage Regeneration materials, Soft tissue materials, Ceramic/Metal Pastes, Thermoplasts, Hydrogels, Acrylates, Graphene and more

UNIVERSITÀ DEGLI STUDI DI BRESCIA

Applicazioni ricerche in corso

Studio dei parametri di processo per la realizzazione di scaffold





UNIVERSITÀ
DEGLI STUDI
DI BRESCIA

Laboratorio di Prototipazione Avanzata (LPA)

UNIVERSITÀ DEGLI STUDI DI BRESCIA

Prof. Luca Giorleo – DIMI
Prof. Daniele Alberti – DSCS
Prof. Marco Ferrari – DII
Prof. Massimiliano Granieri - DIMI