IMT Lille Douai
École Mines-Télécom
IMT-Université de Lille

Interreg
France-Wallonie-Vlaanderen

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GoToS3
Elasto-Plast

L'IMPRESSION 3D POLYMÈRE
POLYMER 3D PRINTING

08/12/2020

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Co financeurs
Cofunding

met de steun van west-vlaanderen de gedreven provincie

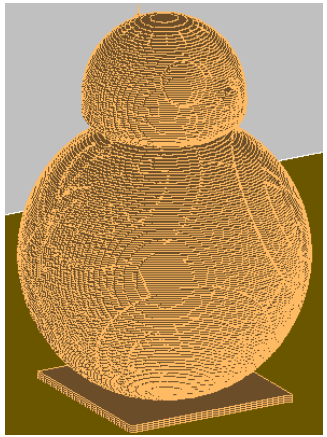
Wallonie

AGENTSCHAP INNOVEREN & ONDERNEMEN

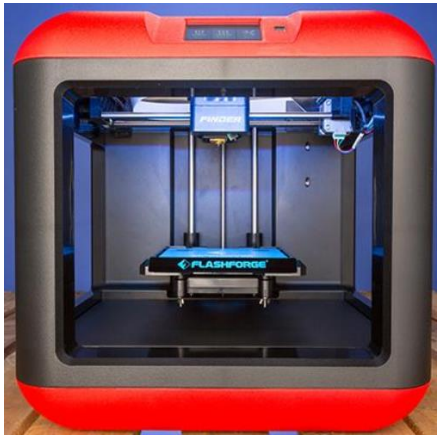
AVEC LE SOUTIEN DU FONDS EUROPÉEN DE DÉVELOPPEMENT RÉGIONAL
WITH THE SUPPORT OF « FONDS EUROPÉEN DE DÉVELOPPEMENT RÉGIONAL »

Proccesses allowing to manufacture, layer by layer, by adding material, a real part from a numerical part, AFNOR strandard NF E 97-001 [1]

CAD File



Slicer



3D printer

Real part

What kind of technology could we use ?

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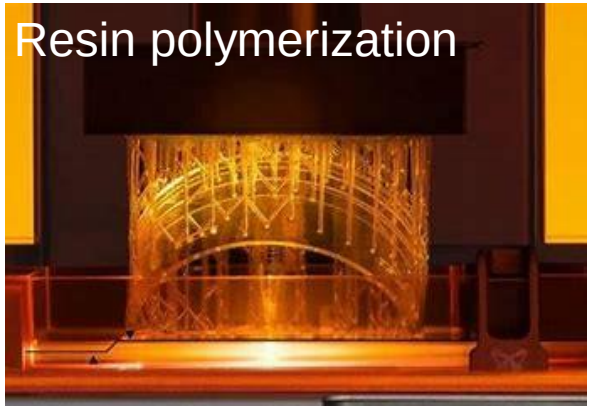
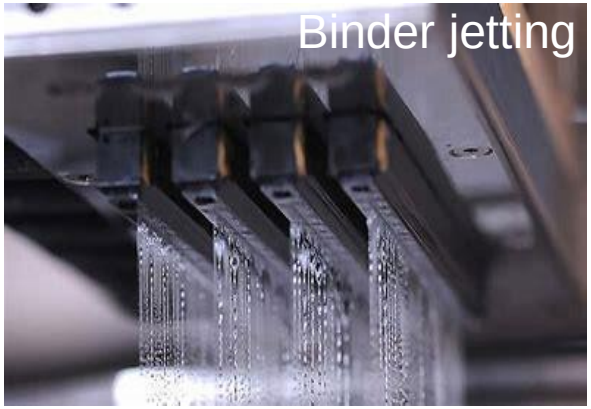
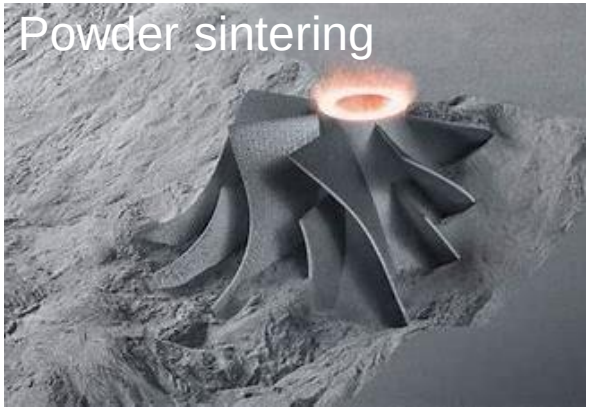
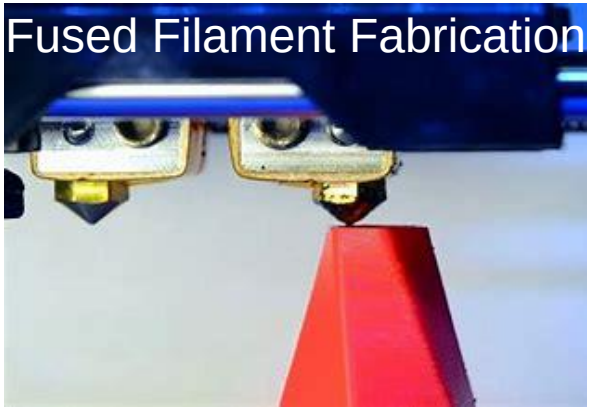
[1] AFNOR NF E67-001: Fabrication additive – vocabulaire. Ed, p4 (2011)

PLAN OF THE PRESENTATION









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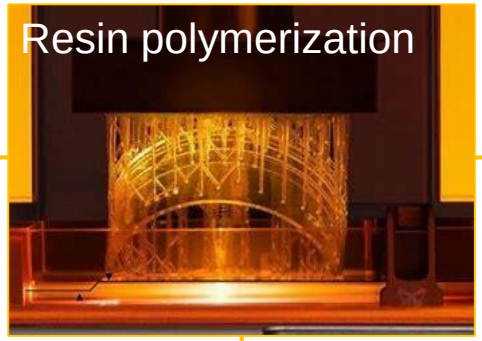
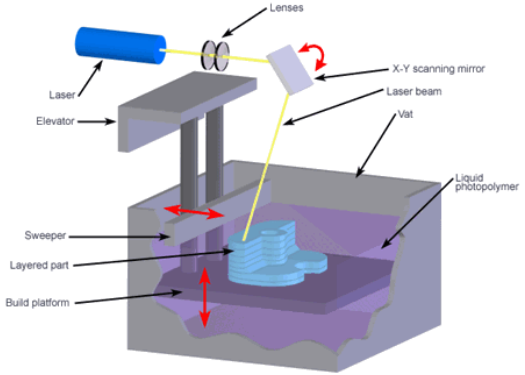
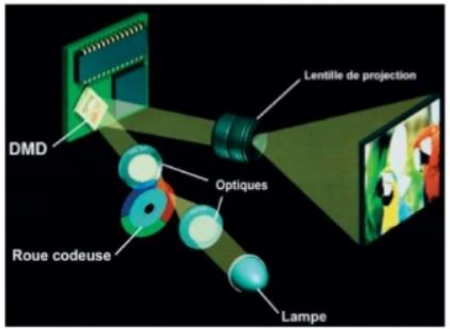
Resin polymerization



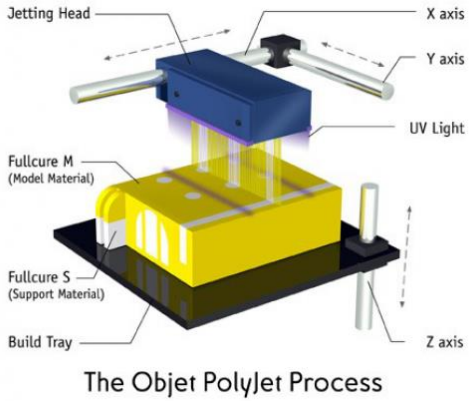
Stereolithography (SLA)

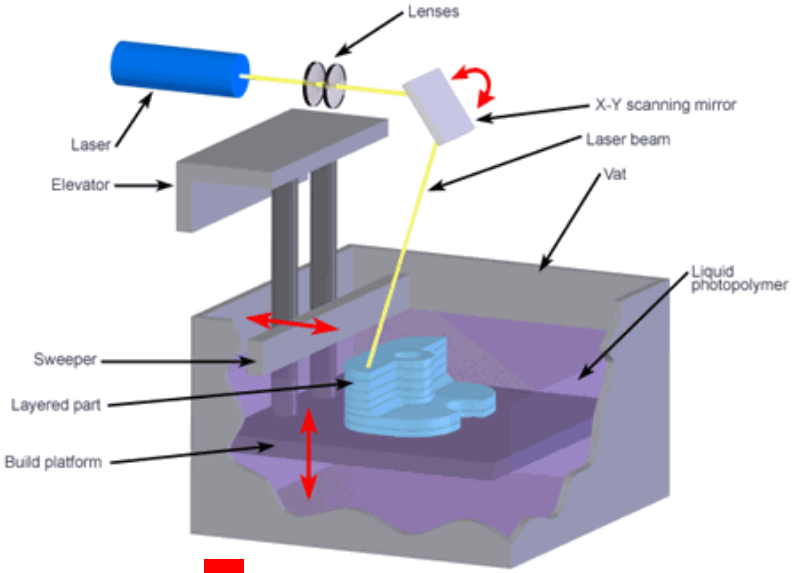


Digital light processing (DLP)



Polyjet

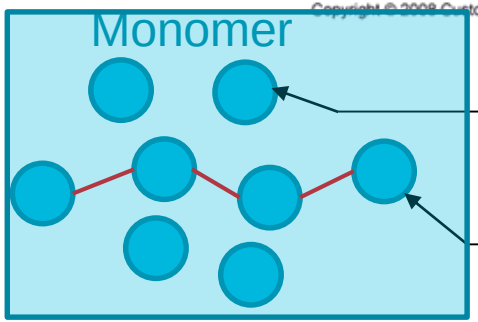




HOW DOES
STEREOLITHOGRAPHY
WORK?

www.youtube.com/watch?v=jeCHKDxQQh0
9s

UV Laser



Monomer (liquid)

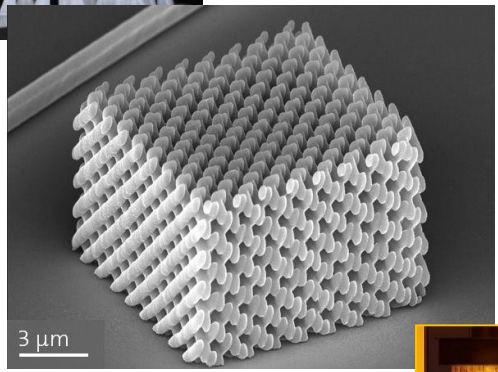
Polymer (solid)

Advantages

- Available cheap 3D printer
- High precision / resolution
- Low surface roughness

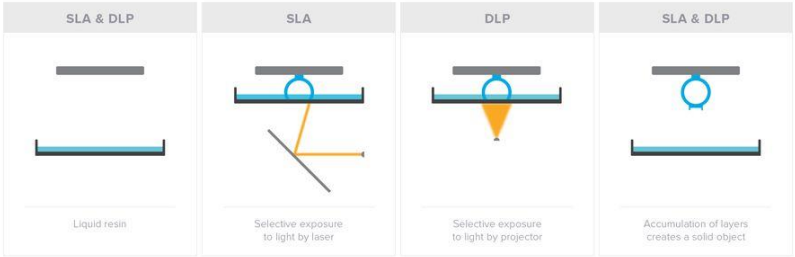
Disadvantages

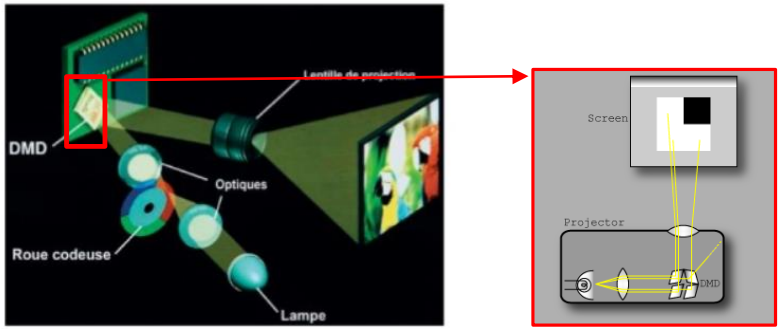
- Low diversity of materials
- Raw material sensible to UV
- Mono material part



RESIN PHOTOPOLYMERIZATION

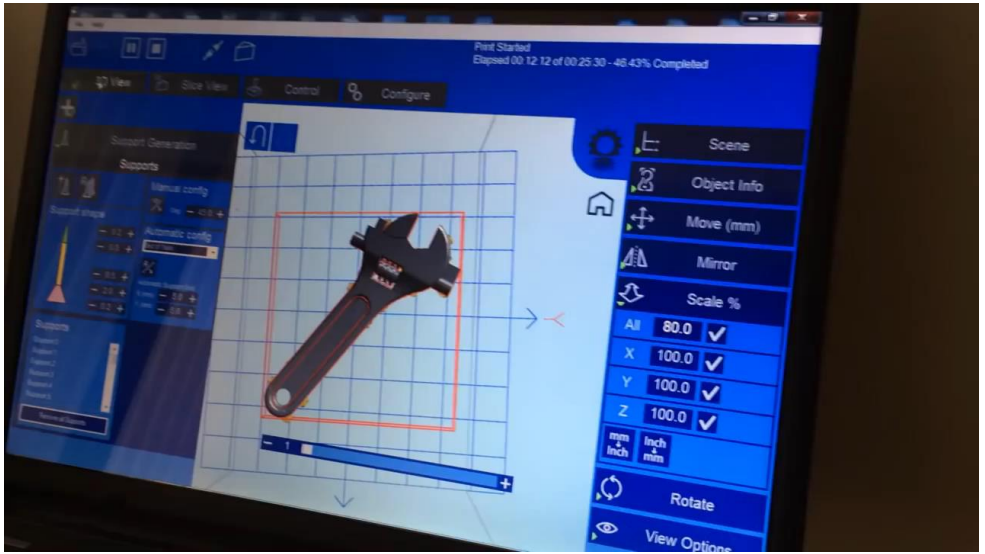
Digital light processing (DLP)





Fonctionnement de la projection DLP

(Source : EreNumerique.fr)



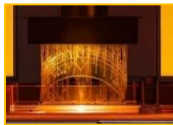
www.youtube.com/watch?v=qZiAu3PouK8

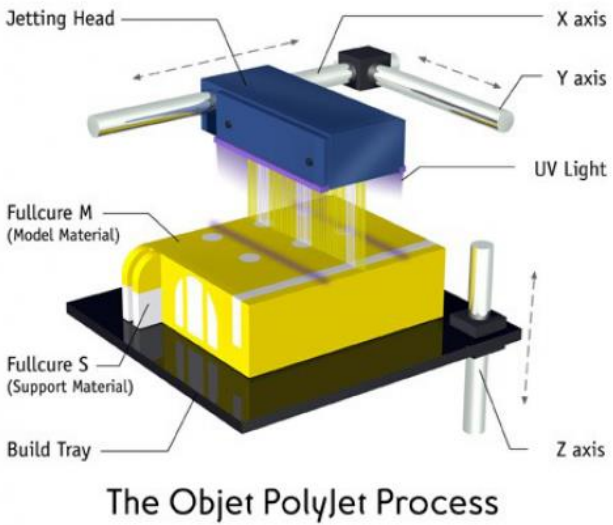
Advantages

- Low fabrication time
- Decrease in the price of the part

Disadvantages

- Higher surface roughness
- Mono material part
- Low diversity of materials
- Raw material sensible to UV





The Objet PolyJet Process

www.youtube.com/watch?v=Som3CddHfZE&t=66s

1min11s
1min42s

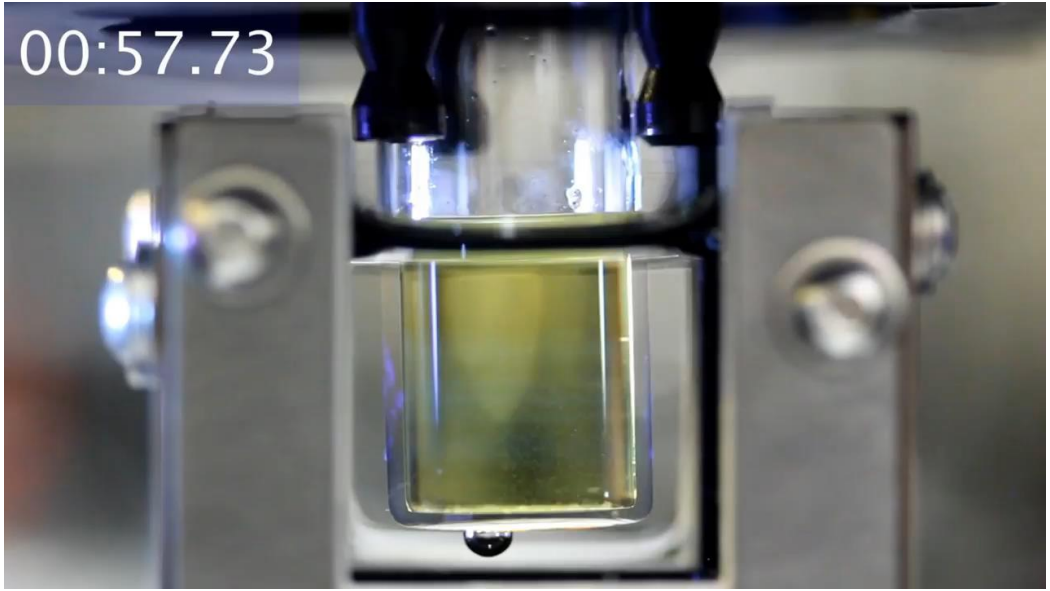
Avantages

- Seveal printing heads
  → multi-materials/multi-colors
- High resolution / precision
- Low surface roughness
- Low fabrication time

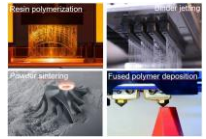
Disadvantages

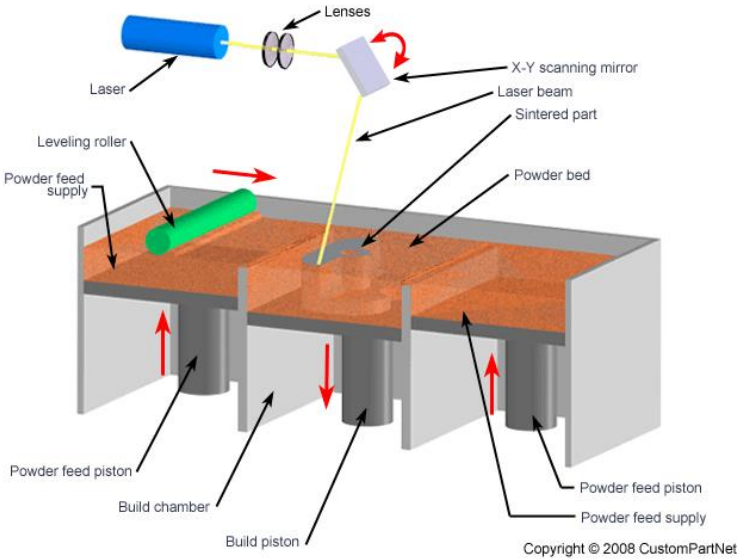
- Low diversity of materials
- Raw material sensible to UV

Lawrence Livemore National Laboratory (USA, California)

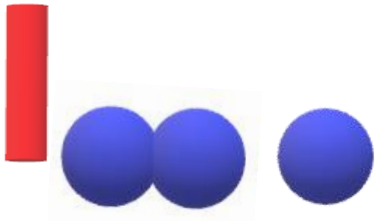


www.youtube.com/watch?v=f7_3kauRbmk





Laser



Powder

HOW DOES
SELECTIVE LASER SINTERING
WORK?

9s

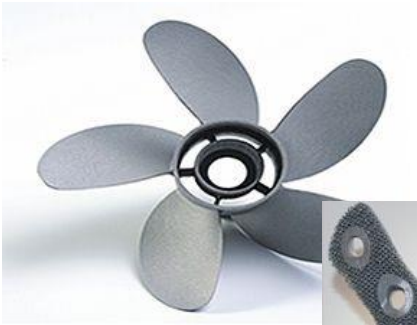
www.youtube.com/watch?v=ruvRijM7f50

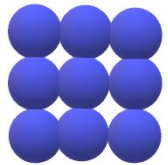
Avantages

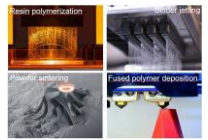
- Technology available for metals, ceramics and polymers
- High precision / resolution

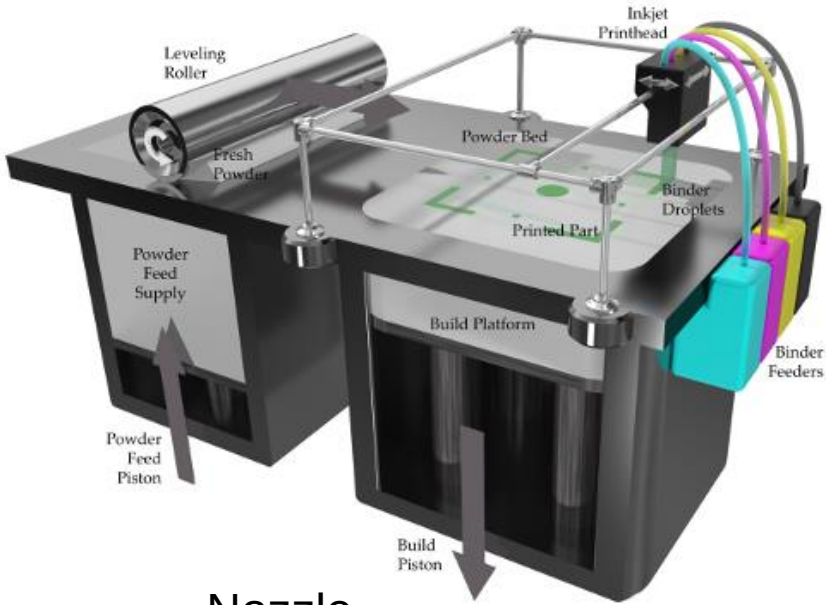
Disandvatages

- Expensive raw materials
- Need to recycle the powder
- Size of the powder
- Mono material part
- Surface aspect: relatively rough
- Porosity in the part









Nozzle

Powder

40s

www.youtube.com/watch?v=ONMYx1yhJuo

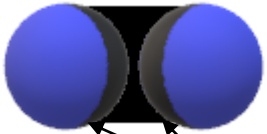
1min 22s

Advantages

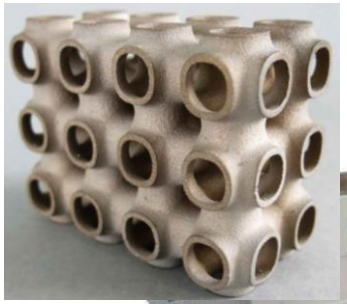
- Technology available for metals, ceramics and polymers
- Multi-colors parts

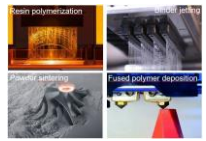
Disadvantages

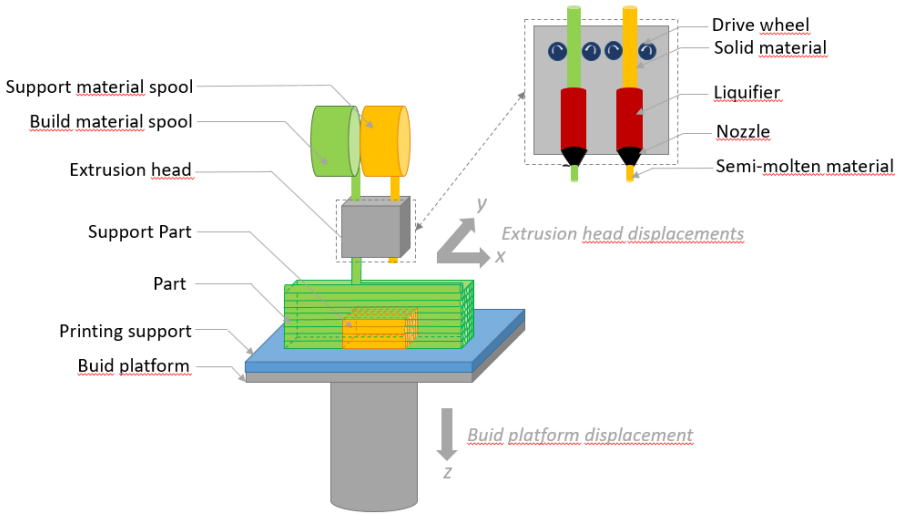
- Particle size
- Need to recycle the powder
- Low mechanical properties



Interfaces = fragilities







www.youtube.com/watch?v=WHO6G67GJbM&t=4s

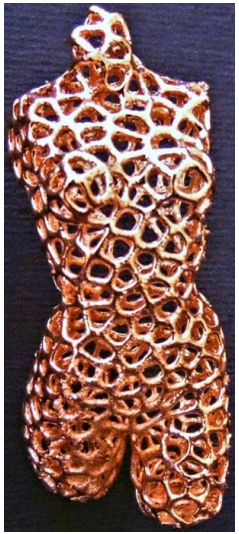
56s
1min40s

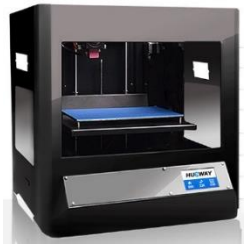
Avantages

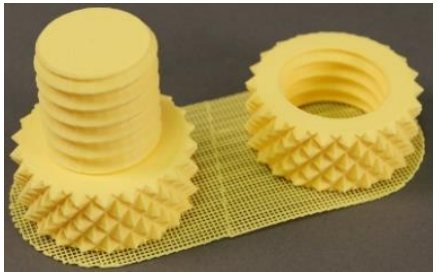
- Cheap 3D printers
- Easy to use
- Multi-materials, multi-colors parts

Disadvantages

- High surface roughness
- Strong anisotropy in the mechanical properties of the parts







Colored FFF

Prusa[1]

XYZ printing

Composites

Markeforge

Anisoprint[3]

FFF à partir de granulés

Freeformer (Arburg)[1]

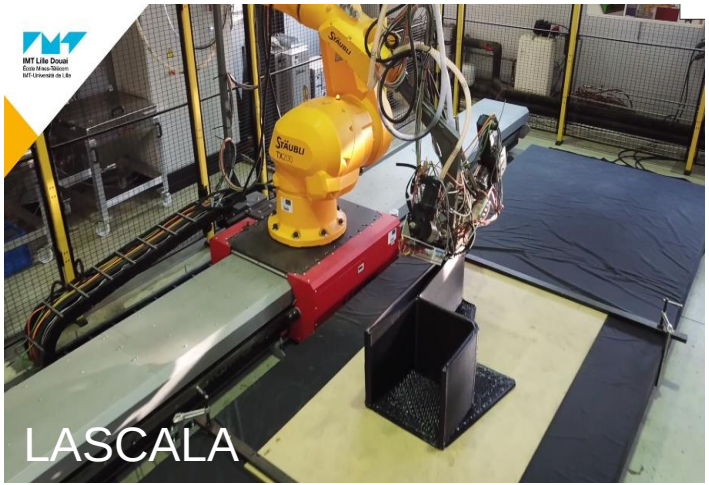
PAM (Pollen AM)[2]

David (Sculptify)

[1] Round Table: **Utilisation de la FA par dépôt de polymère fondu au CERI MP**

[2] Round Table: **Procédé PAM**

[3] Round Table: **La FA composite**



- ✓ Large part: 5m x 2m x 1m (LASCALA)
- ✓ 2 extruders (LASCALA)
- ✓ Raw material = pellets
- ✓ Customizable nozzle
- ✓ Insertion of short or long fibers

→ Round table: **FA grandes dimensions: Présentation de LASCALA**

How could we choose the appropriate AM technology ?

Type of polymer
Rigid thermoplastic
Soft thermoplastic (TPE)
Thermostable polymers
Elastomers
…

System
Opened system
Closed system

Dimensions of the part

Composition of the part
Mono material
Multi materials

Precision of the part
Resolution of the part

Cost
AM machine
Raw material

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UNION EUROPÉENNE
EUROPESE UNIE

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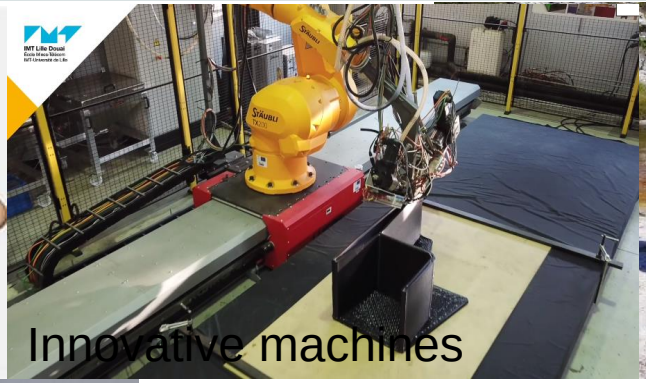
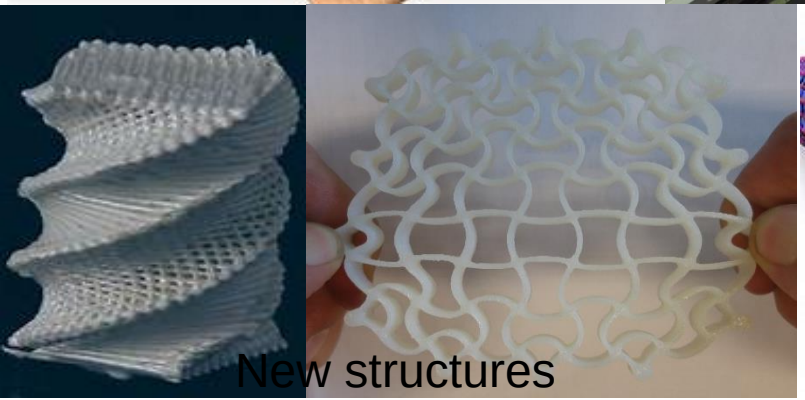
IF YOU HAVE ANY QUESTIONS ON OUR AM ACTIVITIES IN THE CERI MP

Commercial machines

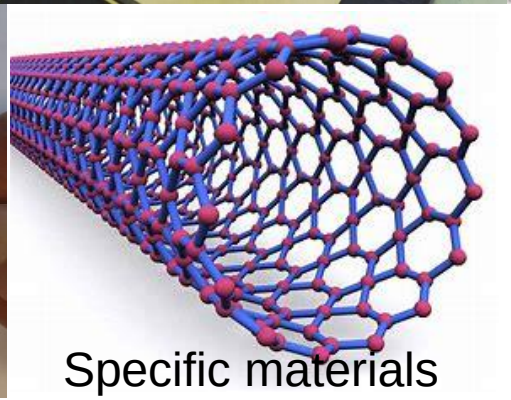


Innovative machines

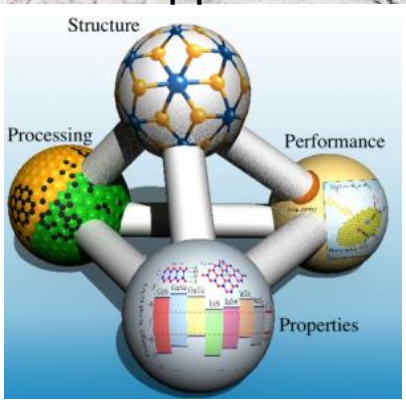
Medical applications



New structures



Specific materials



→ Round table: **Utilisation de la FA par dépôt de polymère fondu au CERI MP**

Thank you for you attention!