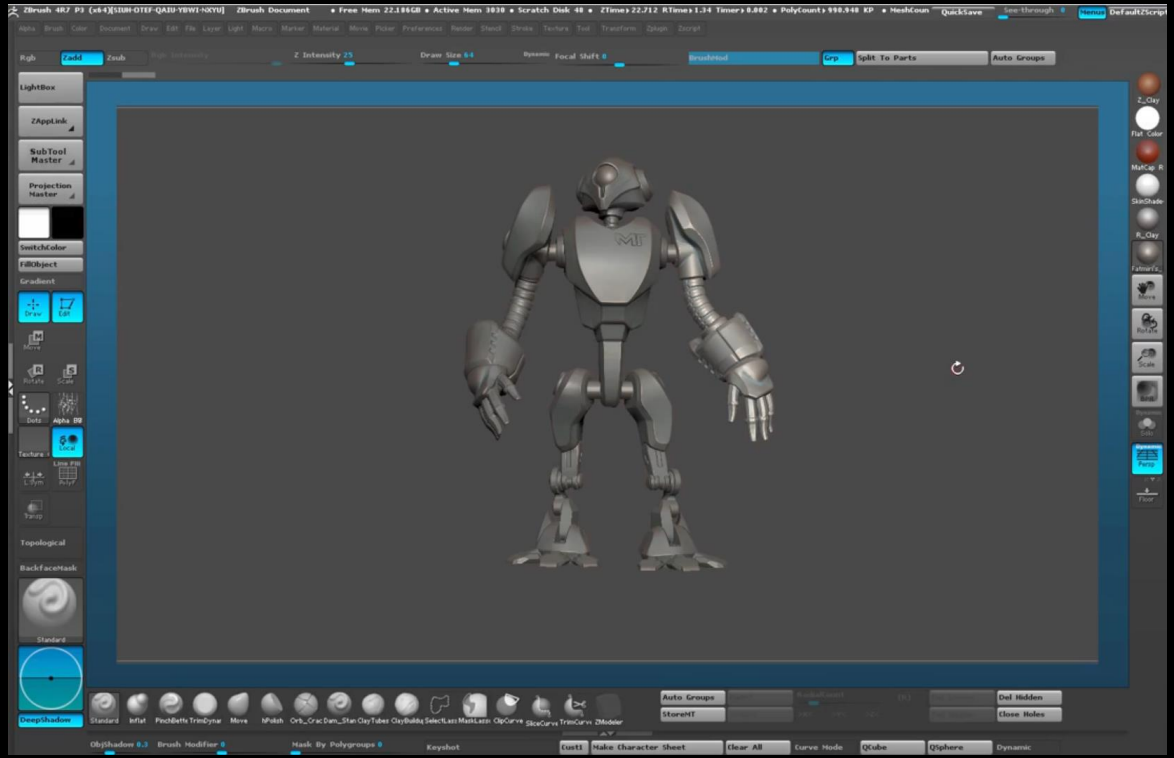
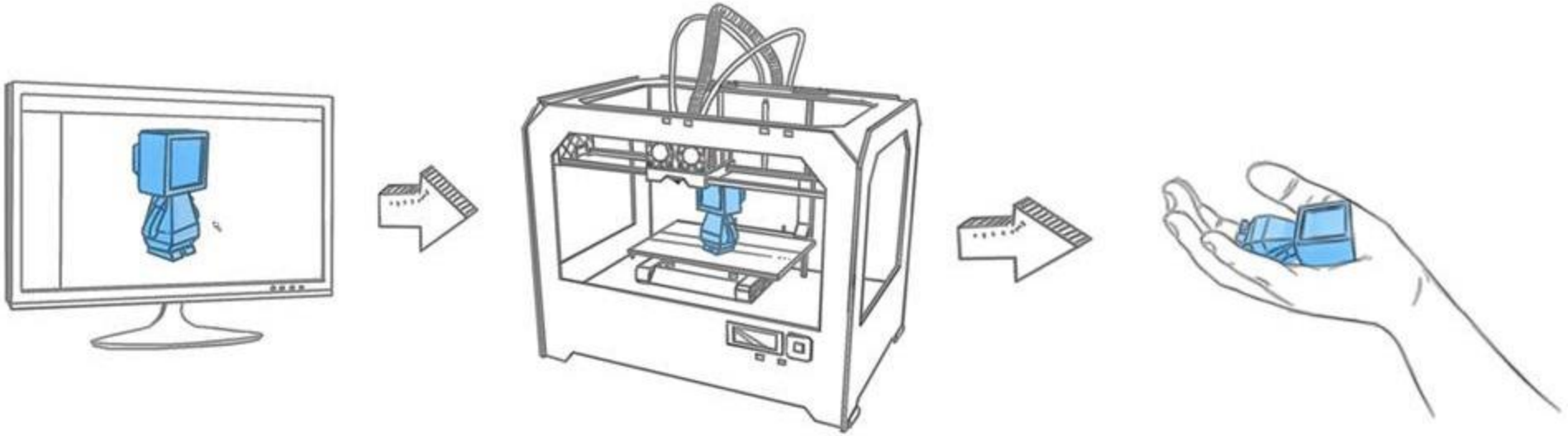
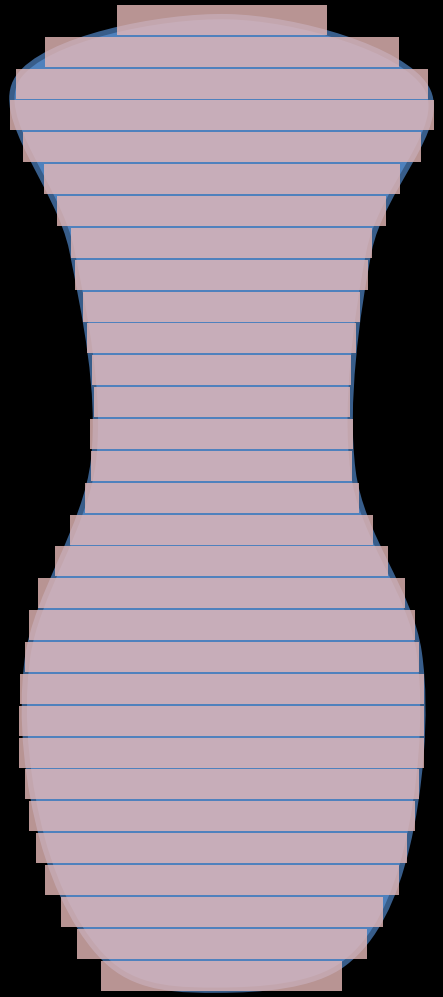
A brief introduction to 3D Printing technologies

3D Printing – From Digital To Real



What is it and how does it work?





*layered additive manufacturing

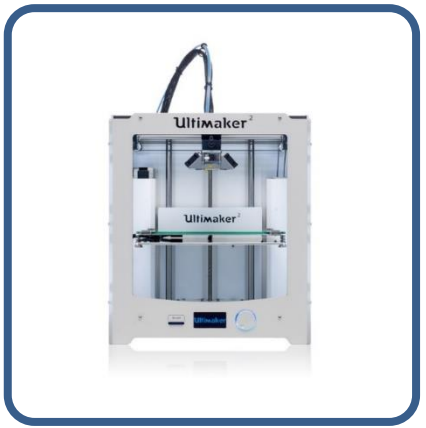
Slicing and G-Code

Modeling

STL

Slicing

G-Code

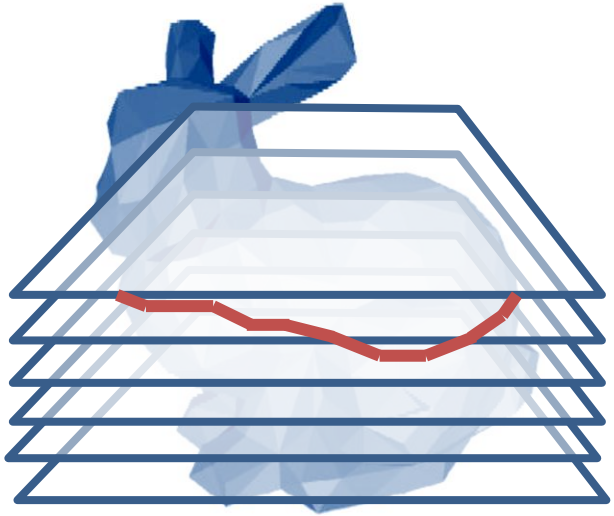


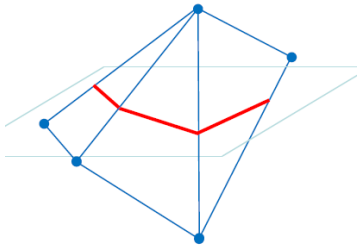
Printing

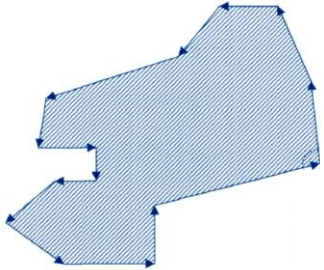
Slicing

Simple algorithm

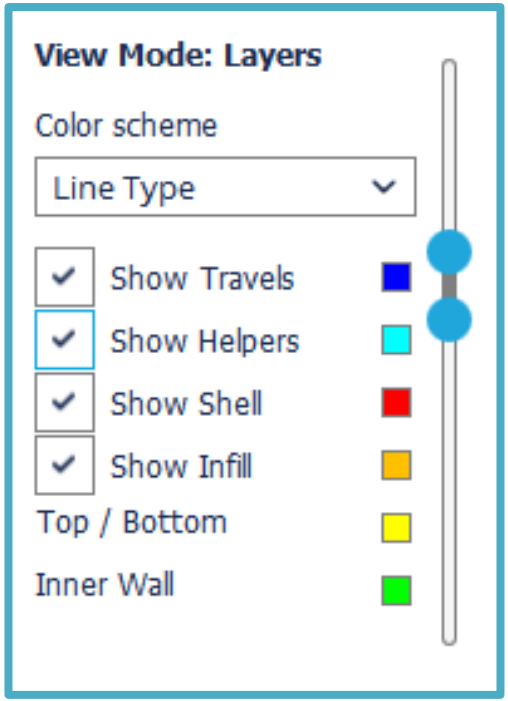
```
for each z-plane p
      for each triangle T
         intersect T with p
         store line segment
         connect line segments
         store contours
         generate in-fill
```

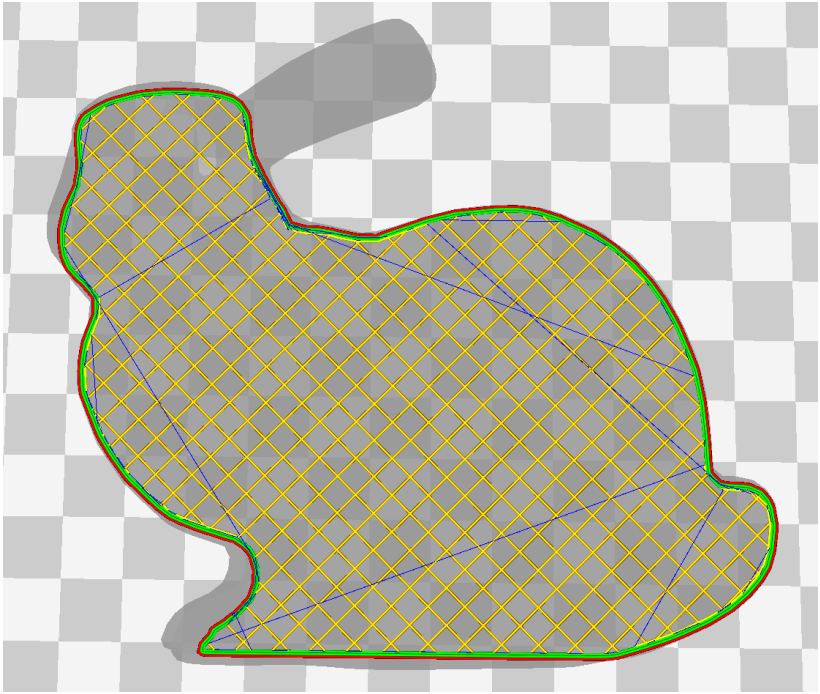






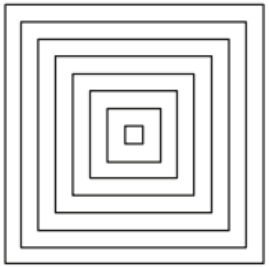
Slicing – In-Fill Structures



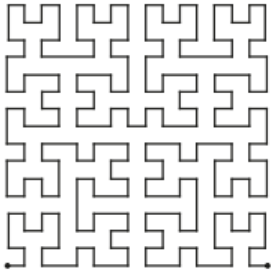


Slicing – In-Fill Structures

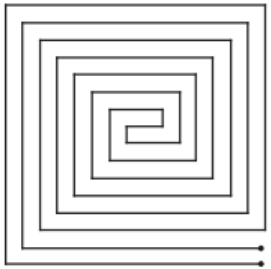
Direction parallel



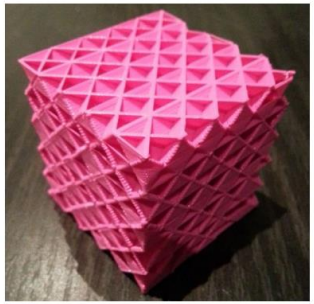
Contour parallel

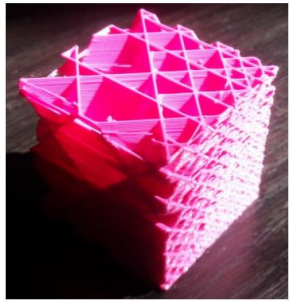


Hilbert curve



Fermat spiral





Hierarchical rhombic in-fill, http://sylefeb.blogspot.ca/

Slicing – Cura

Cura Software

Cura prepares your model for 3D printing. For novices, it makes it easy to get great results. For experts, there are over 200 settings to adjust to your needs. As it's open source, our community helps enrich it even more.

Windows
Cura 2.7
(64)

Download for free

View the Cura manual

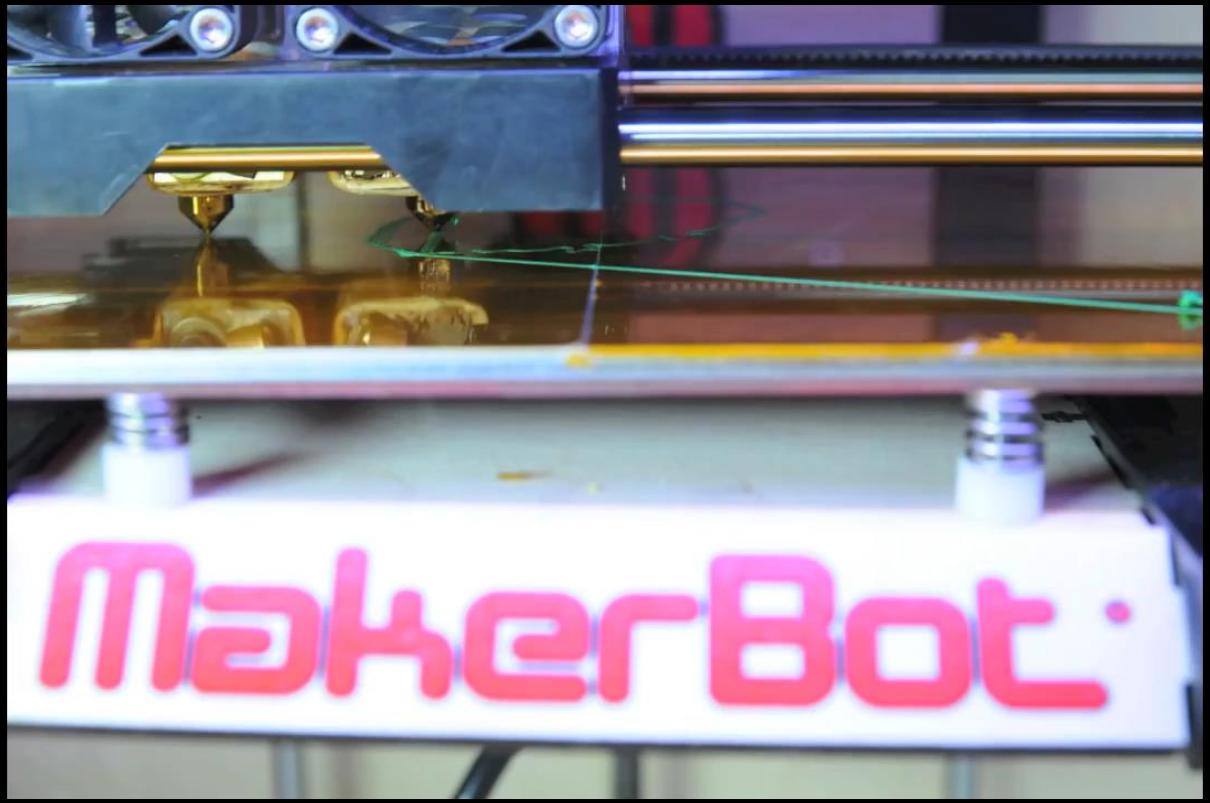
View all versions

Release notes

https://ultimaker.com/en/products/cura-software

An Example

An Example



3D Printing: how it started

- Chuck Hull, father of 3D Printing
- Came up with the idea in 1983 while using UV light to harden tabletop coatings.
- Developed many of the concepts and processes still in use today
- First commercial 3D printing system in 1989

Good Morning America (1989)

3D Printing today

From Rapid Prototyping to Direct Manufacturing

3D Printing today

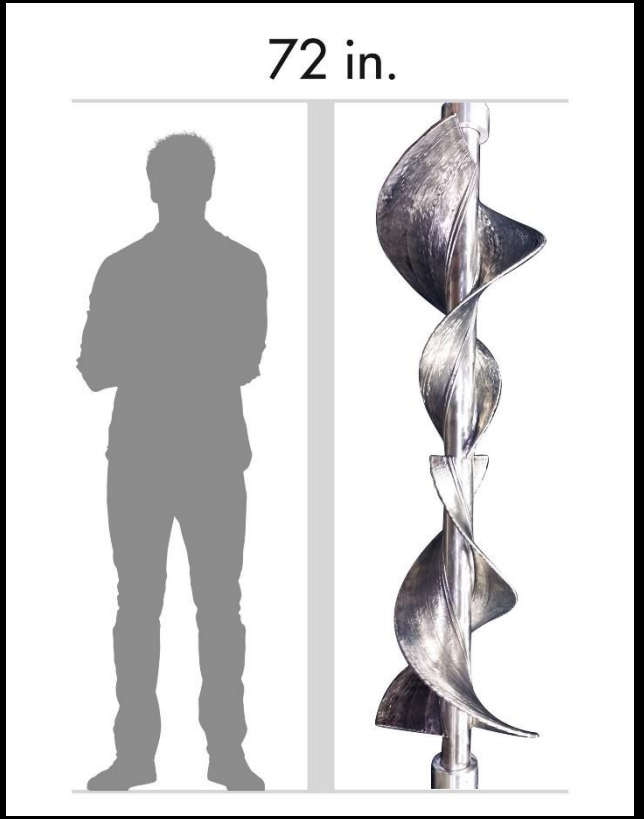
From Industrial Equipment to Home Use

3D Printing – why all the excitement?

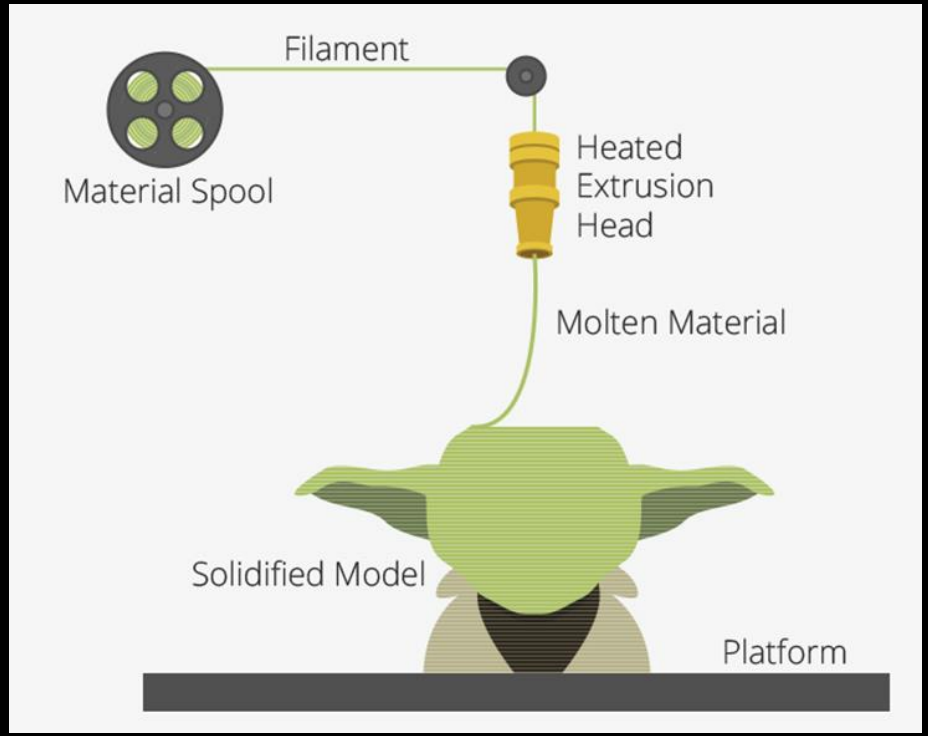
- complexity is for free
- Monolithic fabrication of multi-material objects
- best option for one-off's
- empowers new designers

Traditional Manufacturing*

Additive Manufacturing

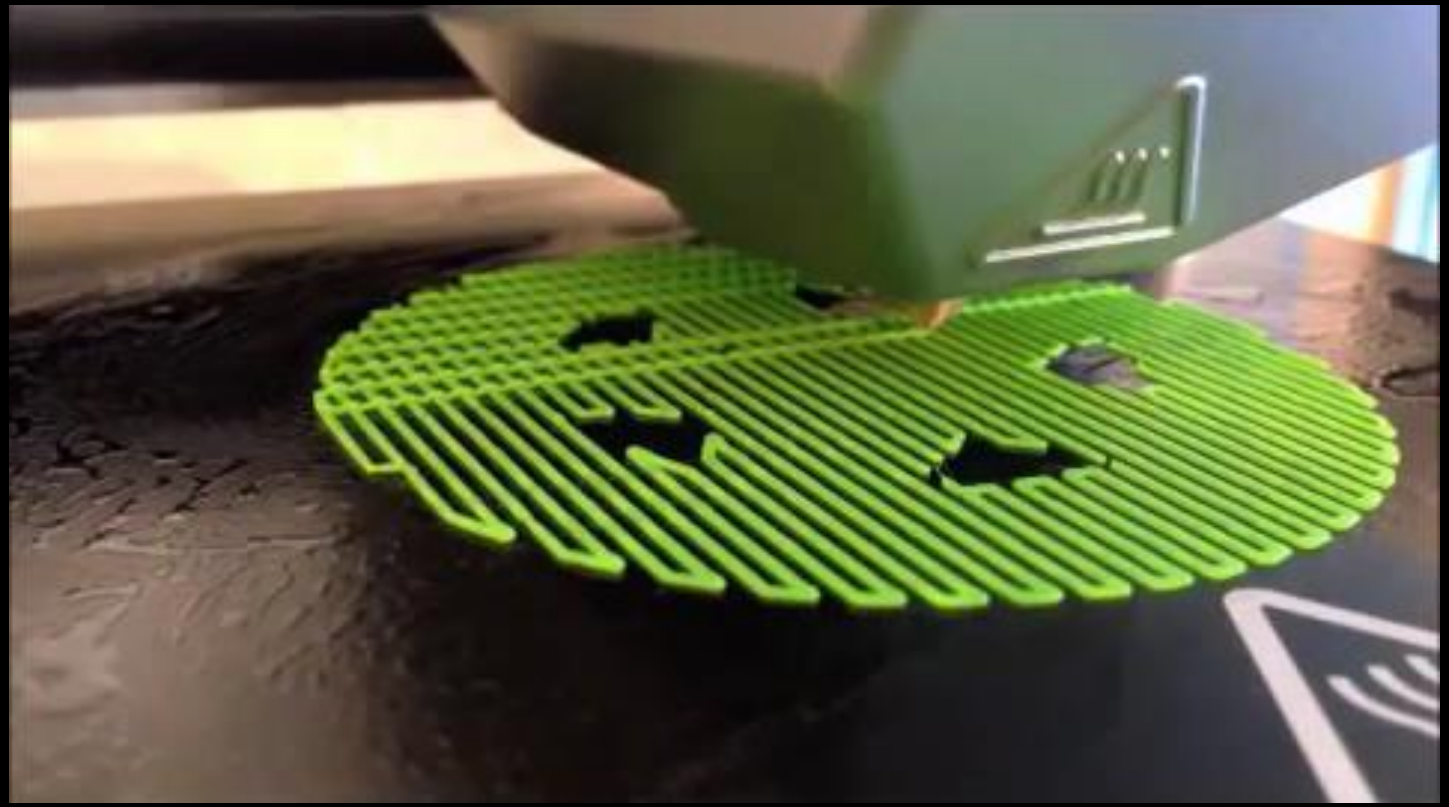


Overview of 3D Printing Technologies



Fused Deposition Modeling (FDM)/Fused Filament Fabrication(FFF)

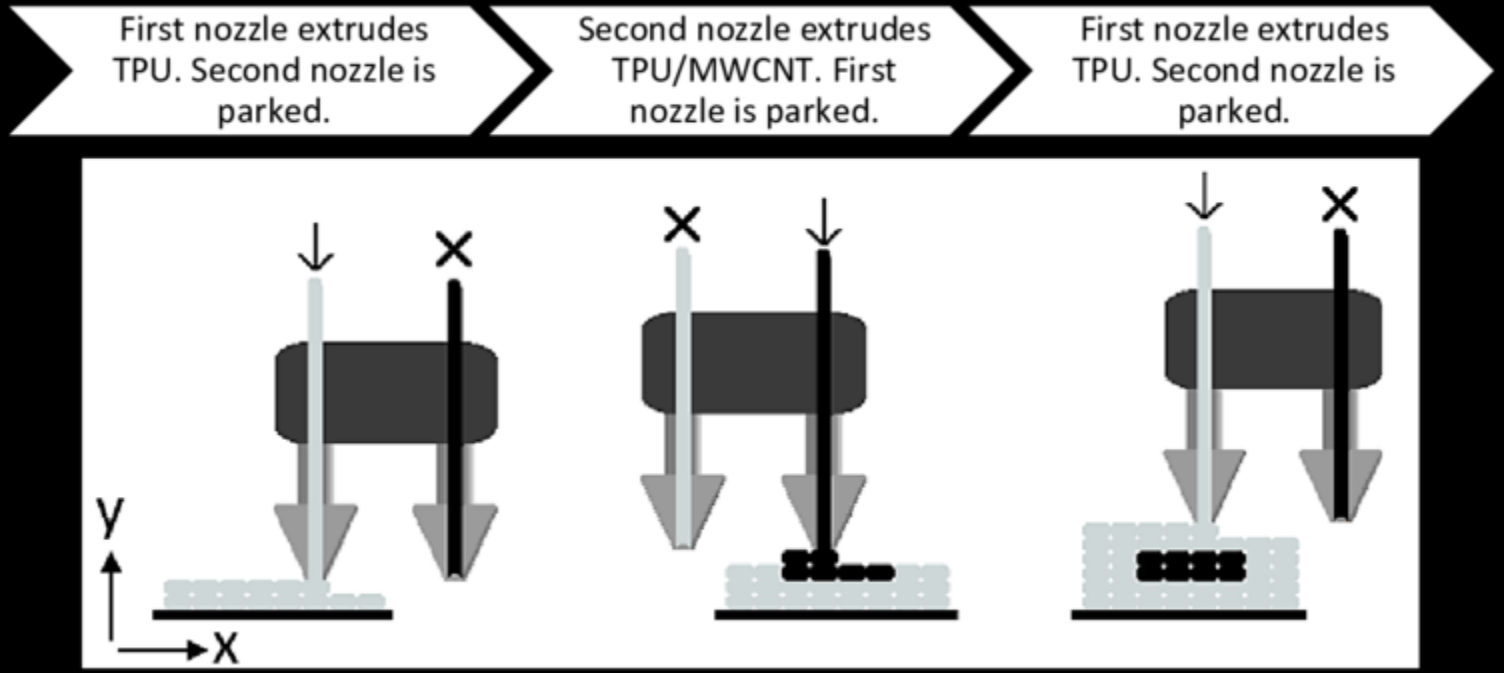
An Example



Overview of 3D Printing Technologies

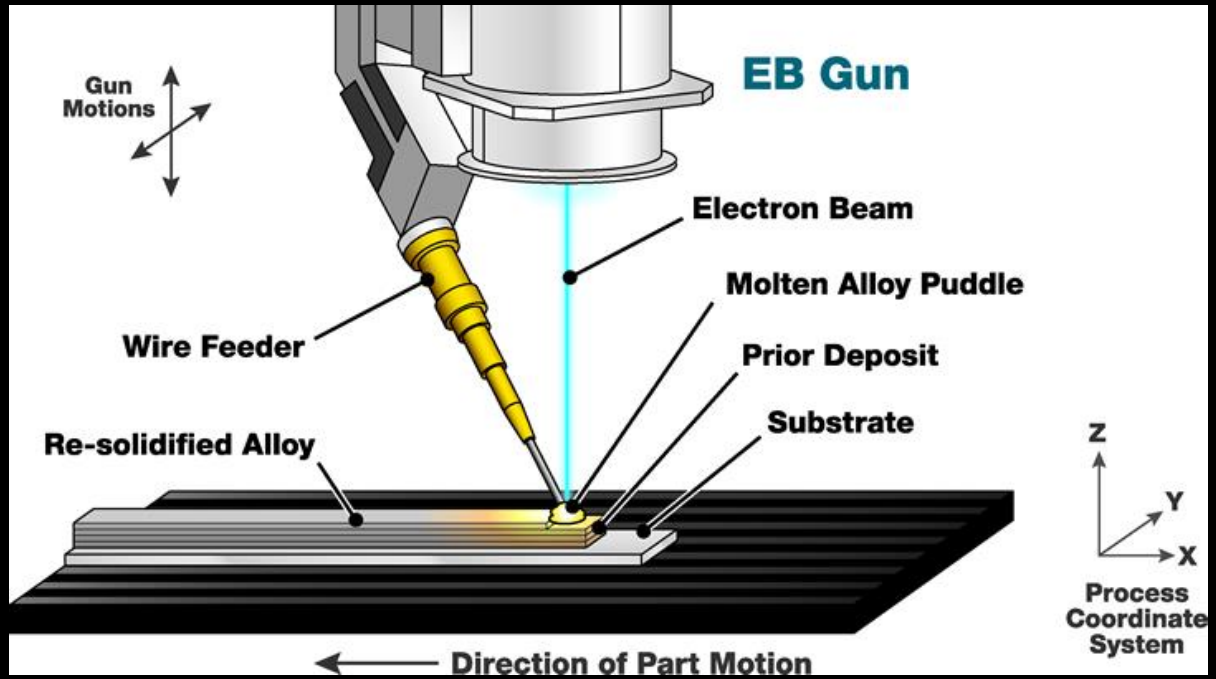
Fused Deposition Modeling (FDM)/Fused Filament Fabrication(FFF)

Multi-material FDM printing



Multi-material FDM printing

Electron beam wirefeed additive manufacturing



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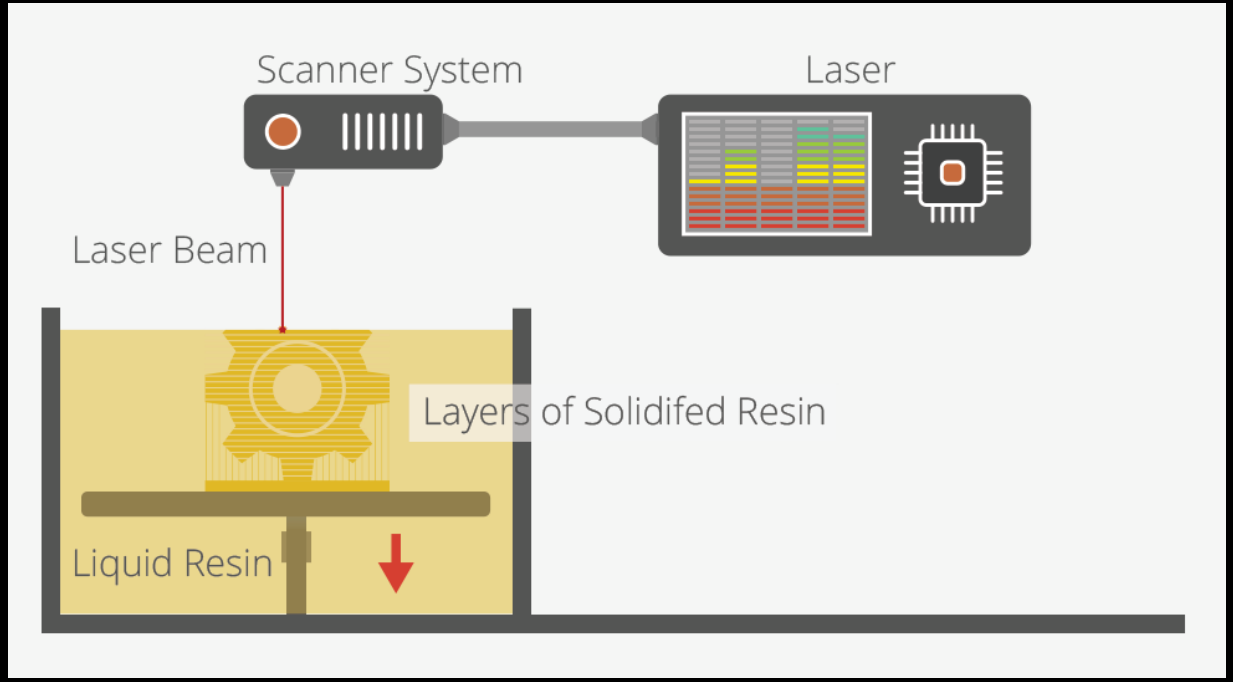

Stereolitography (SLA)/Digital Light Processing (DLP)/ Photopolymer Phase Change Inkjets (PolyJet)

Overview of 3D Printing Technologies

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Stereolitography (SLA)/Digital Light Processing (DLP)/ Photopolymer Phase Change Inkjets (PolyJet)

SLA/DLP printing – single material

Overview of 3D Printing Technologies

Stereolitography (SLA)/Digital Light Processing (DLP)/ Photopolymer Phase Change Inkjets (PolyJet)

Overview of 3D Printing Technologies

Stereolitography (SLA)/Digital Light Processing (DLP)/ Photopolymer Phase Change Inkjets (PolyJet)

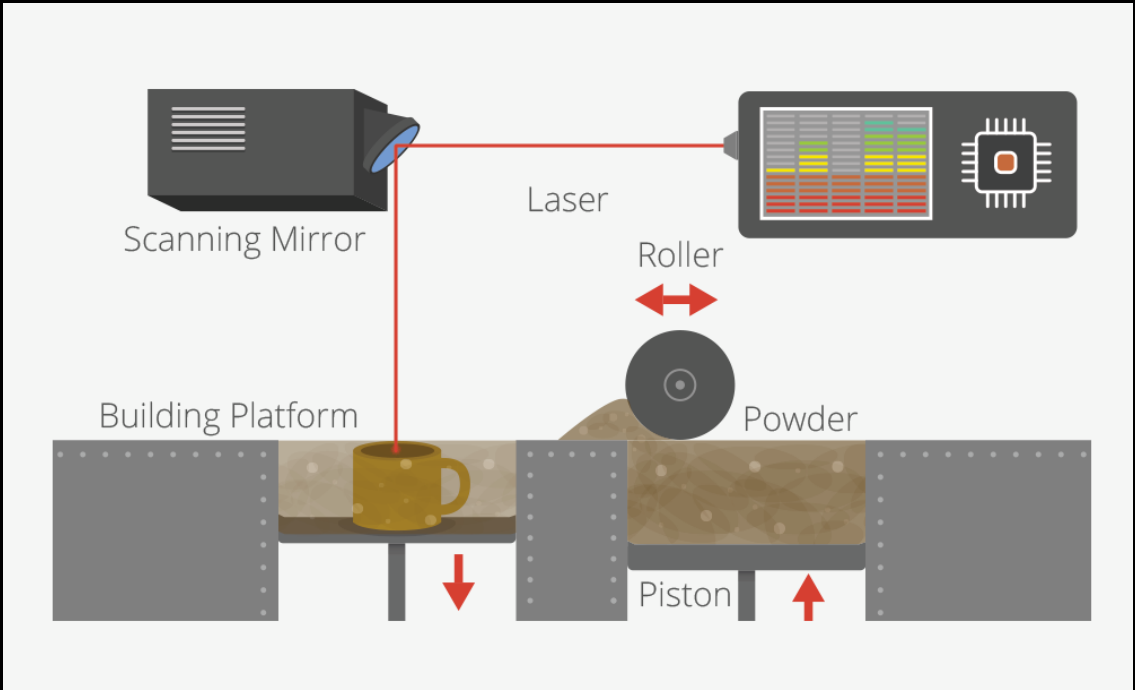
Overview of 3D Printing Technologies

Basis for 3D Printing: reconfigurable matter

We’ve seen the options of melting thin strands of material into a desired shape, or selectively solidifying liquid resins via photopolymerization

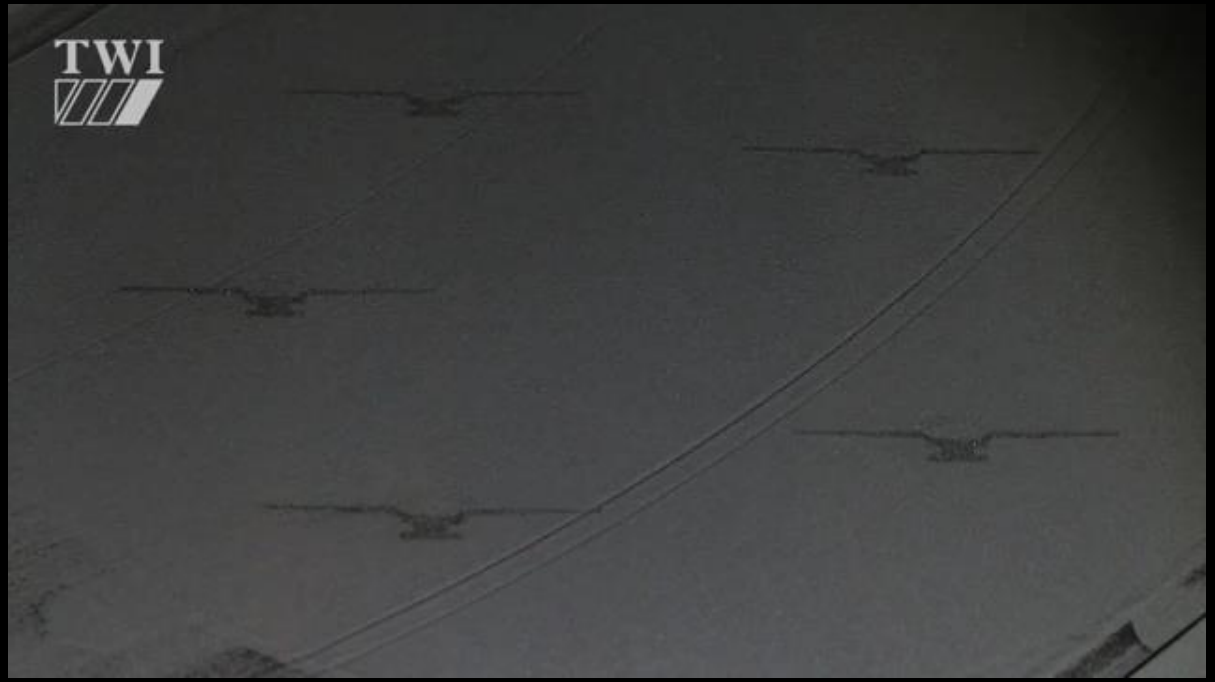
Other possibilities?

Overview of 3D Printing Technologies



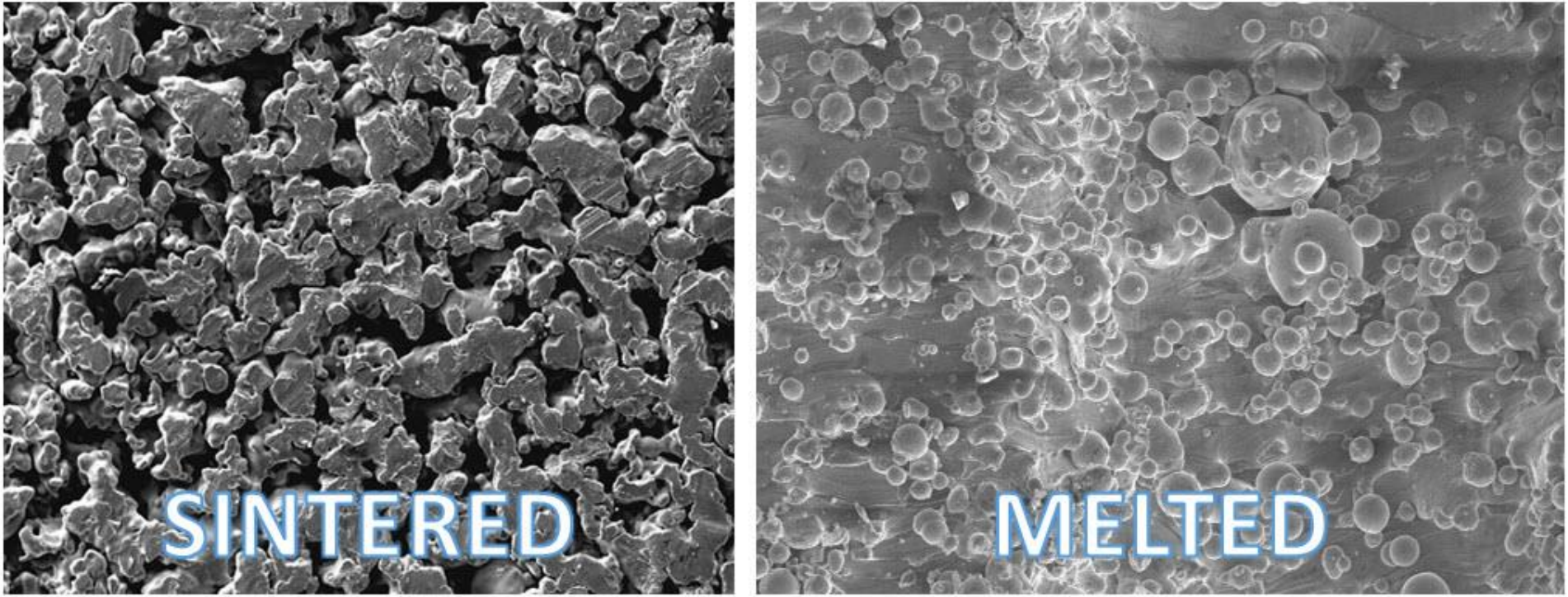
Selective Laser Sintering (SLS) / Direct Metal Laser Sintering (DMLS)/Plaster-based 3D Printing (PP)

Overview of 3D Printing Technologies



Selective Laser Sintering (SLS) / Direct Metal Laser Sintering (DMLS)/Plaster-based 3D Printing (PP)

Sintering vs Melting



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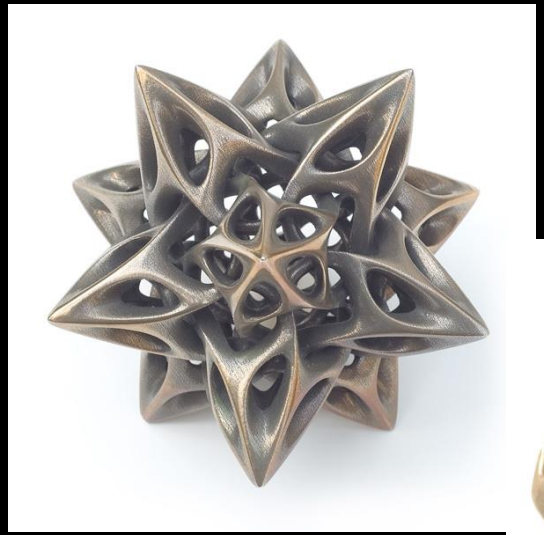
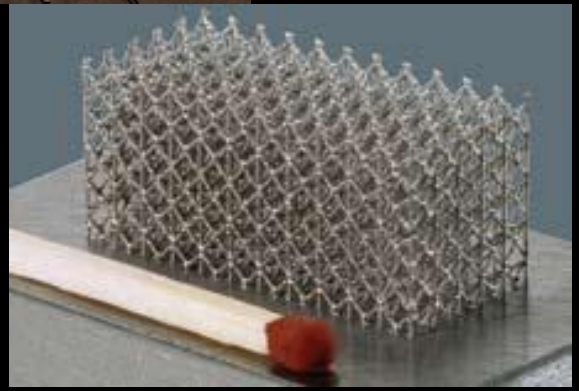
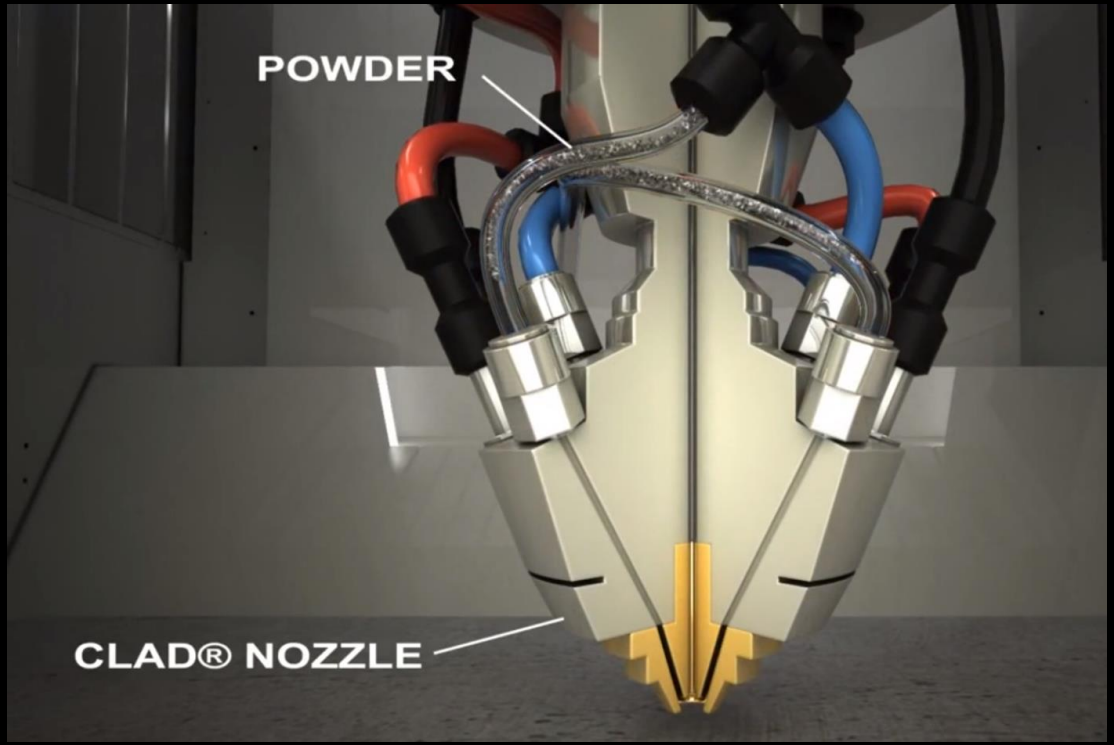




Selective Laser Sintering (SLS) / Direct Metal Laser Sintering (DMLS)/Plaster-based 3D Printing (PP)

Multi-material capabilities?



https://www.youtube.com/watch?v=Pjqysyy1ySs

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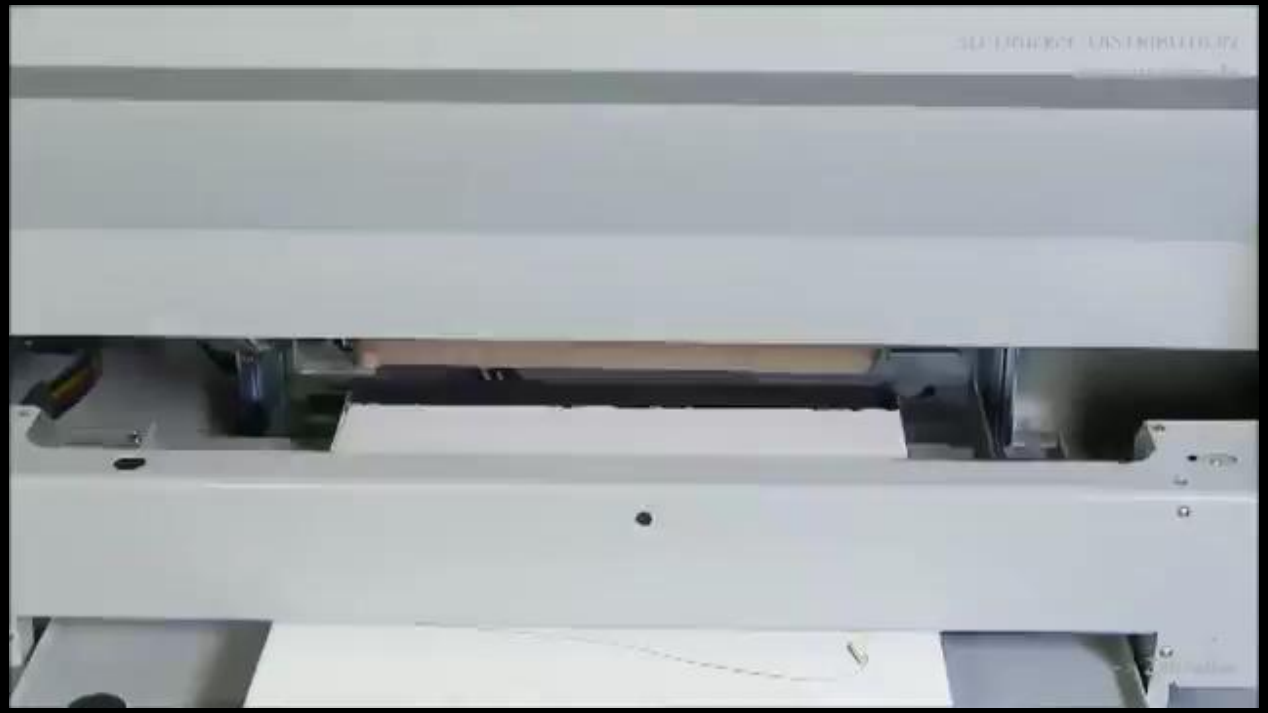

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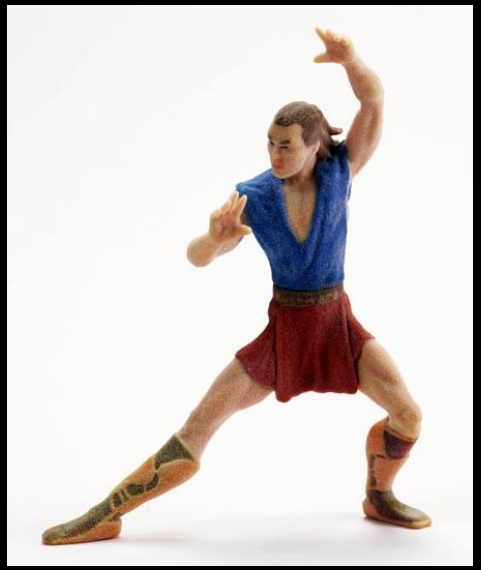

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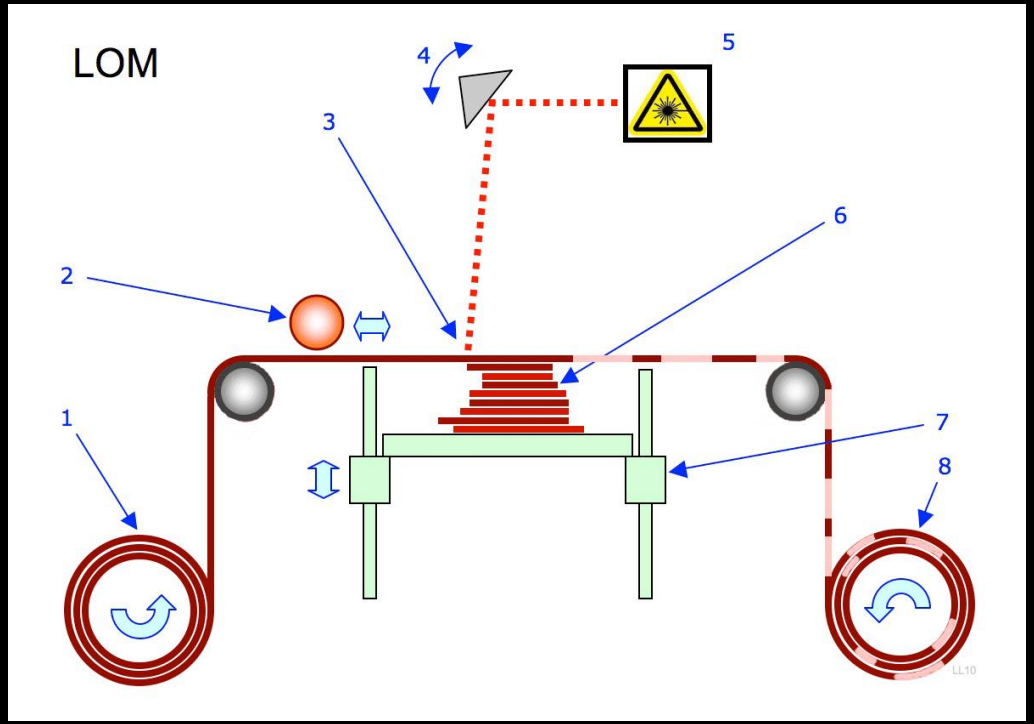


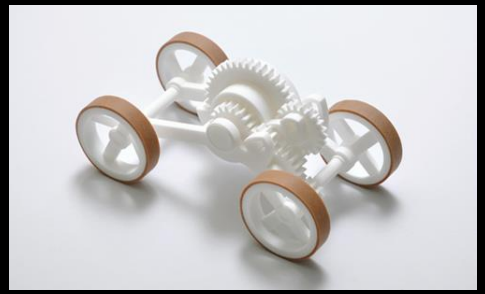
Laminated Object Manufacturing

Overview of 3D Printing Technologies

Laminated Object Manufacturing

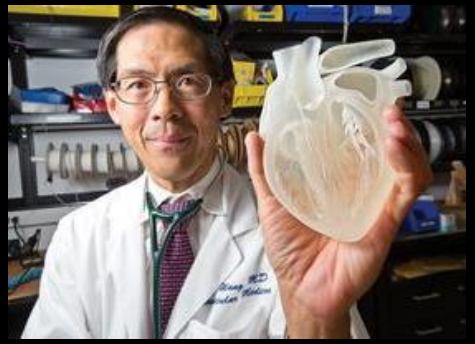
And many, many other variations…

3D Printing: What is it good for?



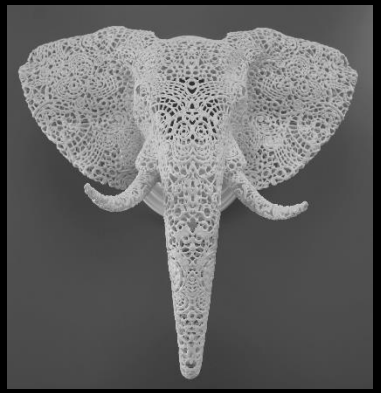
Consumer Products

3D Selfies



Medical Applications

Arcitecture



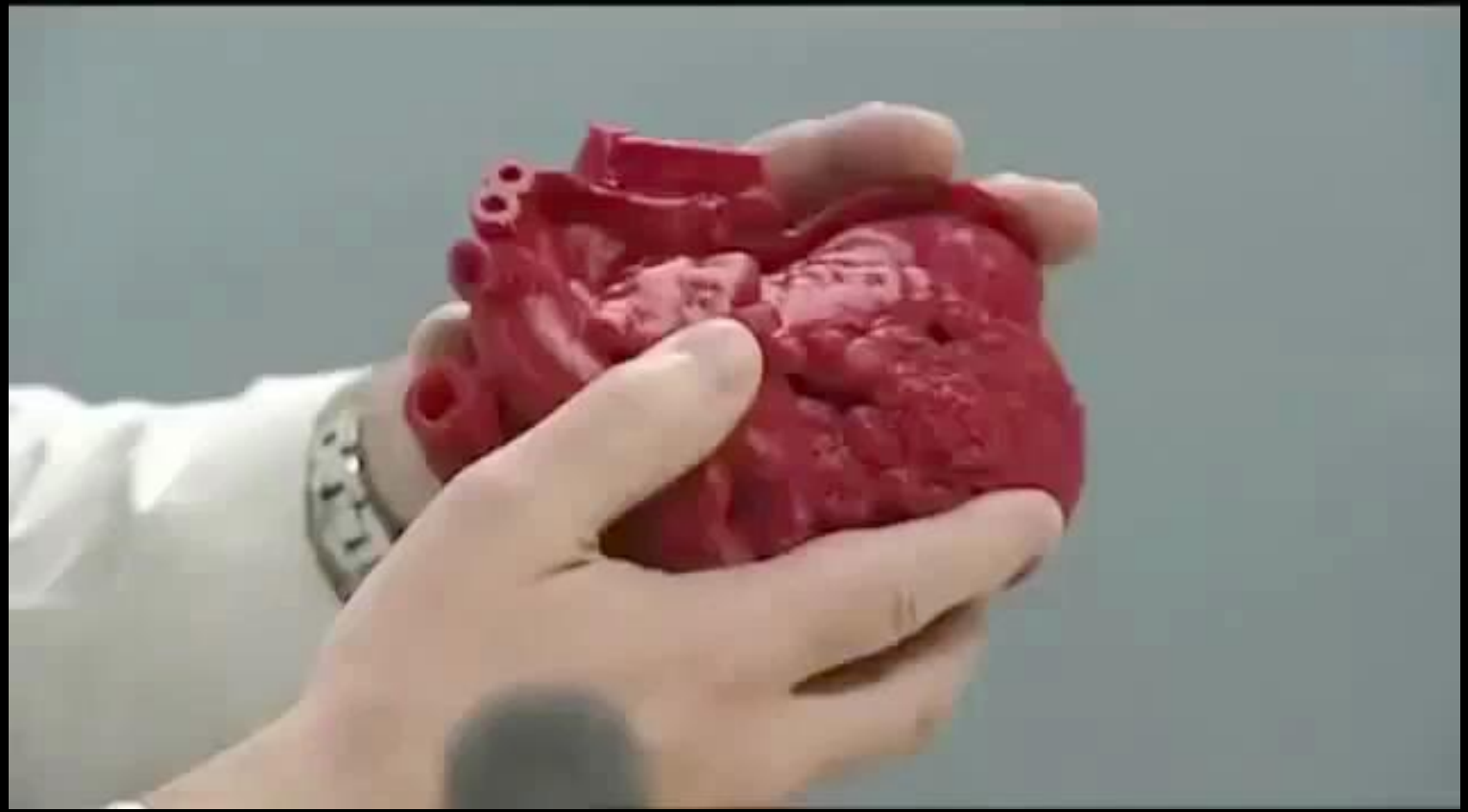
Art

Robotics

Prosthetics and wearables

Fashion

3D Printing: What is it good for?



3D Printing: What is it good for?

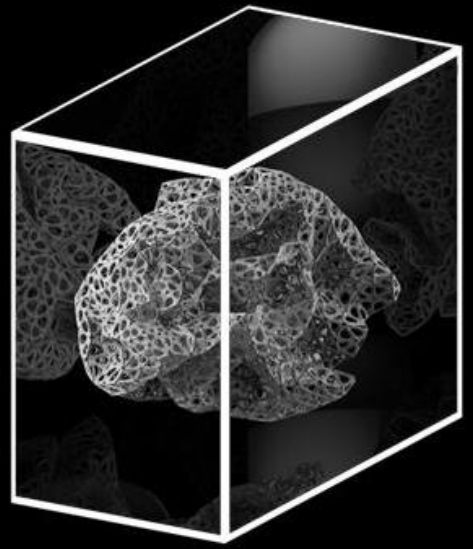
3D Printing: What is it good for?

3D SCAN

DRESS SHAPE

KINEMATICS STRUCTURE

COMPRESSED DRESS
FITS IN 3D PRINTER BUILD VOLUME



3D Printing: What is it good for?

3D Printing: What is it good for?

But how can we navigate the vast space of design possibilities?

To be continued…