
3D printing

What is 3D Printing?

3D printing is an additive manufacturing process. In 3D printing, material is added layer upon layer to create the object.

Some of the advantages of 3D printing:

- Design freedom – no limitations on product's structure
- Closed system – objects can be printed in one piece
- Quick production – can combine several materials in a single build process
- Customisation

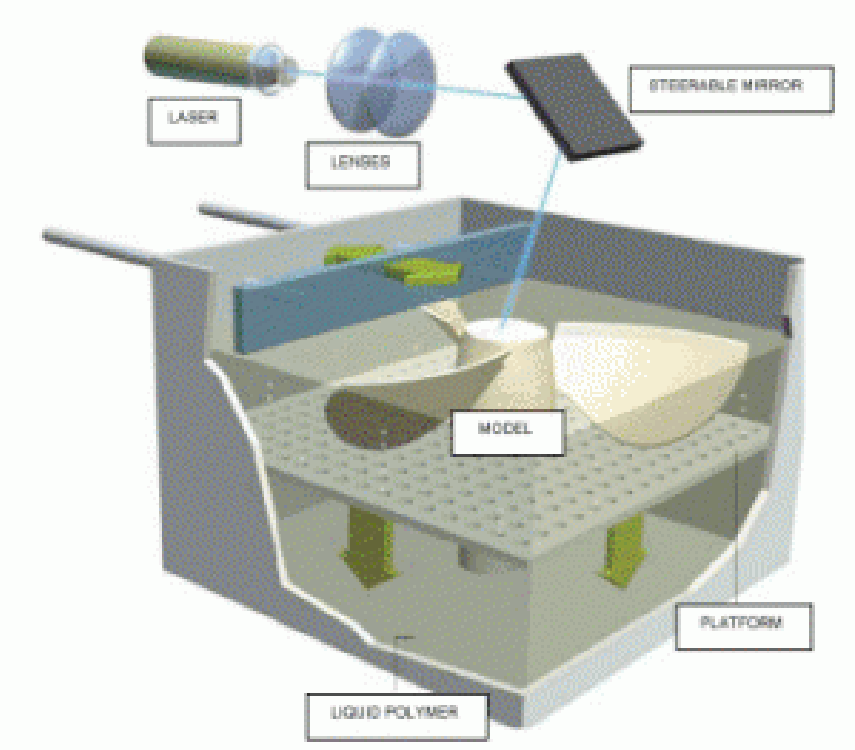
How Does It Work?

- Photopolymerization
  - SLA (Stereo Lithography)
  - DLP, CDLP
- FDM, FFF
- Material jetting
  - MJ
  - NPJ (Nano Particle Jetting)
  - DOD (Drop-on-Demand)
- Binder jetting
- Powder bed fusion
  - MJF (Multi-jet Fusion)
  - SLS
  - DMLS/SLM
  - EBM (Electron Beam Melting)
- Direct energy deposition
  - LENS (Laser Engineered Net Shaping)
  - EBAM (Electron Beam Add Mfg)
- Sheet lamination
  - LOM

Reference: what-is-3d-printing Comparison of 3D printing technologies

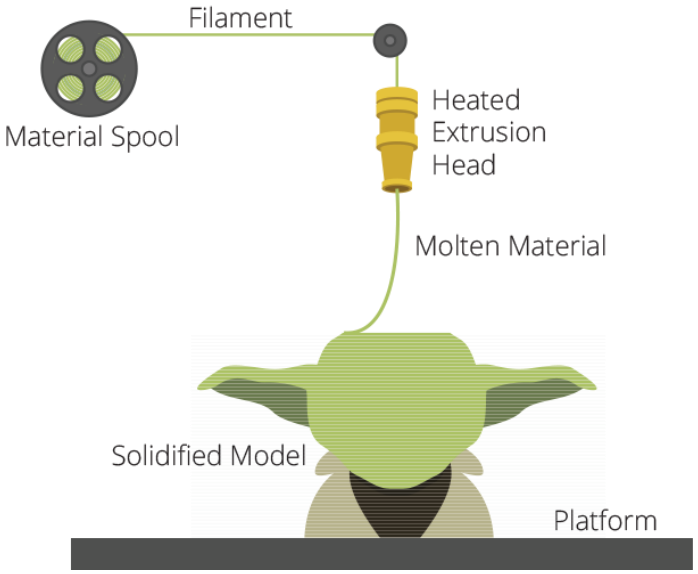
SLA – Stereolithography

SLA is a process that creates the object slice by slice from bottom to top, building over a vessel of liquid polymer that hardens when it is struck by a laser beam.



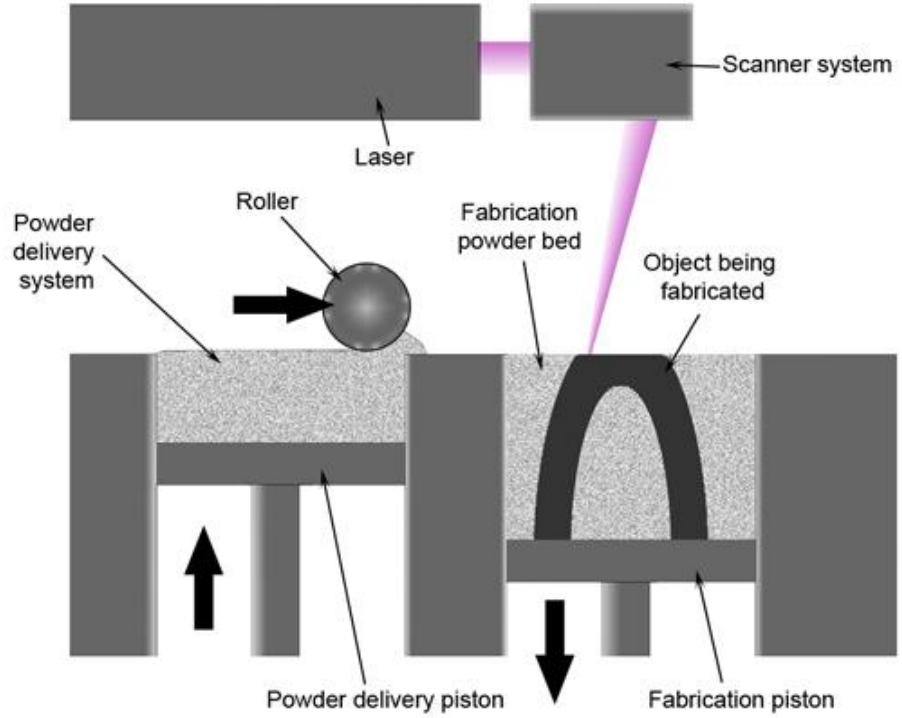
FDM – Fused deposition Modelling

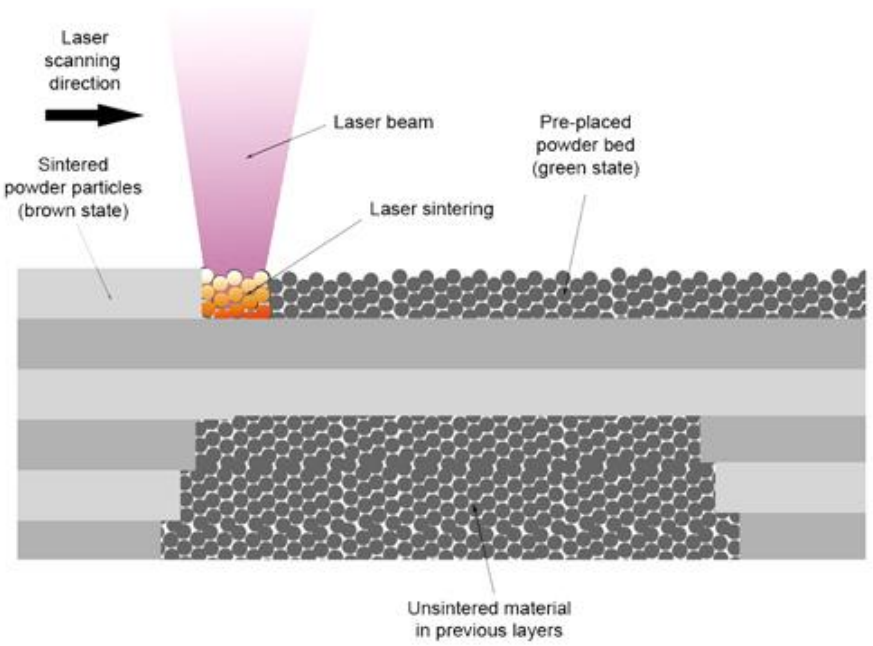
The Plastic material is fed into a heated extruder head. The head extrudes the semi-molten material on the build platform and builds the product layer by layer in the X-Y co-ordinate. Upon finishing the layer, the head will move up in the Z-Direction and continue its build on the next layer. Commonly used material is ABS and PLA.



SLS – Selective laser sintering

The laser is used to sinter powdered material typically metal. The component is built layer by layer. SLM (Selective laser melting) is a similar process except that the metal is melted instead.

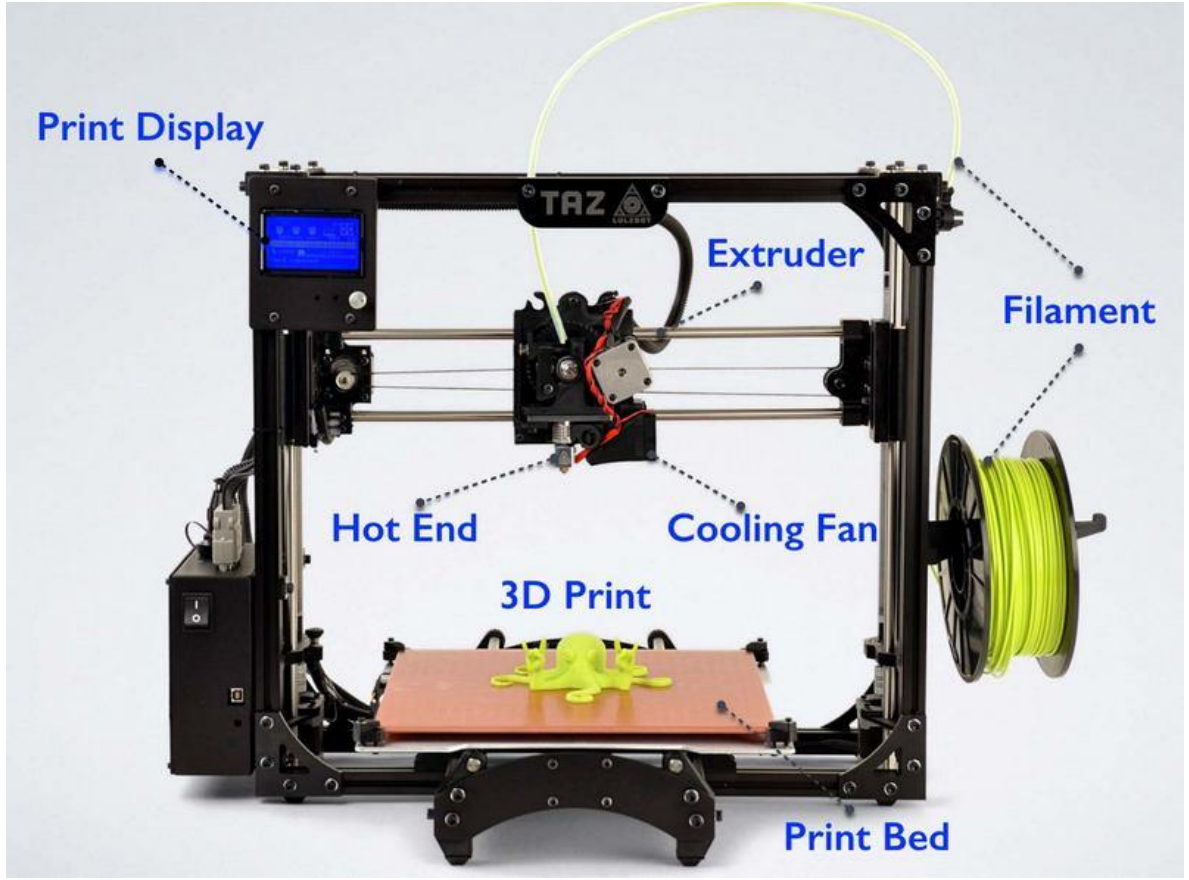


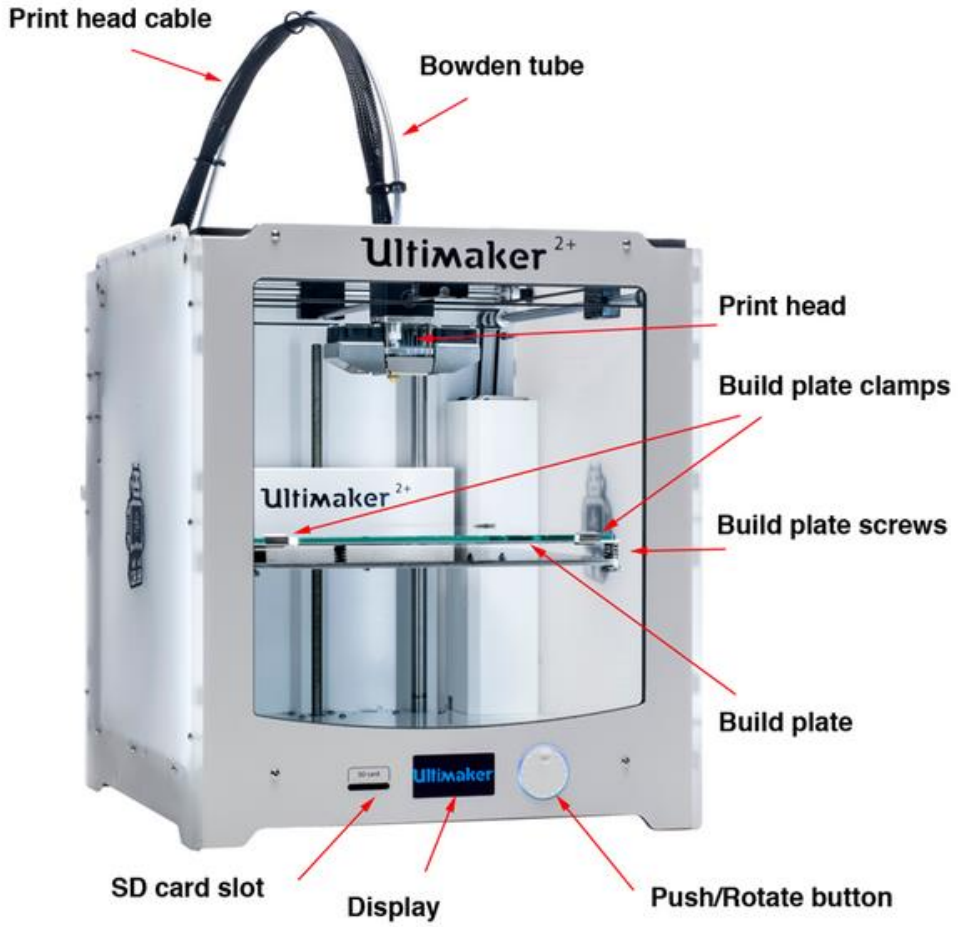


Who is Using 3D printing?

- Automotive
- Medical (Doctors, Dentists)
- Prosthetics
- Aircraft manufacturers
- Aerospace companies
- Prop makers
- Product designers
- Architects
- Students
- Military
- Space
- Consumer product makers
- Impact of 3D printing

Parts of 3D Printer





Materials

- Plastics
  - PLA
  - ABS
  - Nylon/Polyamide
  - Laywood
- Metals
  - Aluminium
  - Stainless steel
  - Gold
  - Silver
  - Bronze
  - Brass
  - Titanium
- Ceramics
- Glass
- Paper
- Bio materials
- Food
  - Chocolate
  - Sugar
  - Pasta
  - Meat

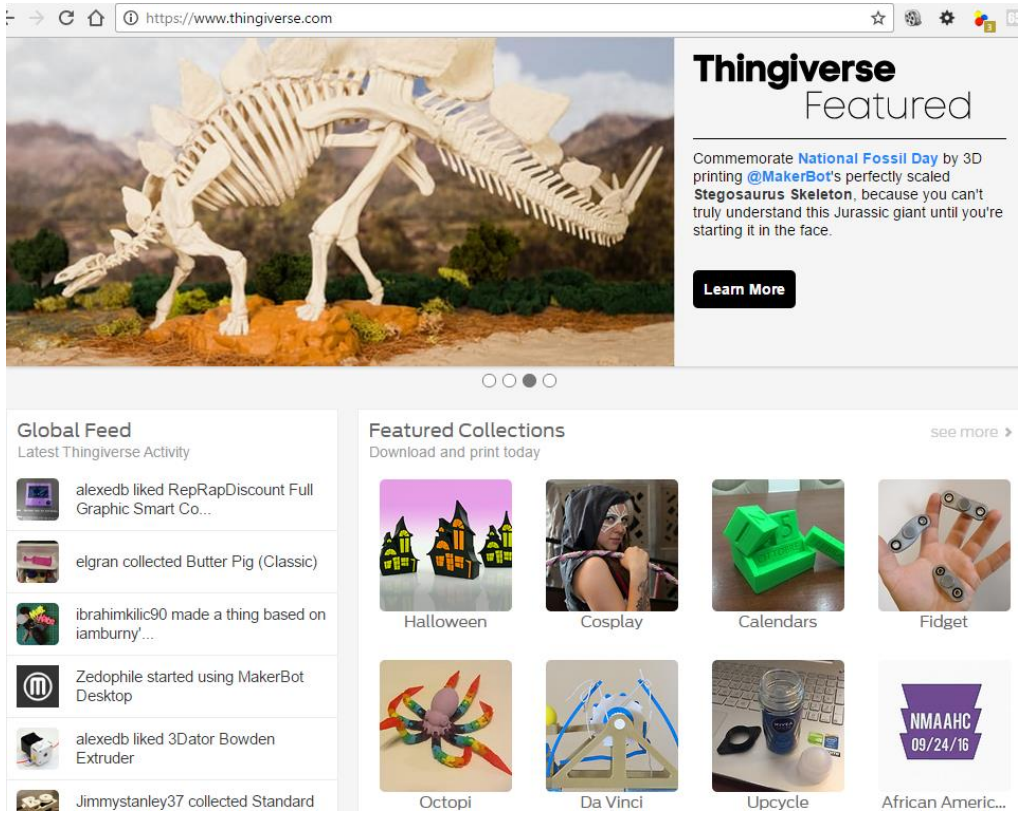
- Shapeways materials

Workflow

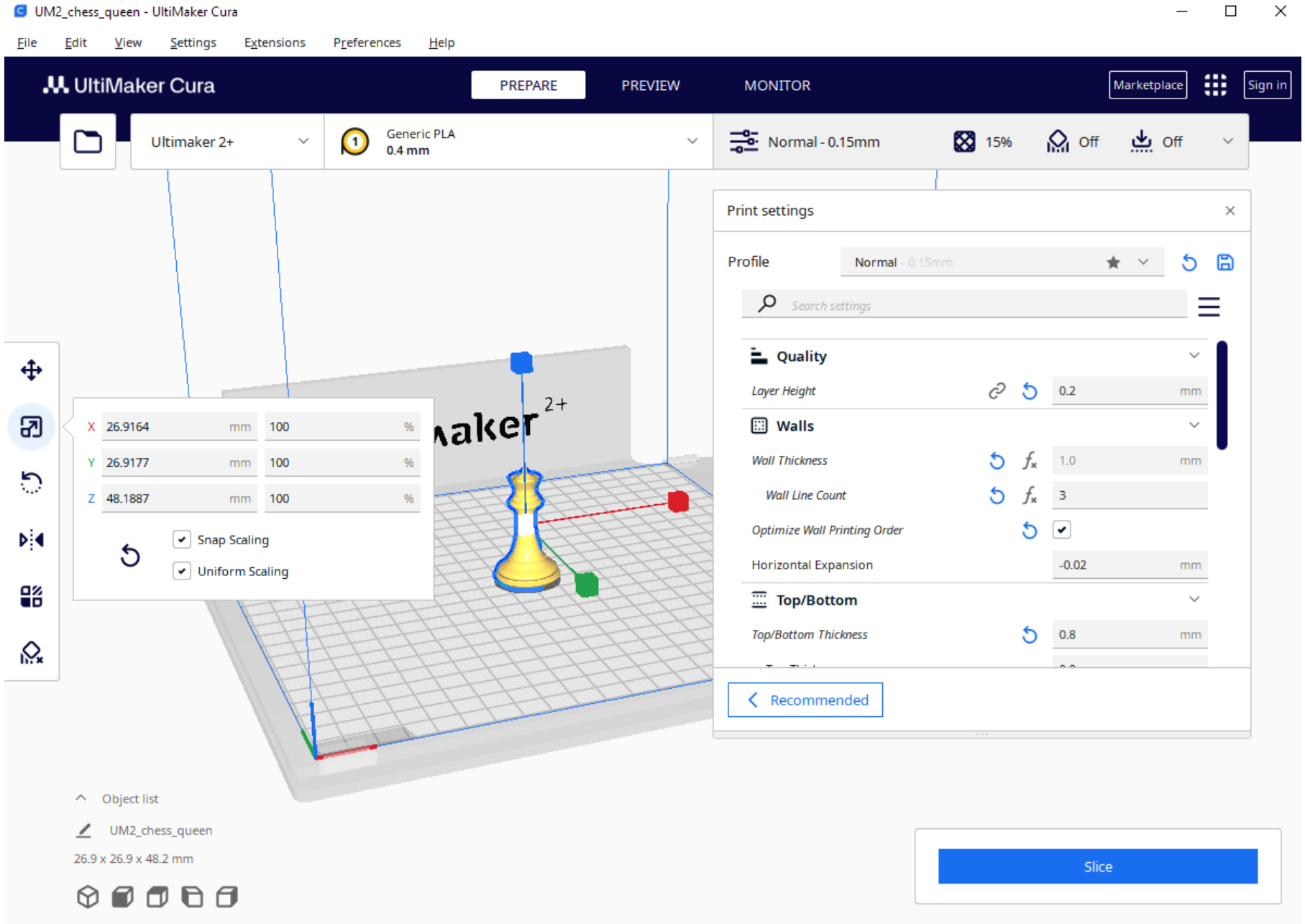
Typical time-consuming workflow for 3D printing models with multiple colors and materials
(source Stratasys)

Where to Find Designs?

- Design it yourself using CAD software
- Thingiverse
- Yeggi
- GrabCad
- SketchFab
- Youmagine



Cura Slicer


UM2_chess_queen - UltiMaker Cura
File
Edit
View
Settings
Extensions
Preferences
Help
UltiMaker Cura
PREPARE
PREVIEW
MONITOR
Marketplace
Sign in
Ultimaker 2+
Generic PLA
0.4 mm
Normal - 0.15mm
15%
Off
Off
Print settings
Profile
Normal - 0.15mm
Search settings
Quality
Layer Height
0.2
mm
Walls
Wall Thickness
1.0
mm
Wall Line Count
3
Optimize Wall Printing Order
Horizontal Expansion
-0.02
mm
Top/Bottom
Top/Bottom Thickness
0.8
mm
Recommended
X
26.9164
mm
100
%
Y
26.9177
mm
100
%
Z
48.1887
mm
100
%
Snap Scaling
Uniform Scaling
Object list
UM2_chess_queen
26.9 x 26.9 x 48.2 mm
Slice

Recommended Settings

- Printer: Ultimaker 2+
- Material: PLA
- Nozzle: 0.4mm
- Layer height: 0.2mm
- Wall thickness: 0.8mm
- Infill: 10 ~ 20%
- Print speed: 80mm/s
- Support: none (preferred), touching buildplate, everywhere
- Adhesion: none/skirt (preferred), brim, raft