So, you wanna print your part…

A high effort sequel dedicated to demystifying 3D printing

Yuck, Admin…

I’ve got two lovely forms for you to fill out!

Attendance: https://forms.gle/8Hds9RiKYyUBN5xQ9

Session Ideas: https://forms.gle/D1aeNYvLdpsDppQW8

The Most Common 3D Printer Technologies

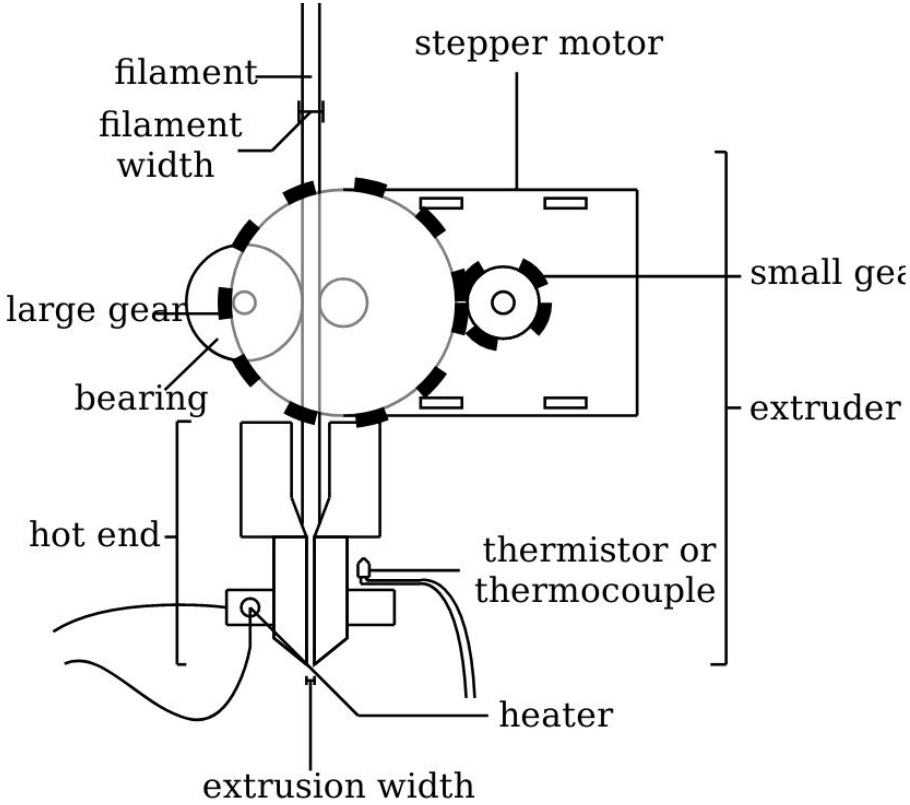
Fused Filament Fabrication (FFF)

Pros:

- Relatively cheap (material & printer)
- Easy to use (very little post-processing)
- Can make use of many different materials

Cons:

- Comparatively low level of detail
- Parts can be anisotropic



A typical direct-drive FFF 3D printer extruder

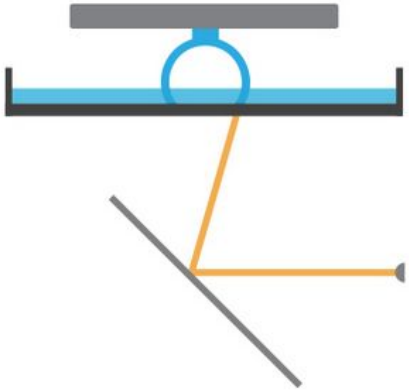
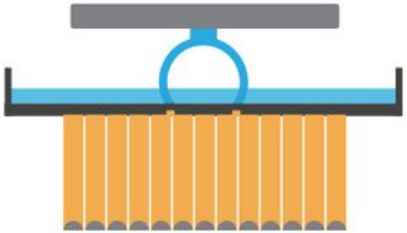
Stereolithography (SLA)

Pros:

- Very high level of detail (0.1mm resolution)
- Parts don’t have layer lines or weaknesses

Cons:

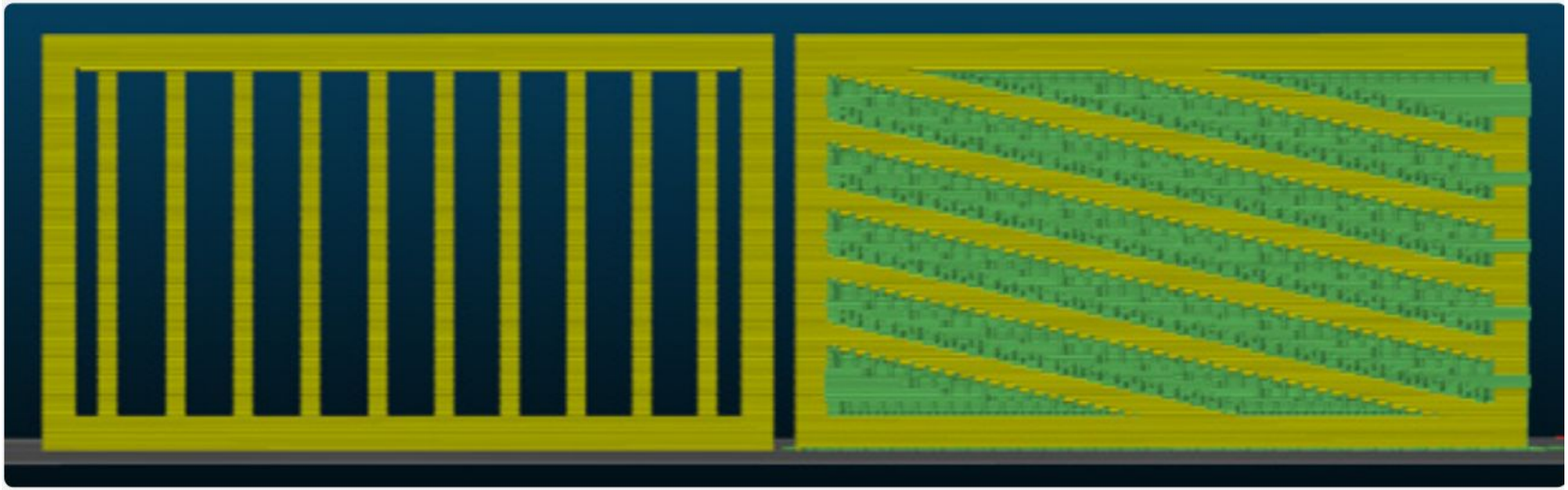
- More expensive (material & usually printer)
- Harder to use, requiring lots of processing
- Materials more limited and often toxic

Laser SLA	DLP-SLA	MSLA
		
Selective exposure to light by laser	Selective exposure to light by projector	Selective exposure to light masked by LCD

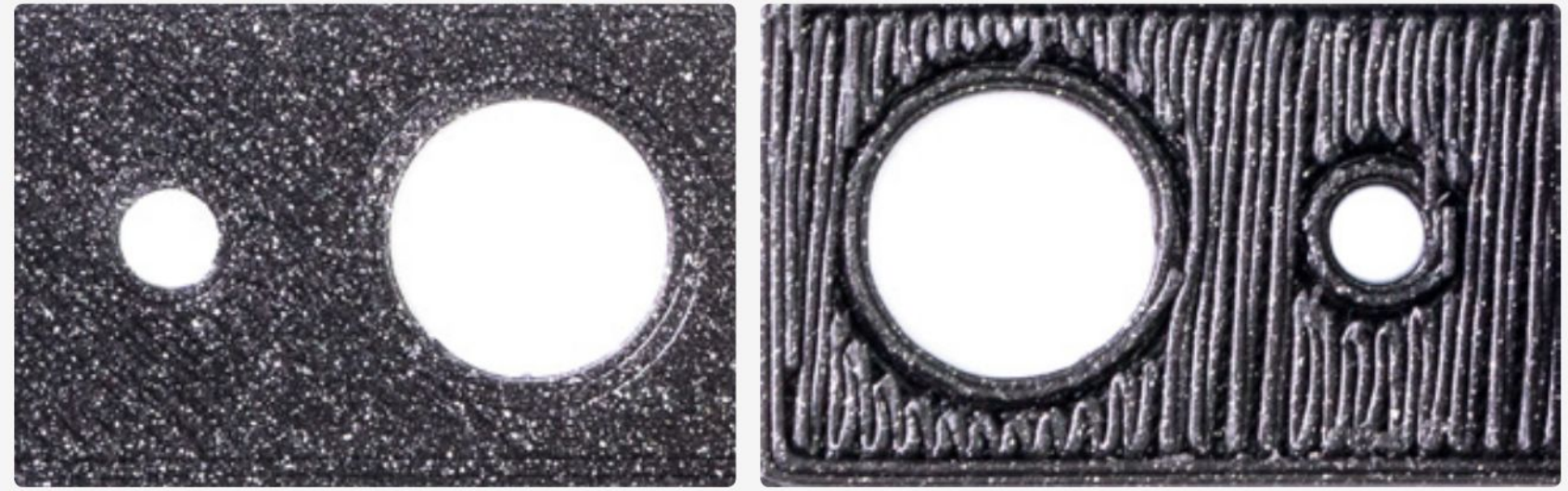
Different methods of SLA photocuring

Design Considerations

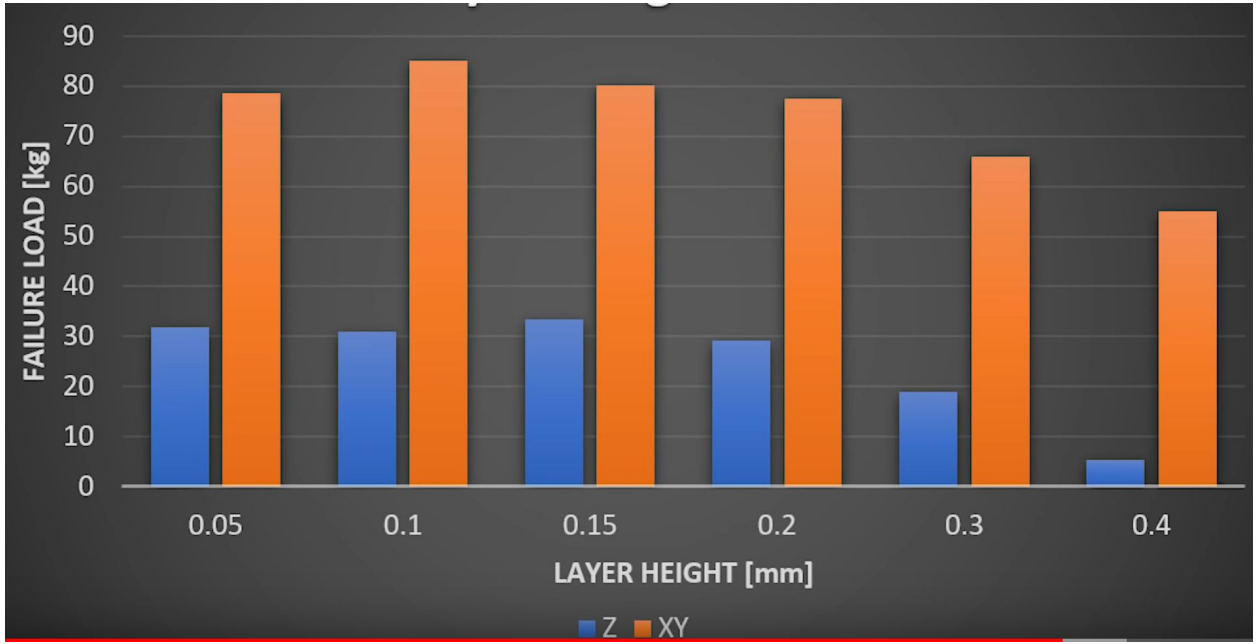
1) Minimise The Need For Supports



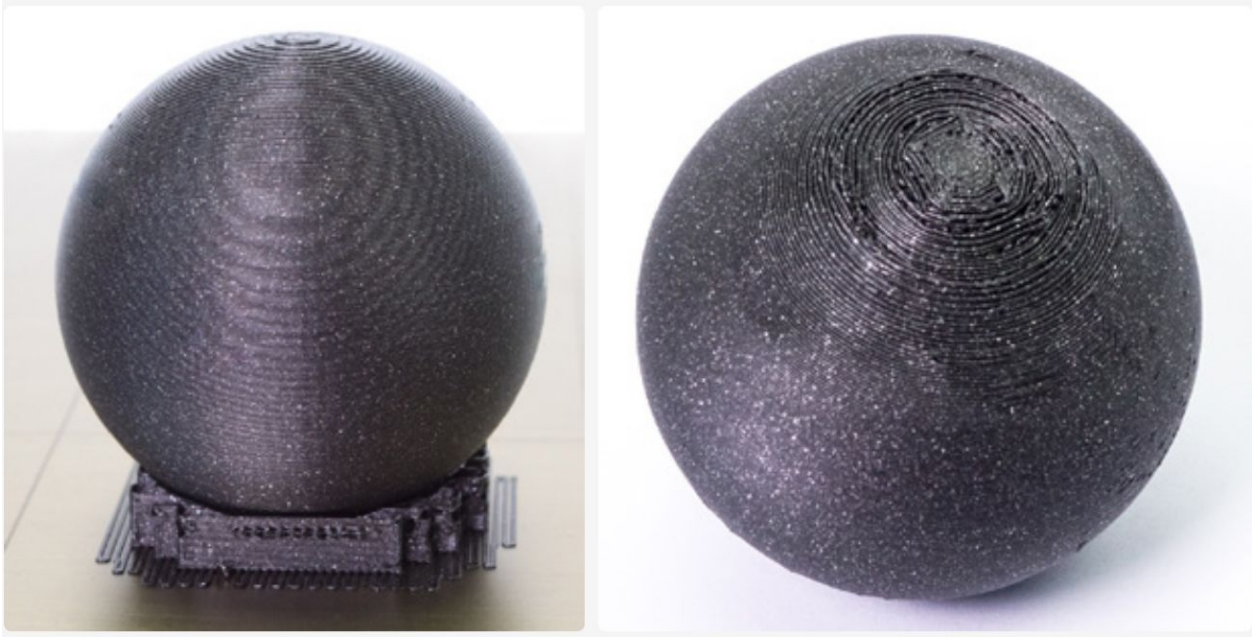
2) Consider Surface Finish When Positioning



3) Print Orientation Affects Strength!



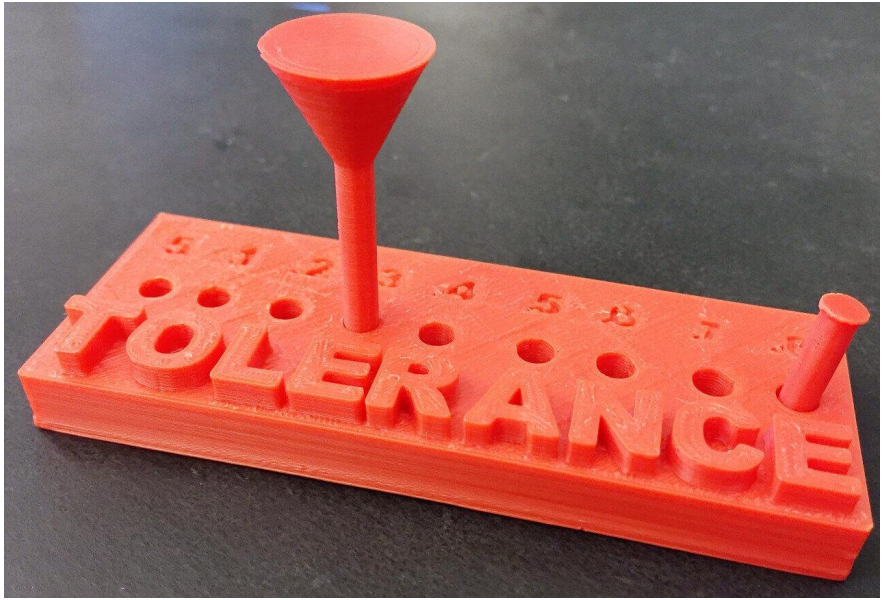
4) Consider Splitting Parts



4) Consider Splitting Parts

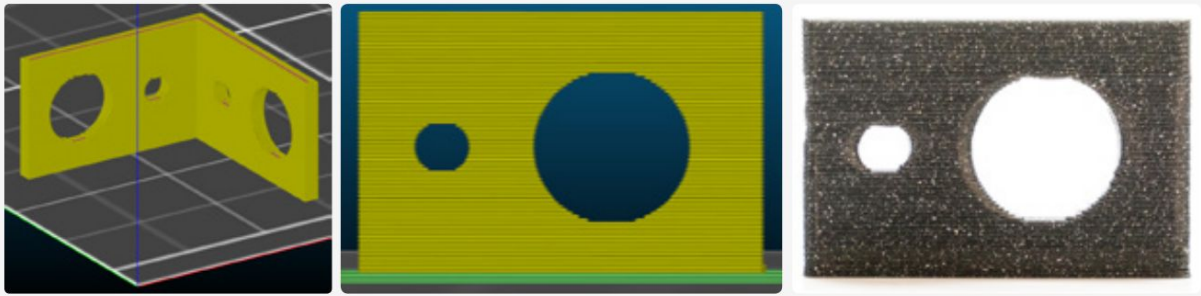
5) Give Yourself Some Wiggle Room

Tolerance	Fit
0,1 mm	Very tight
0,15 mm	Tight
0,20 mm	Loose

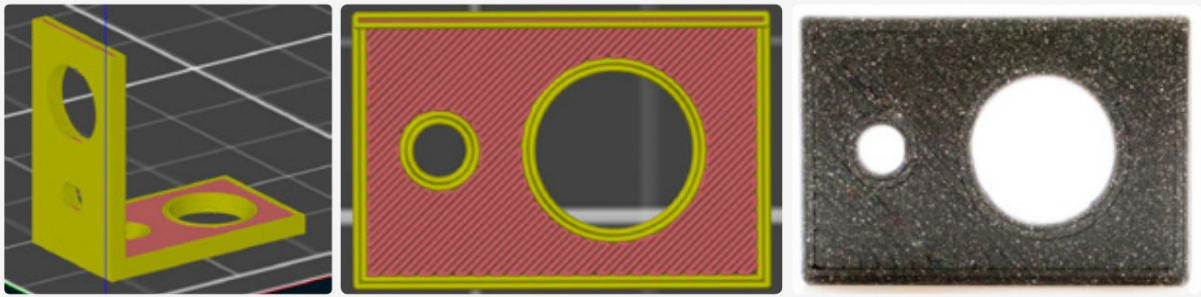


6) If You Need Perfect Circles, Print Horizontally

A circular hole printed vertically



A circular hole printed horizontally



7) Keep Minimum Widths In Mind

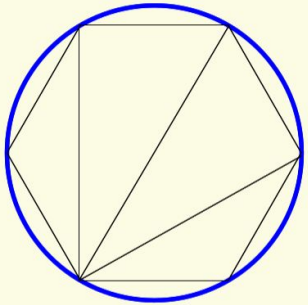
Wall thickness	Is it possible to print?
Less than the width of one perimeter	✗
One perimeter	✓
More than the width of one perimeter, but less than two perimeters	✗
More than twice the width of one perimeter	✓

A standard 0.4mm nozzle has a perimeter width of 0.45mm

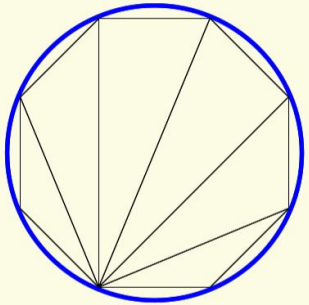
Exporting and STLs

Things to Keep in Mind

- STLs represent everything as a triangular mesh, so curved surfaces are always approximated
- They only contain surface geometry information (nothing internal or extra)

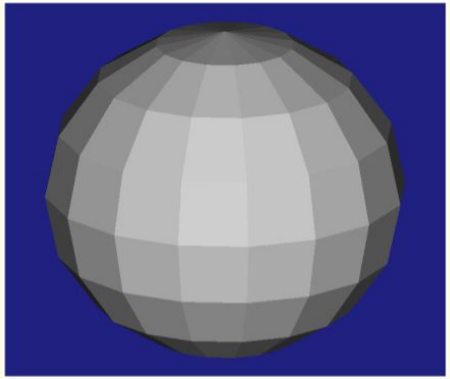


Low tolerance

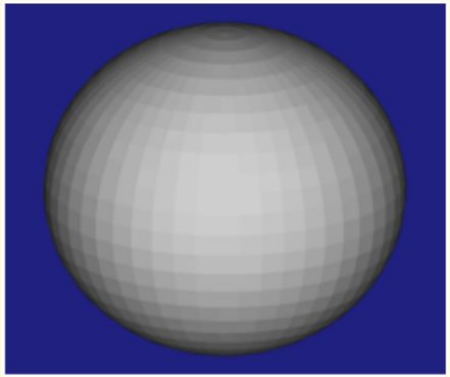


Higher tolerance

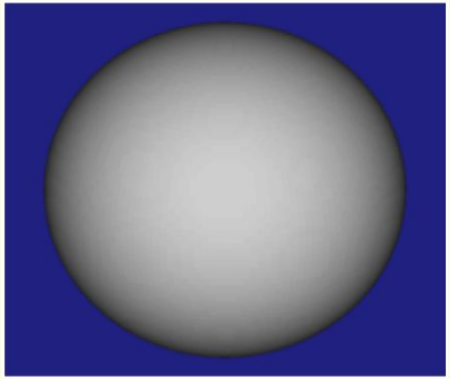
Resolution and File Size Are A Tradeoff



Resolution: 0.1 mm
224 triangles



Resolution: 0.01 mm
2400 triangles



Resolution: 0.001 mm
24648 triangles

Common Print Materials

PLA

9.1 PLA

PLA is the most commonly used material for 3D printing. **It is biodegradable, easy to print with, and PLA prints are very hard.** It's the **perfect choice for printing large objects** due to low thermal expansion (prints do not warp on the heatbed) and for printing small detailed models. It is the only material that is well suited for printing 50-micron layers (Ultradetail resolution) and it can be also used to produce great-looking miniatures.

Advantages

- Easy to print, suitable for beginners
- Detailed prints of small models
- Trouble-free printing of large objects
- Almost odorless
- Affordable
- Wide color selection

Disadvantages

- Brittle and inflexible
- Low-temperature resistance (54 °C)
- Difficult to post-process
- Not suitable for outdoor use (low UV and temperature resistance)

PET / PETG

9.2 PET/PETG

PETG is another commonly used material for 3D printing. It is a **great choice for printing mechanical components.** Compared to PLA, it has **higher temperature resistance, is more ductile and therefore less brittle.** Due to its low thermal expansion it holds well on the heatbed and does not warp. Printing with it is almost as easy as with PLA. But unlike PLA, it can offer better mechanical properties. Parts for our printers are printed from PETG!

Advantages

- High-temperature resistance
- Easy to print
- Low warping
- Tough and durable
- Easy post-processing (sanding)
- Almost odorless
- Glossy surface
- Good layer adhesion
- Water and humidity resistant

Disadvantages

- Not suitable for printing small/detailed models
- Possible stringing
- Poor bridging and overhangs
- Strong adhesion to the printbed
- Cannot be smoothed with acetone, soluble only in dangerous chemicals
- Supports can be difficult to remove

ASA / ABS

9.3 ASA/ABS

ASA and ABS are very similar materials. ASA is many ways even better than ABS and can be considered a successor to ABS. ASA is UV stable compared to ABS (less yellowing) and shrinks somewhat less when printed. The only advantage of ABS is the easier surface treatment with acetone. Going forward, we will only talk about ASA, but the same goes for ABS.

ASA is a strong and versatile material. A higher melting point than PLA gives ASA excellent heat resistance, your prints will not show signs of deformation up to around 100 °C. Unfortunately, ASA has a very high thermal expansion compared to PLA, which complicates printing, especially for larger models. Even with a heated bed set to 100 °C, the print can begin to warp and peel off the bed. The material also produces an unpleasant odor during printing.

Advantages

- High impact and wear resistance
- Very good temperature resistance
- Suitable for outdoor use - UV stable
- Soluble in acetone - easy to glue together
- Can be smoothed with acetone vapors
- Detailed prints with no stringing
- Easy postprocessing (e.g. sanding, cutting etc.)

Disadvantages

- Difficult to print
- Tendency to warp (large models should be printed in an enclosure)
- Unpleasant odor during printing (contains styrene)

Slicing & Build Prep

Layer Height & Speed

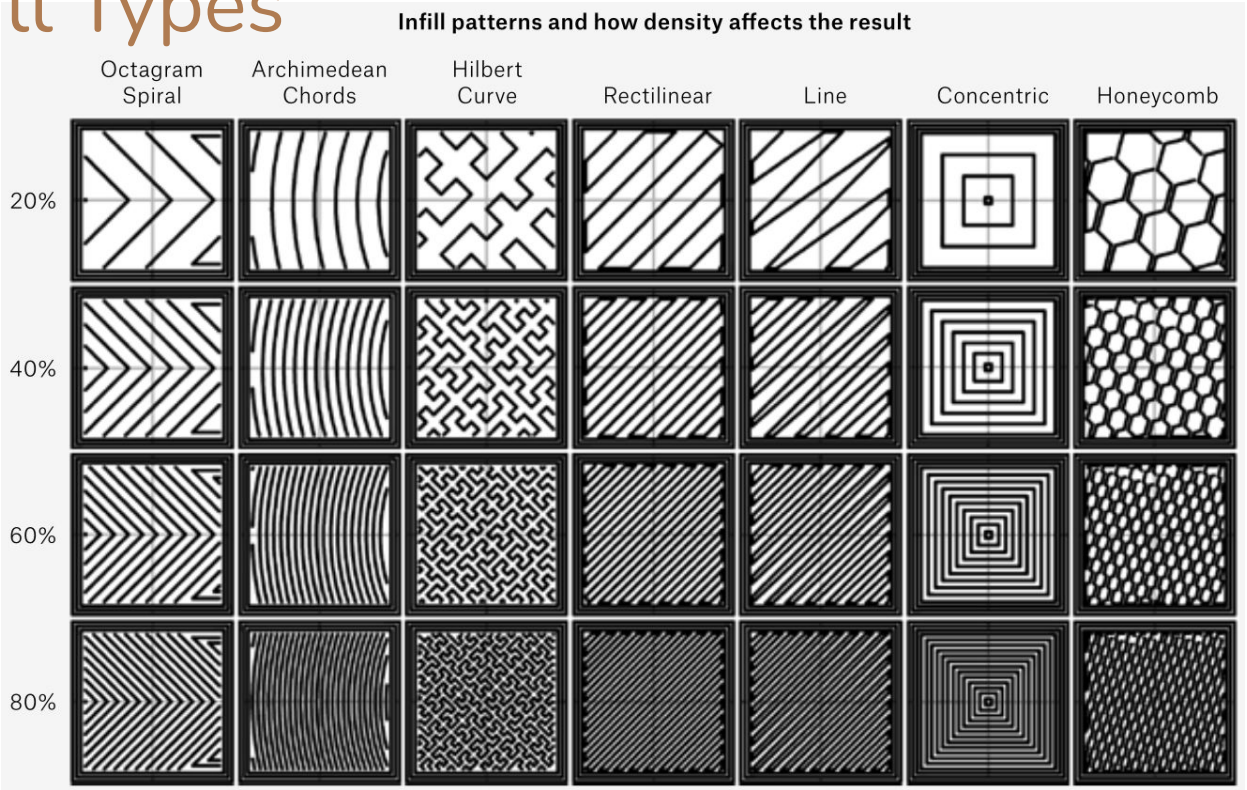
Layer Height & Speed

0,2 mm
18 minutes

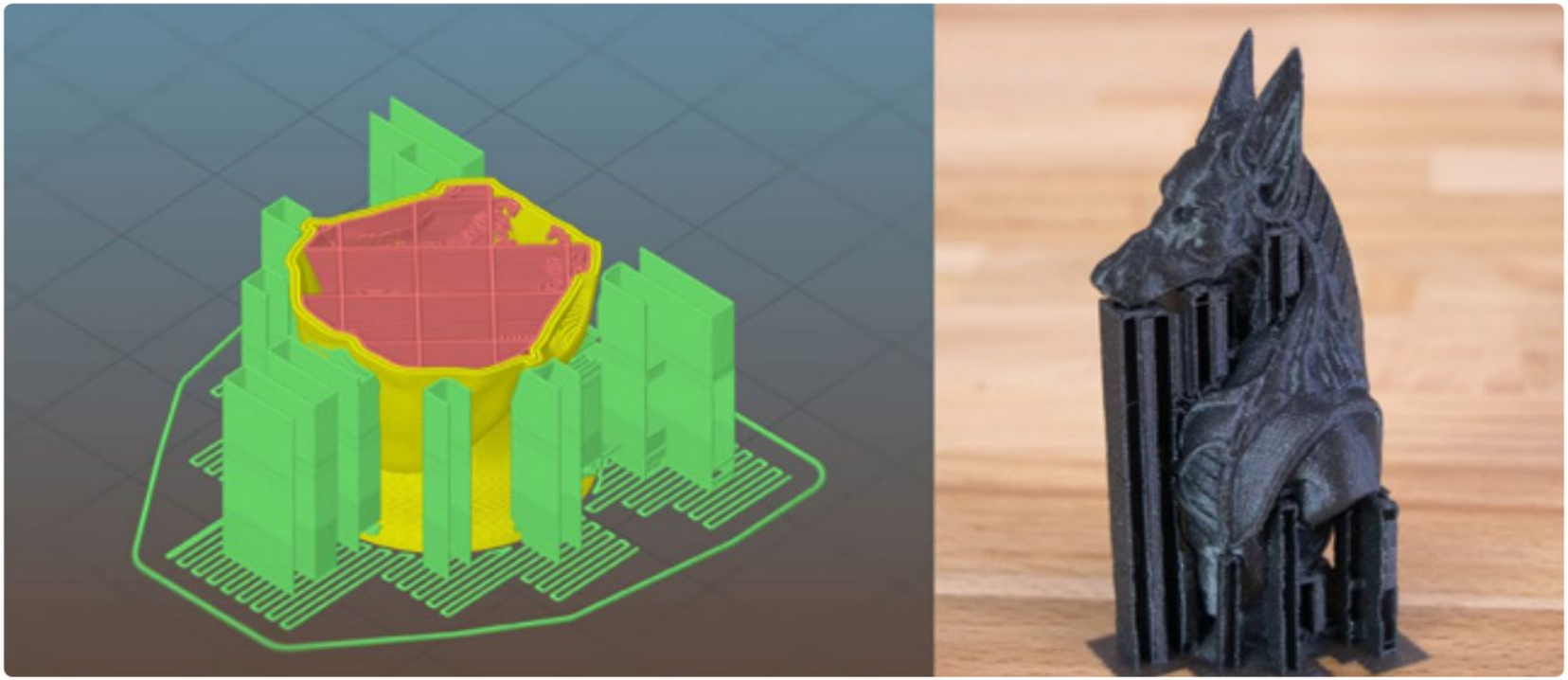
0,1 mm
33 minutes

0,05 mm
75 minutes

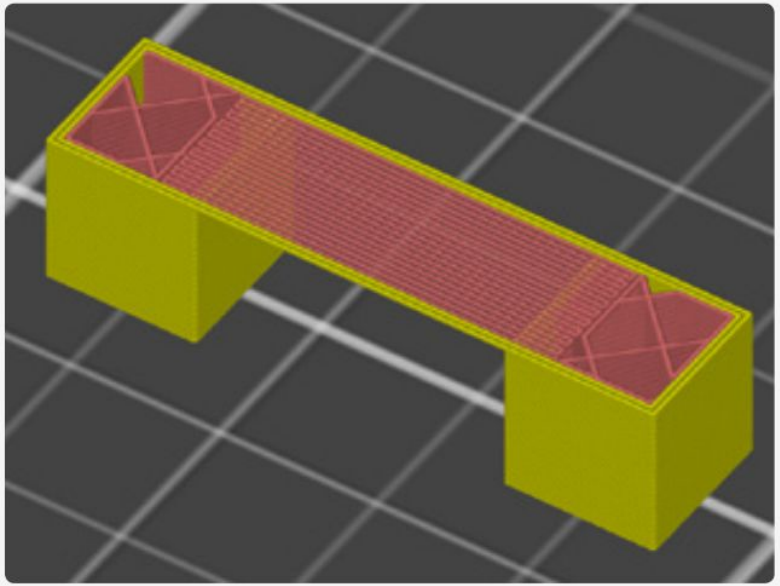
Infill Types



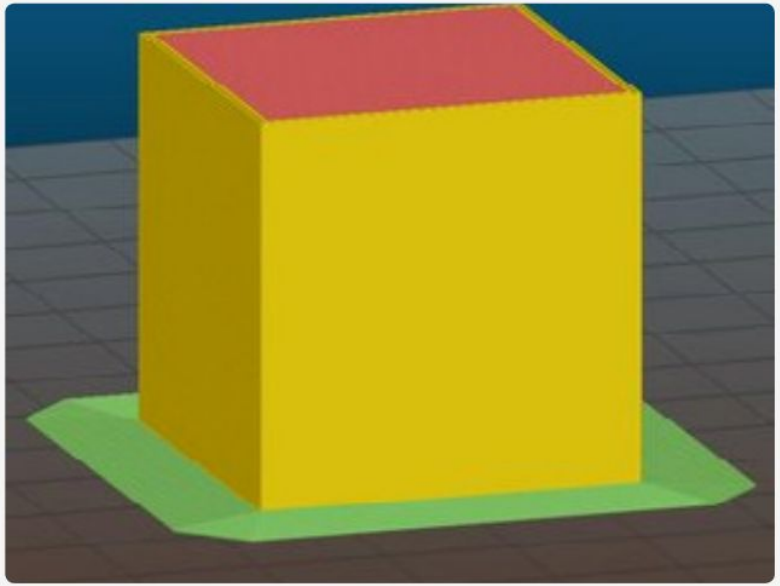
Supports



Bridging & Brim

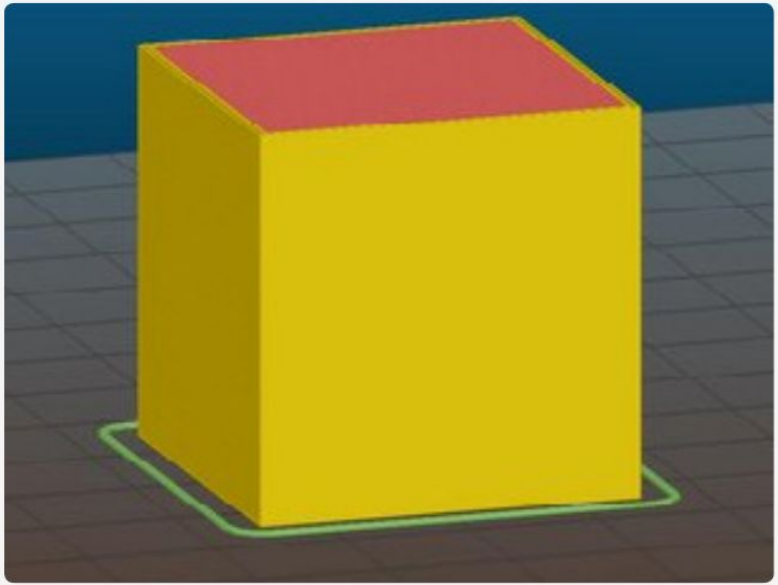


Bridging

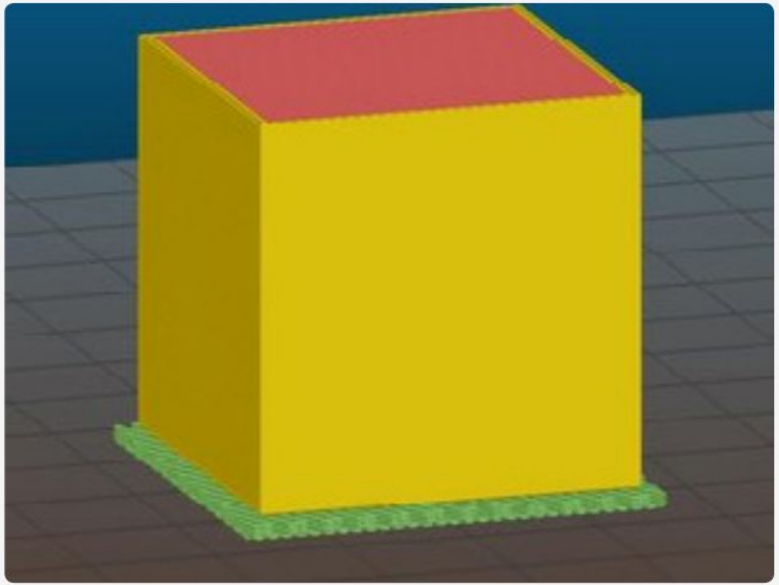


Brim

Skirts & Rafts



Skirt



Raft

On The Fly Demo Time!