

Designing for 3D Printers

PART 1: KNOW YOUR PRINTER

A solid orange horizontal bar at the bottom of the slide.

Quick overview

- Important features of printers
 - Build volume & area
 - Nozzle diameter
 - Resolution
 - Materials
 - Previously printed parts

Build area and volume

- Know how big your printer is.
- The build area is the maximum footprint your part can have
- The build volume will tell you how tall your part can be

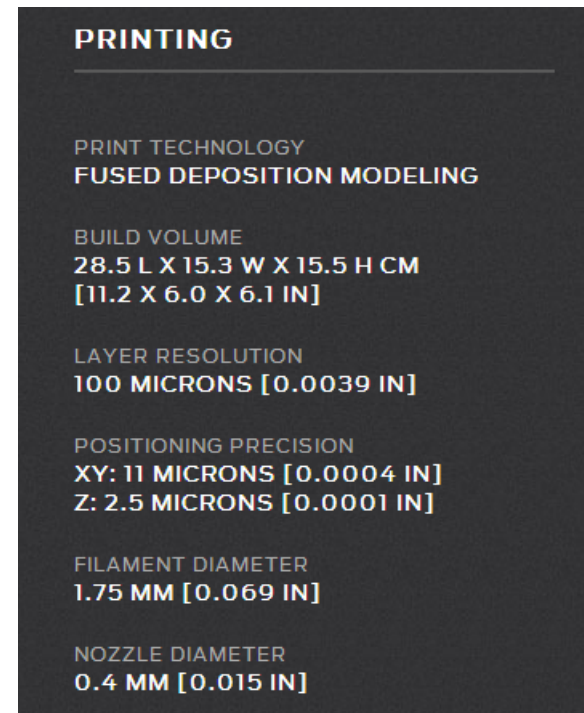


Image source:
<http://store.makerbot.com/replicator2>

Build area and volume

- If you need to print a larger part, split it into multiple pieces and join them together afterwards
- Larger parts will be more difficult to print: they will be more prone to warping and the bed will have to be more level for them to be successful

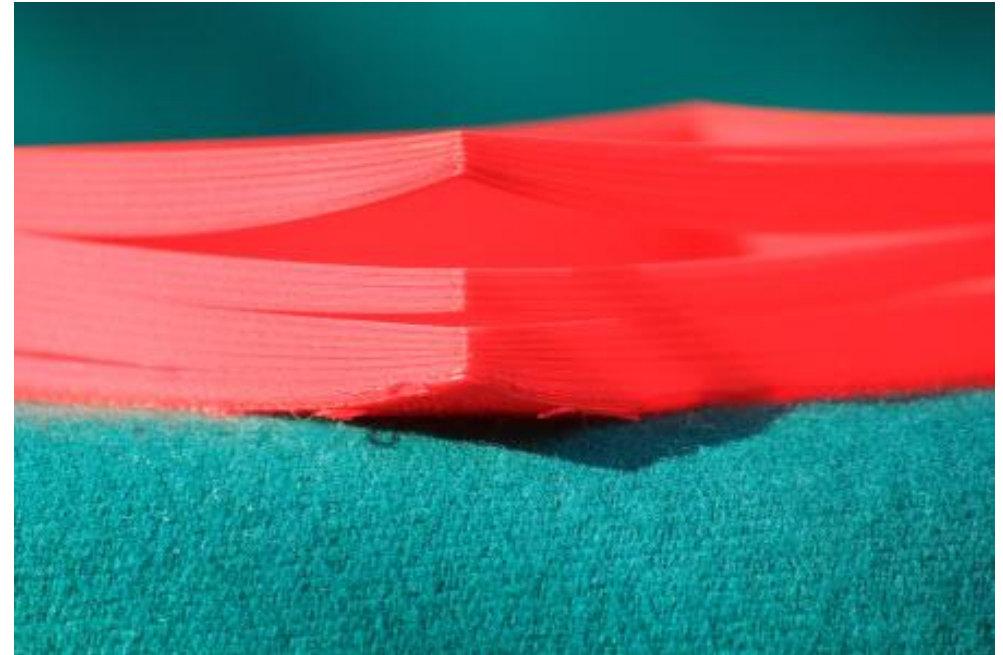


Image source: <http://www.deelip.com/?p=7151>

Nozzle diameter & resolution

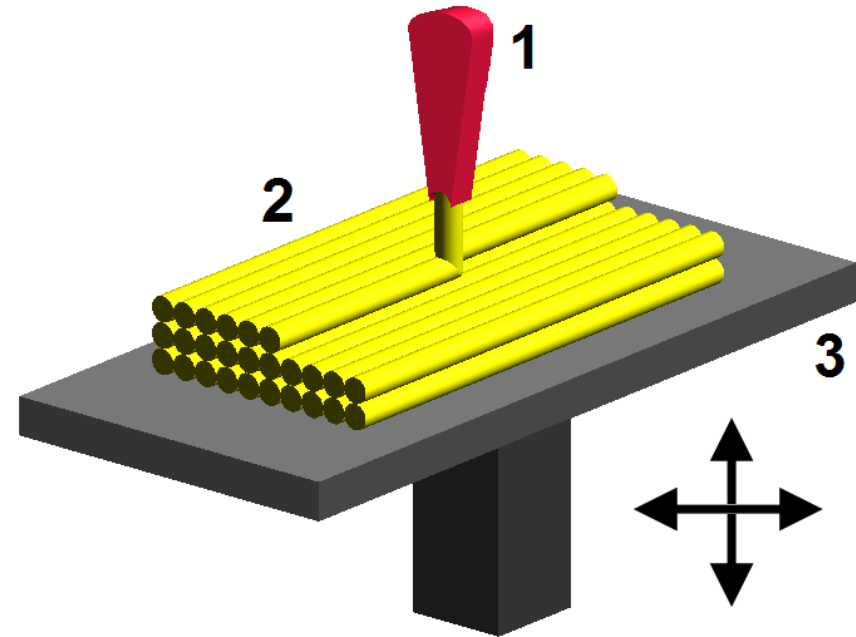
- The nozzle diameter and resolution of your printer determine how close your part will look to what you designed
- The nozzle diameter also determines how much plastic will flow from the nozzle per second.



Image source: <http://e3d-online.com/E3D-v5/v5-Nozzle-Packs/175mm-Nozzle-Pack>

Nozzle diameter & resolution

- A small-diameter nozzle will produce higher-quality parts, but take much longer.
- The smallest increment of movement of the x- and y-axis are not significant measurements: when plastic is extruded, it spreads out much more than any positional error



3D printed models don't look like this: the plastic spreads out as it's extruded
Image source: Wikimedia Commons

Nozzle diameter & resolution

- The resolution of a 3D printer refers to the smallest increment of movement of the z-axis
- This number impacts the layer height of the model, which can be different for each print
 - It should be greater than the resolution and less than the diameter of the nozzle

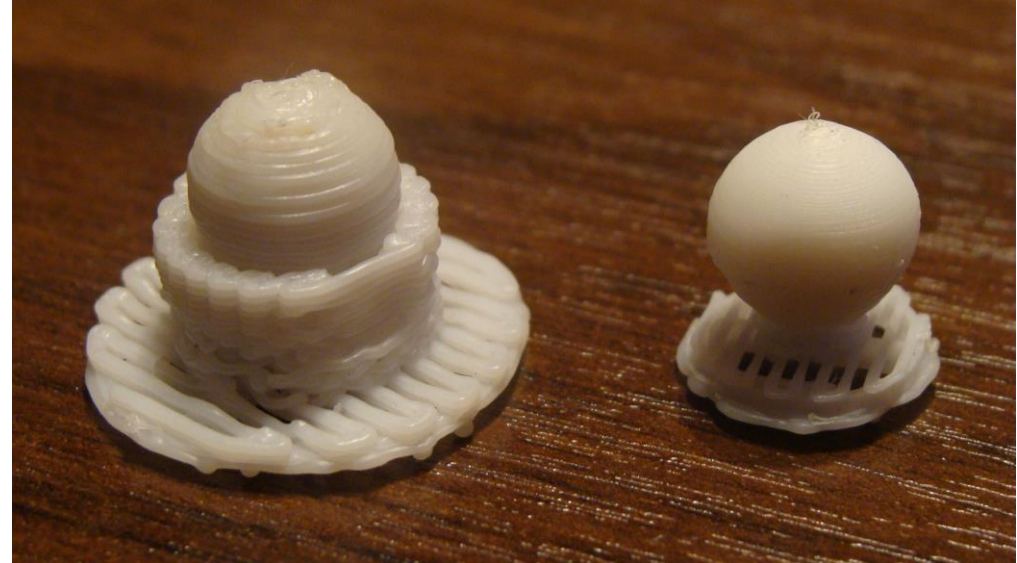


Image source:

<http://academy.cba.mit.edu/2013/students/torres.ricardo/3D%20Scanning%20and%20printing.html>

Nozzle diameter & resolution

- If you have small features, make sure that the resolution is set so that it's a multiple of the thickness of those features
- What layer height should you use for a model with features that are 0.2mm, 0.4mm, and 1mm thick, with a 0.4mm nozzle? What about a 0.2 mm nozzle?

Answer: 0.2mm for the 0.4mm nozzle, and 0.1mm for the 0.2mm nozzle.

All features are evenly divisible by the layer heights. Using a layer height that's the same as your diameter is risky: the layers might not adhere.

Materials and previous parts

- Know what materials your printer can use, and which one of them to use
 - ABS is strong and can be vapour-smoothed, but it tends to warp and your printer will need a heated bed.
 - PLA is weaker than ABS, but doesn't warp as much, and doesn't need a heated bed.
 - If you want to use an exotic material, like a nylon or another polymer, look online for recommended uses and settings

Materials and previous parts

- The best way to determine if a printer is capable of printing your model is to look at similar parts it has printed
 - Look at parts with similar features. Are they the right size? Are they warped? Are they strong enough?
 - Be careful about looking online for previous parts: your machine will have its own quirks
 - Avoid manufacturer websites, and see what hobbyists have done. Manufacturers will only post the best pictures, and they know their printers very well

Review

- How big is your printer? How big is your part? Can you make it smaller?
- How finely can your printer print? Can you use a smaller nozzle?
- What material do you want to use?
- What parts has this printer previously made? Are you satisfied with that quality?