



3D Printing Course for Beginners (Lecture-3)

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SCOPES OF THIS COURSE



3D Printing Materials

A

- Polymers
- Composite
- Resin

3D Printing Parameters

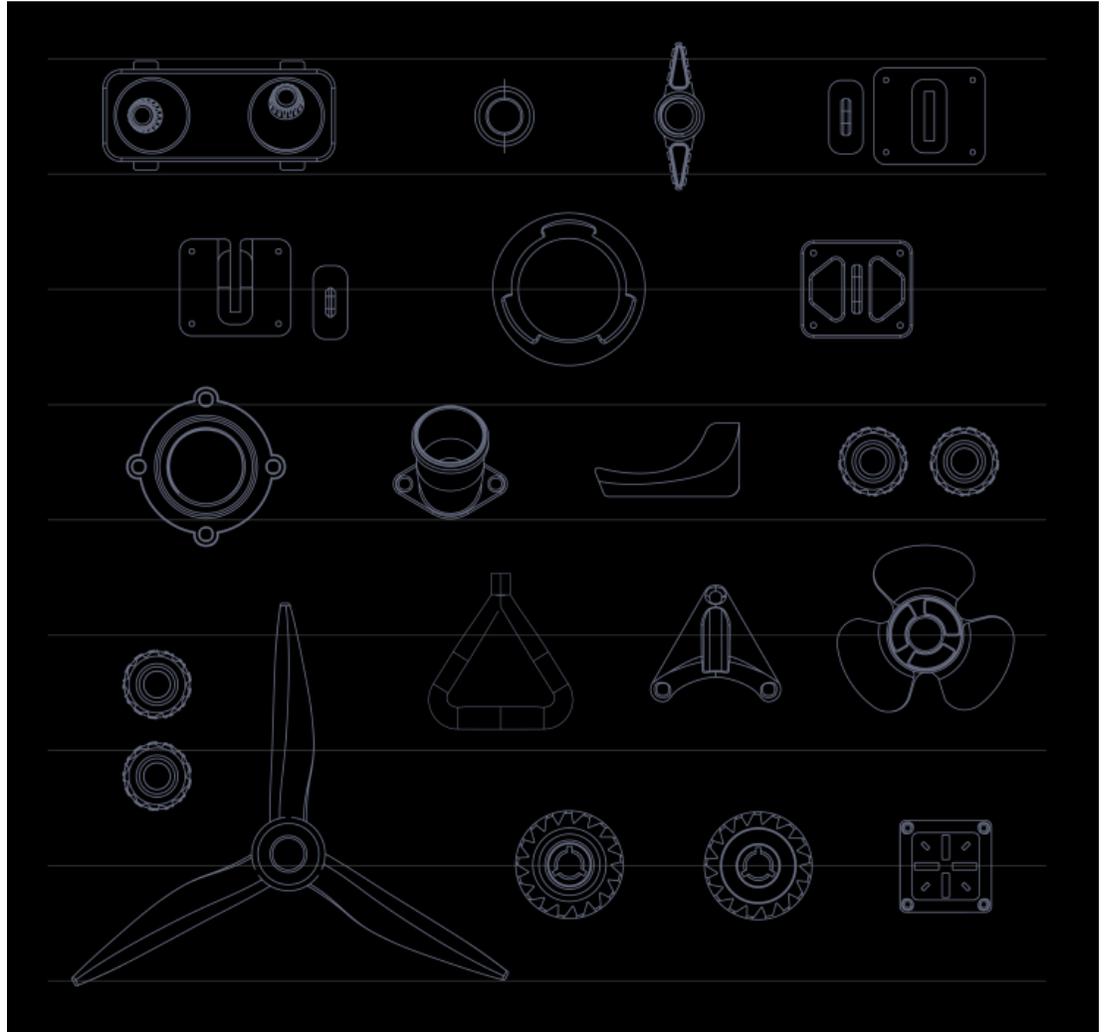
B

- 11 key parameters of 3D Printer

3D PRINTING MATERIALS

The materials available for 3D printing have come a long way since the early days of the technology. There is now a wide variety of different material types, that are supplied in different states (powder, filament, pellets, granules, resin etc).

Specific materials are now generally developed for specific platforms performing dedicated applications (an example would be the dental sector) with material properties that more precisely suit the application.



3D PRINTING MATERIALS: POLYMERS

PLA

Fast, Easy, Rigid

PLA (polylactic acid) is a great material for early concept models because it is easy to use, office-friendly, and works well with breakaway supports which print faster and can be removed faster than dissolvable supports. PLA is a corn-based plastic and is considered biodegradable under industrial processes. PLA is strong in tensile strength and modulus relative to other base polymers, which may be surprising to some because it is generally viewed as a fairly basic material. One potential downside of PLA is its brittleness – if it fails, it fractures catastrophically whereas some of the other polymers may bend.



3D PRINTING MATERIALS: POLYMERS

ABS

Smooth, Durable, Heat-resistant

ABS (acrylonitrile butadiene styrene) is one of the most popular materials for injection molded consumer products due to its clean surface finish, durability, and heat resistance. For this reason, it is often used for prototyping consumer products that will later be injection molded. By using ABS, the prototype is more likely to look, feel, and perform like the final product. ABS's durability and high heat deflection temperature also make it a good material for use in the lab or on the factory floor.



3D PRINTING MATERIALS: POLYMERS

PETG

Chemical Resistant, Durable

PETG's (glycol-modified polyethylene terephthalate) chemical resistance makes it a choice material for liquid containers and bottles, which also makes it great for prototyping those types of products. While available in a range of colors, PETG's glycol addition removes haziness to give it a nice translucence. The glycol also increases the strength and heat-resistance compared to PET. In addition to containers, the liquid / chemical resistance can benefit a range of uses from the machine shop to the lab. This vacuum nozzle was printed as an attachment for a shop vac for removing waste material from a CNC machine. PETG is a great choice for this application due to the material's chemical resistance to the CNC coolant.



3D PRINTING MATERIALS: POLYMERS

ASA

UV and Weather Resistant, Durable

ASA (acrylonitrile styrene acrylate) combines the qualities of ABS with the added benefit of UV resistance and additional moisture resistance, making it ideal for equipment exposed to sunlight and rain over long periods of time – such as products for the agriculture, transportation, and power and utility industries. Because the use of ASA is fairly common in production parts for these industries, the prototyping of the same parts in ASA allows test engineers to better understand how their products will hold up in extreme weather conditions. In the field, a utility worker or a farmer could benefit from printing replacement parts as needed for broken equipment.



3D PRINTING MATERIALS: POLYMERS

NYLON

Abrasion Resistant, Strong

Nylon's ability to withstand high temperatures and its durability combine to give it above average abrasion resistance. While the storage of replacement parts can be costly, the ability to instead store the CAD file and print the parts as needed is an alternative that can save space and provide flexibility. Gears take consistent punishment and high abrasion, making Nylon an ideal material for this type of part.



3D PRINTING MATERIALS: POLYMERS

TPU

Flexible, Shock Absorbing, Durable

TPU (Thermoplastic polyurethane) is a type of flexible and elastic 3D printing filament. Its rubber-like elasticity, resilience, and durability make it suitable for uses requiring impact-absorption and a soft-touch surface. Examples of TPU 3D printed parts include tubes, seals, bushings and vibration dampeners.



3D PRINTING MATERIALS: COMPOSITE

NYLON (6/66) CARBON FIBER

Industrial grade, Durable, Light weight

Nylon 6 Carbon Fiber has the strength and lightweight benefits of other carbon fiber composites. The main thing about Nylon 6 that sets it apart from others in that category is its ability to withstand higher temperatures. The heat deflection temperature is significantly higher than many of the popular base polymers. In the case of MakerBot Nylon Carbon Fiber, the HDT is 100°C higher than that of ABS and 93°C higher than regular Nylon 6.



3D PRINTING MATERIALS: COMPOSITE

NYLON 12 CARBON FIBER

Industrial grade, Durable, Light weight

Much like Nylon 6 Carbon Fiber, the Nylon 12 variant has the benefits of strength, stiffness, and lightweight. Unlike Nylon 6, Nylon 12 has a better resistance to moisture uptake, making it somewhat easier to print and giving the printed part a cleaner final appearance without the need for post-processing. One drawback of Nylon 12 compared to Nylon 6 is it will generally have a lower HDT - so you really just need to weigh what is most important for your specific application.



3D PRINTING MATERIALS: METAL

ULTRAFUSE 316L STAINLESS STEEL

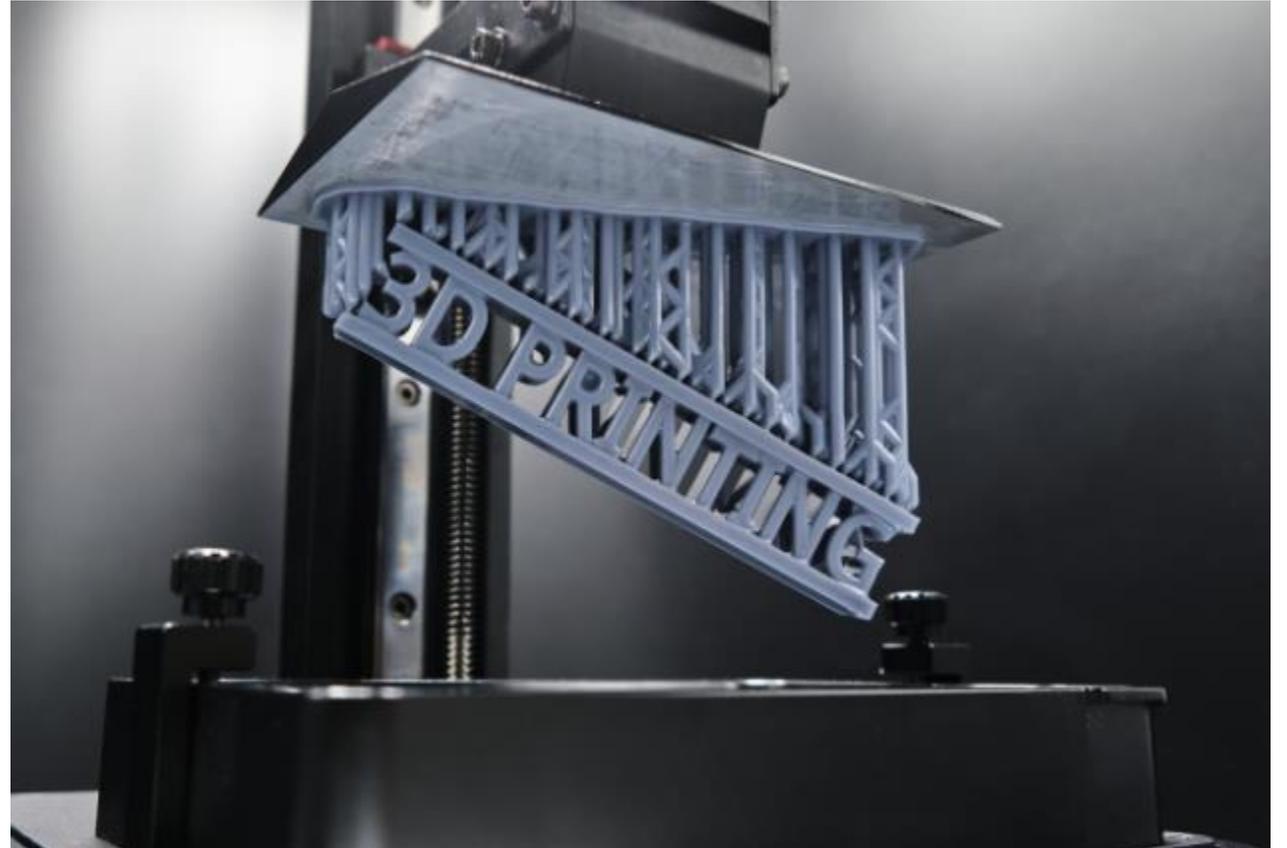
Ultrafuse 316L is a unique FDM material that allows for users to produce real, solid 316L stainless steel parts. In filament form it is a bound material (ie. metal powder suspended within an ABS-like polymer). This allows for relatively easy use with FDM 3D printers such as the MakerBot METHOD. Upon completion of the print, a green part must then go through a debinding and sintering process in which the binder material is removed, and the remaining metal material is sintered together to form the final solid metal part. The resulting part can withstand forces and temperatures far beyond the threshold of polymers or composites, making it an extremely valuable option for certain end parts.



3D PRINTING MATERIALS: RESIN

RESIN Polymer

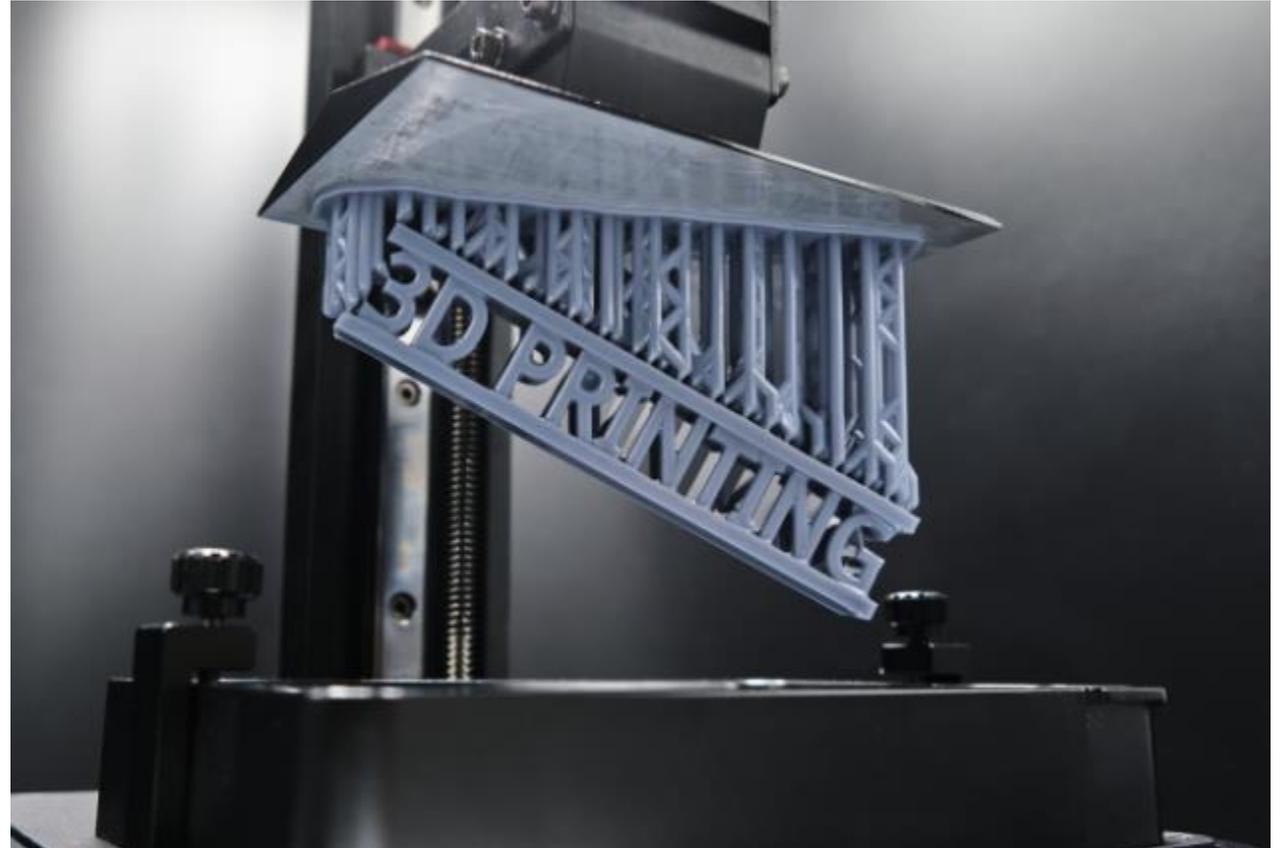
The kind of resin used in 3D printing is called **photopolymer resin**, which is a liquid that turns into plastic through a chemical reaction with UV light. Some people confuse epoxy resin with 3D printing resin, but that is a fundamentally different type of material. Gray photopolymer resin is the most popular color.



3D PRINTING MATERIALS: RESIN

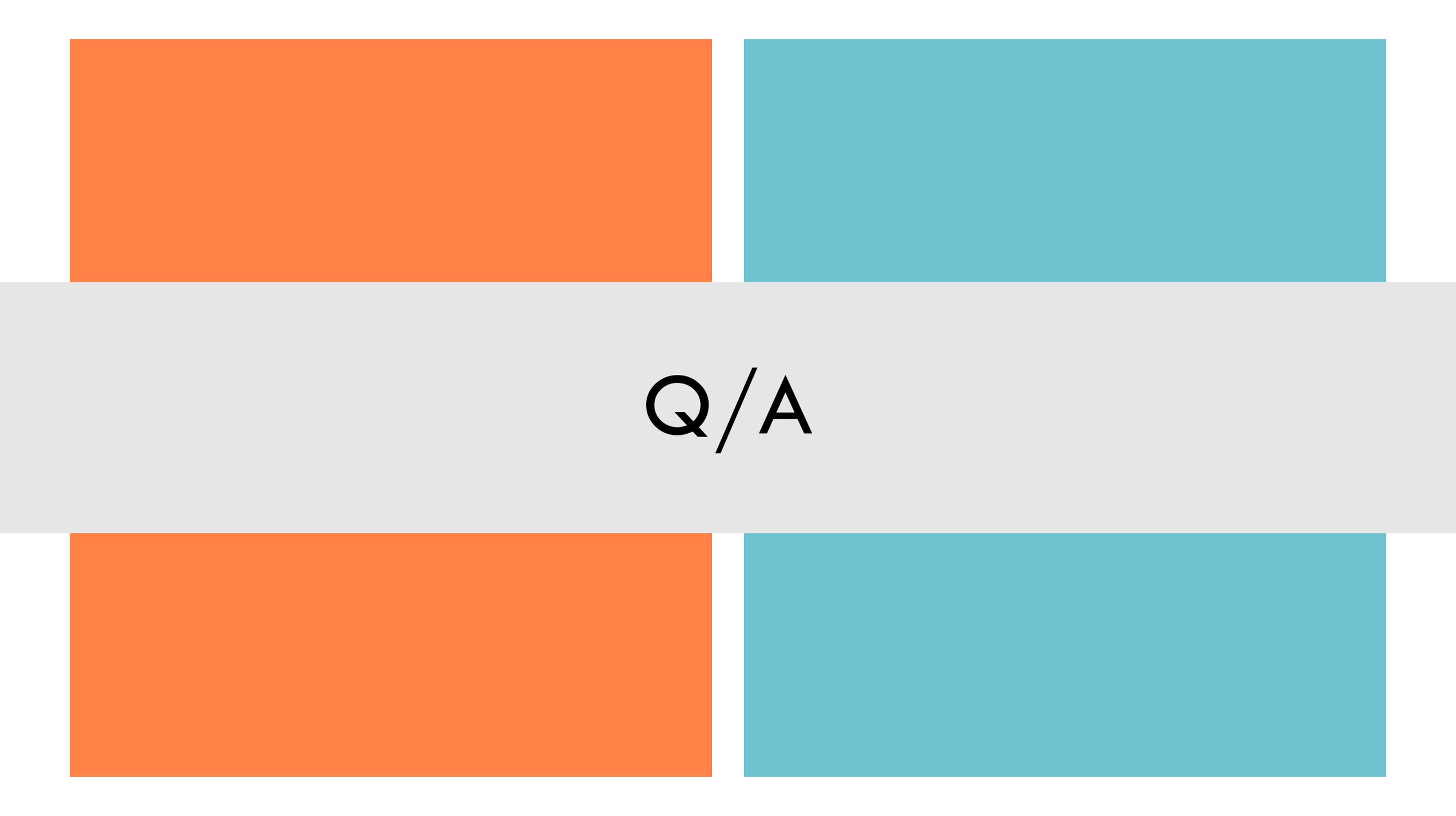
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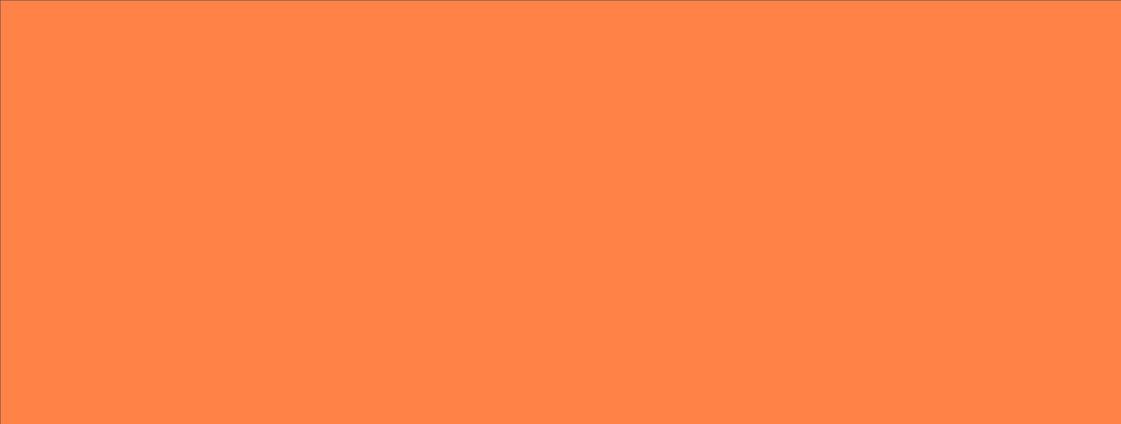


3D PRINTING PARAMETERS

1. Layer Height
2. Wall thickness
3. Infill density
4. Infill pattern (for rigidity)
5. Top and Bottom Layer
6. Nozzle temperature
7. Build plate temperature
8. Retraction
9. Support structure
10. Build Plate adhesion
11. Printing Speed



Q/A



THANK YOU

