Applications of 3D Printing in Laboratory Research

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What is 3D Printing?

- 3D Printing is the construction of an object by subdividing the main structure into smaller sections that are stacked together to create the desired object.
- 3D Printers take many forms, but the most prevalent type of 3D Printers are Fused Deposition Modeling (FDM) printers.
- Fused Deposition Modeling Printers work by melting a thermoplastic Filament and pushing it though a nozzle.
- The 3D printer then use motors to move the nozzle and a heated platform (bed).
- As the nozzle and heated bed move around plastic is pushed through the nozzle at predetermined times and deposited at different locations to form a layer.
- Each layer has a unique shape that builds off the previous layer and supports the next one (Figure 1).
- By combing all the layers together, it is possible to make almost any shape (Figures: 5 - 13).

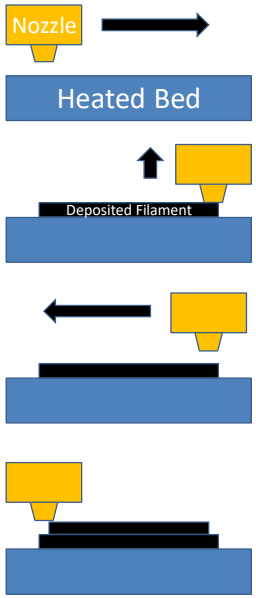

Figure 1: Steps Of 3D Printing

How Do You 3D Print?

- 3d printing begins by creating a 3D module in Computed Aided Design (CAD) Program such as Solidworks or Auto Desk Inventor (Figure 2).
- The model is then transferred to a slicer that creates gcode for the 3d printer based on parameters giving by the user (Figure 3).
- The 3d printer then reads the gcode and the object is slowly created layer by layer (Figure 4).

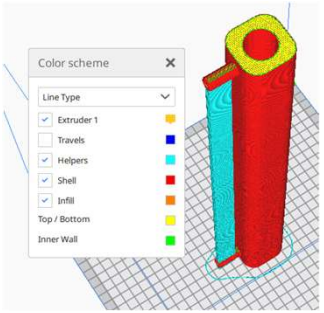

Figure 3: Slicer Rendering

Figure 2: CAD Model Rendering

Figure 4: Model Being Printed

Current Application

Figure 5: 3D Printed Double Pipe Heat Exchanger

Figure 6: 3D Printed Double Pipe Heat Exchanger Heating HPLC Column

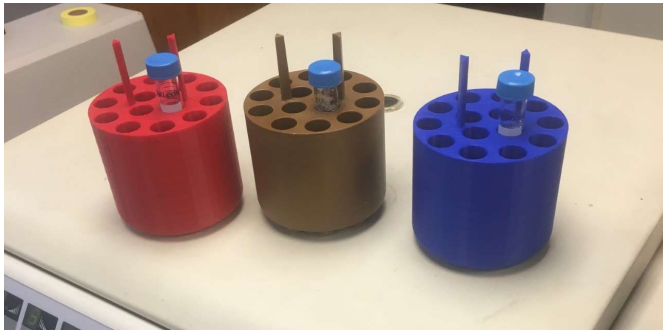

Figure 7: Centrifuge Adaptor: Factory Part (Center) Vs 3D Printed (Left and Right)

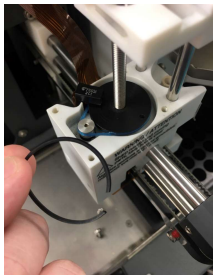

Figure 8: Broken Belt (held) Next to Installed 3D Printed Belt

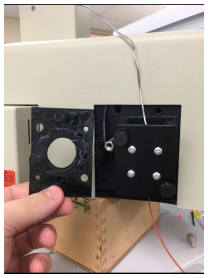

Figure 9: Damaged UV Detector Part Held Next to Installed Replacement Part

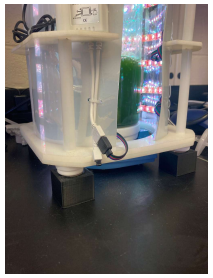

Figure 10: Risers For Led Bio Reactor Lighting Fixture

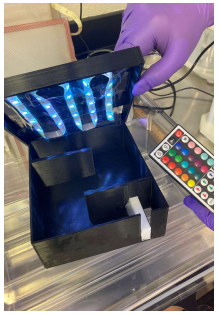

Figure 11: Fully 3D Printed Custom Photo Bio Reactor For Suspended Algae Growth

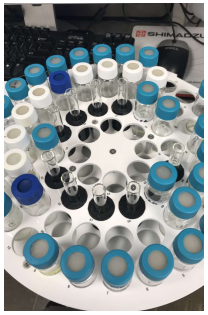

Figure 12: Test Tube to Tray Adapters for Auto Sampler

Figure 13: Custom Stoppers for Glassware

What Are The Benefits Of 3D Printing?

- By 3D printing parts it is possible to cut projects time delays that are cause by waiting for important components to arrive after they are ordered as can be seen in (Figure 14).
- Computed Aided Design Software such as Autodesk Inventor or Soldworks can be used to design custom parts or modify predesigned parts. These parts can then be 3D printed and used before any ordered parts would arrive.
- 3d printing also allows the rapid production of scale models to help validate designs before large finical investment.
- 3d printed parts can also be create as full-sized parts that can be used for permanent upgrades or as a fast fix of critical equipment.
- There is a wide verity of filaments based on polymers such as PLA, PEEK, TPU, ABS, and PETG. Each of these polymers can have other material such as metals, wood particles, or Carbon Fiber, mixed into them to create improved physical properties. In addition, many post print treatment are possible which can further expend upon the desired physical properties.

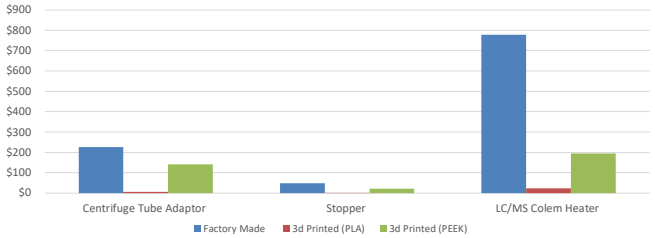

Figure 14: Cost Visitation of Factory Parts vs Analogous 3D Printed Parts