

Adhesion Process in Polymer Three-Dimensional Printing

Dual-Degree
Engineering Program

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DESIGN PROBLEM

Problem Statement

- In regards to polymer based print production, there are some issues when finalizing a three-dimensional printed object. The difficulty is removing the object from the print platform. The production platform can cause time consumption concern. For polymers, three-dimensional printing platforms are designed for adhesion; through a thermal and non-thermal technique. All polymer pieces have to be manually removed from the production platform. With design and testing it was found that changing the structure of the machine platform could possibly reduce production time at a larger scale. Utilizing simulation modeling and visualization one can determine the over all efficiency of a high performance production platform.

Design Objective

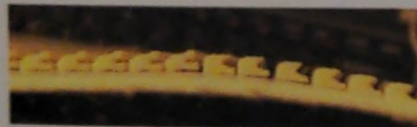
- To design a high performance printing platform for polymer three-dimensional additive manufacturing. To construct a platform that allows quality and time efficient mass prototyping.

Design Requirements/Constraints

- Must fit the measurements of a desktop 3D printer platform
- Print Platform must be made of a material that will not melt at the same temperature as the polymer being printed
- Must utilize a special technique that will remove the printed object efficiently

Design Criteria

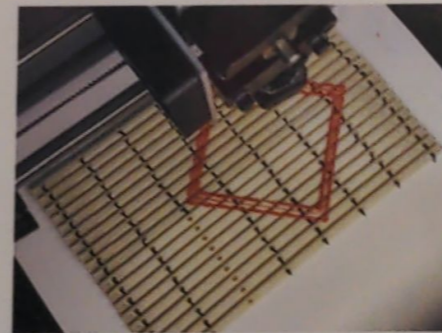
- The solution of the above stated problems can be addressed using Ultem (a polymer that melts at a higher temperature than the initial printed material). Also using a cleat conveyor belt design can effectively remove a printed object.



Figures 1 & 2: Shows the top and side profile of the finished print platform.

DESIGN SOLUTION

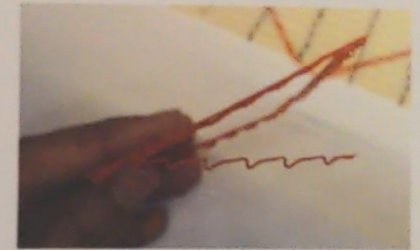
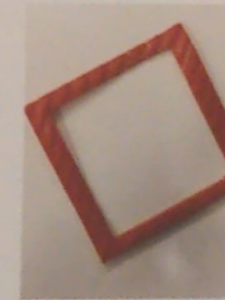
- Built on the idea of a conveyor belt 3D printer platform
- Utilized the materials given to design cleats that would be the base of the print platform
- Used Solid Works (CAD System) to effectively design and model the cleats
- Printed the cleats in Ultem plastic, which melts at a higher temperature than ABS plastic (the initial desktop 3D print material)
- Sewed the cleats using Nylon thread to a fabric belt with a spacing that would allow the polymer material to flow in and attach to the platform
- When finalized, attached the belt to a desktop 3D printer (Solidoodle), that utilizes a heated bed plate for ABS plastic
- Ran the printer to produce basic prints at different print settings to test different variable solutions



Figures 3 & 4: The Solidoodle was the 3D desktop printer used to perform testing.

RESULTS

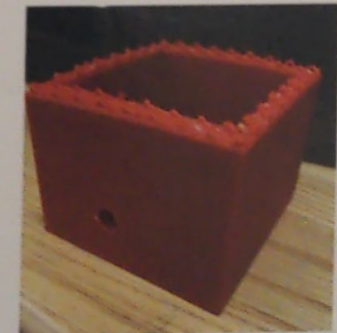
Testing Results



Figures 5 & 6: Images taken from some of the testing prints.

Validation Results

The needs of the 3D Polymer Desktop Print Platform have been met.



Final Test Print

DISCUSSION/CONCLUSION

- The results provided prove that the variables to consider when testing can vary print performance on the platform.
- In conclusion, it was found that the slicer settings of the desktop 3D printer and the surface of the print platform are the most significant factors to consider when producing a quality printed object on this specific platform.
- With further testing and data accumulation, one can utilize this unique print platform on a larger scale. Large scale 3D polymer printers also display this same adhesion issue. This print platform can help improve the time efficiency and manufacturing performance of a 3D printed polymer object at any scale.

Instructor: Dr. Olu Olatidoye

Student Poster Competition- Spring 2016