

Research Proposal for Bachelor Thesis

Effects of different 3D Printer Nozzles Material on printing an Abrasive Material

Andika Bramantio Wicaksono (11201902005)

Overview

3D Printing is a process of creating a 3D model or object into reality, it was first developed in the 1981 by a Japanese Researcher Hideo Kodama with a layer-by-layer technique. In which later most popularly known as a Fused Deposited Modeling (FDM). It is a part of a wider technique known as the Additive Manufacturing Method because it involves of adding/fusing a material to create the product.

Nowadays, many and many more 3D printers has entered the market and the price of 3D printer has becoming more affordable to purchase even for home consumer grade. Which also came along with the fact of more and more material being developed to meet the requirement of 3D printing by many types of the customers.

The material used for 3D printing by Fused Deposition Modeling is called a Filament. A filament is a thermoplastic that must follow a Heating, Extruding, and Cooling Process during a printing cycle. The process began with the Filament being Heated to just slightly above its glass transition temperature inside a chamber that is more known as a Hotend. Then it is extruded by the hotend to a flat surface where it will be cooled down. The process is continuing layer by layer to make a finished model.

There are several types of Filaments that available in the market. The most used for 3D printing are Polylactic Acid (PLA), Acrylonitrile Butadiene Styrene (ABS), Polyethylene Terephthalate Glycol (PETG). There are also some Unique and Exotic types of filaments that is available for 3D printing, although they might require some special modification to the machines or the printing environment to get the most optimized results out from them.

One of the types of Exotic/Unique Material is Abrasive type of filaments. These kinds of Filaments can cause accelerated wear damages for the stock brass-made nozzle for 3D printer. To print them effectively without making much damage to the printer itself, some modifications are required to effectively use the abrasive type of filaments.

Some Popular Nozzle Material to Print Abrasive Material:

- Stainless Steel Nozzle
- Hardened Steel Nozzle
- Ruby-Tipped Nozzle
- Assembled Nozzle
- Titanium Nozzle

Hypothesis

- Nozzle Material and Abrasive Filaments can correlate in terms of the Nozzle Wear Resistance to Abrasive Elements of the 3D Printer Filaments
- A Different Printing Temperature for each nozzle is needed to print the same material.
- How actually an Abrasive Material can damage the 3D Printer Nozzles
- There is a difference of quality of 3D Printed Results from each nozzle types
- The Performance of 3D Printer itself could differ depending on the nozzle for the same material

Empirical Method and Structure of the Thesis

The first part of the Thesis should have introduced to the reader the existing 3D printing technology especially the FDM method. The Particular interest of this part would be the background of FDM 3D Printing as well as with regard to the personal experience using a 3D printer for a while.

The Main part of the thesis should have cover Abrasive Material as the 3D printing material. One of the reasons of people wanting to use an abrasive material as a 3D Printing material is what they offers compared to the ordinary/regular 3D printing material such as PLA and ABS. However, compared to a normal 3D printing material it can cause severe wear damages to the nozzle depending what material and how often a 3D printer prints an abrasive material. The use of different types of nozzles in order to be able prints without furthermore problem and it doesn't mean it can remove the wear problem completely. Some nozzles were made with different material with a purpose. There should be a difference in terms of print settings and temperature because since different material have different heat transfer coefficient and thermal conductivity values.

The final part of the Thesis should be covering integrating this thesis into more commonly known research regarding the Abrasive Material and 3D Printer Nozzles as well as the relevance of the findings during the Thesis. Also includes what needs to be clarified in the future research and if this research is only nature or can be applied into a real world applications.