"REVIEW OF FABRICATION AND PERFORMANCE OF FILAMENT EXTRUDER"

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Abstract : The aim of this is to give the complete design information about the 3D-printing filament extruder Machine. Also the machine had to be simple in design and construction such that it could aid easy maintenance. The 3D-printing filament extruder Machine is automatic as well as it can be operated manually also and thus it is important of it to have an optimum usage of effort. Accordingly, the system was designed. The conceptualized machine should have the ability to form a filament and hence the dimensions and other design aspects were chosen accordingly.

***IndexTerms* – Filament Extruder,3D-Printer, Heating Coil, include acrylonitrile butadiene styrene (ABS), poly-lactic acid (PLA),**

I. INTRODUCTION

We have pleasure in introducing our new project "FABRICATION AND PERFORMANCE OF FILAMENT EXTRUDER". In 3D printing the filament is used and making the product in 3D printing process the waste material generated form the process. To recycle the waste of 3D printing we make the machine to reuse of 3D printing waste. In the filament extrusion of waste 3d printing plastics, the raw compound material is commonly in the form of different shape parts (small and big part that grind in mixer this material is called pellets) that are gravity fed from a top mounted hopper into the barrel of the extruder. Additives such as colorants and UV inhibitors (in either liquid or pellet form) are often used and can be mixed into the resin prior to arriving at the hopper. The process has much in common with plastic injection molding from the point of the extruder technology, although it differs in that it is usually a continuous process. While pultrusion can offer many similar profiles in continuous lengths, usually with added reinforcing, this is achieved by pushing the melted product out of a barrel instead of extruding the polymer melt through a barrel.

II. LITERATURE REVIEW

A. 3D printers have been recorded in studies since 2013 (Burley et al., 2019; Stephens et al., 2013; Vance et al., 2017)

These emissions consist of both particles and volatile organic compounds (VOCs) that are released from the heated feedstock material as it is pushed through the printer's nozzle to create a 3D object. The majority of these particles have been consistently found to be ultrafine in size (less than 100 nm in physical diameter) and released on the order of millions to billions of particles per min. Emitted VOCs have been found to be a mix of different compounds depending on the filament used. Available filament materials include acrylonitrile butadiene styrene (ABS), poly-lactic acid (PLA), nylon, high impact polystyrene (HIPs), polyvinyl alcohol (PVA) and others. VOCs, and their associated filaments, that have been recorded include styrene (ABS), ethylbenzene (ABS, HIPs), benzaldehyde (ABS, PLA), acetaldehyde (ABS, PLA), caprolactam (PLA, nylon, HIPs), acetone (ABS, PLA), lactide (PLA) and many others.

B. Particle and volatile organic compound emissions from (Oberdorster et al., 2005; Poh et al., 2018; Schmidt et al., 2009)

UFPs have been shown to have greater deposition efficiency in the deep lung than larger particles. Inhalation of some VOCs has been linked to adverse effects, including irritation of the respiratory system, sensory effects, and cancer formation. In particular, styrene and ethylbenzene are labeled as "probably carcinogenic to humans" (Group 2A) and "possibly carcinogenic to humans" (Group 2B), respectively by the International Agency for Research on Cancer (IARC). 3D printer emissions stimulated adverse cardiovascular responses in Sprague-Dawley rats. Also, a recent study found that 3D printer emissions induced toxicological effects in human small airway epithelial cells.

C. Design and Optimization of filament extruder a commercially available twin-screw 3D printer filament extruder was placed inside a Hazelton (Lab Products, Seaford, DE) 2000 liter (2 m3) chamber and operated according to manufacturer instructions. Particle emissions and VOCs were measured from the extrusion process the extrusion head to ensure the capture of particles. After sampling, the grids were secured to metal stubs and imaged using a Zeiss Sigma EVO Scanning Electron Microscope.

D. Plastic recycling in additive manufacturing (Department of Materials Science & Engineering, Department of Electrical & Computer Engineering, Michigan Technological University, Houghton, MI 49931- 1295, USA Submitted on 1 May 2020).

III. PROBLEM IDENTIFICATION

Too little or too much tension on the extruder idler spring can also cause issues with filament extrusion. With the idler screw being too loose, the gears can't grip the filament and the motor can start skipping. With the idler screw being too tight, the teeth on the gears might grind the filament and get choked. The major drawbacks of the existing machines are: -

- Too large.
- Occupy huge area.
- Imported.
- Too costly.
- Require more power to operate.

A very common problem during the extrusion of 3D-printing filament, is the variation of the filament thickness or diameter. Of course there will always be some deviation, even store-bought industrial grade filament does not have a perfectly constant diameter. If this deviation of thickness is too great it can cause problems for your 3D-printing quality, since the material input is not constant enough, or the intake mechanism might experience some difficulties. Also the severity of this issue also depends on the type of 3D-printer which is being used, some are less sensitive to a variating filament diameter than others. In this document the possible causes for this filament thickness deviation issue will be discussed, followed by some possible corrective actions.

So the current 3D-printing filament manufacturing process is highly costly to minimize the cost and area to use by most they used 3D-printing and reuse material wasted by process. We analyses all problem and make solution to solve it we make filament extruder machine in low cost and use less space to operate the machine..

IV. METHODOLOGY

To start of this project, a meeting with guide in the first week is done to manage the schedule of weekly meetings. The purpose is to inform the guide on the progress of the project and guided by the guide to solve difficulty. Briefing based on the introduction and next task of the project is given by guide. Make research of literature review with the means of the internet, books, available published articles and materials that is related to the title.

Designing phase start of by sketching few model models using manual sketch on A4 papers. Do it comparison for choose the best concept. Software applications are downloaded from internet to design the model based on the sketches. Software Creo parametric 2.0 helps to draw the better dimension. The preparation of mid-presentation of the project is next. Before presenting, the guide will see through the slide presentations and comment on corrections to be made. Then, presentation on the knowledge attained and instilled in the design phase is presented to a panel of three judges. Following up, is the fabrication of make some method for this project. Choose the material, make some list for the material and dimension. Doing it planning of fabrication process for this project. After that, start the fabrication process. It would take seven weeks to get this design and fabrication process alteration done. Make some analysis and testing for the project. Do it correction for error this project. Finish the fabrication process with painting process. After that, the final report writing and final presentation will be the last task to be accomplished. The guide will review the final presentation and revise mistakes to be amended. The final presentation then again will be presented to three panels. A draft report would then be submitted to the guide to be point out the flaws. Corrections are done and the real final report is handed over as a completion of the final year project.

- Scope of Work:

1. Literature review on the knowledge of mechanism design.
2. To design the mechanical part of PBMM using CAD software.
3. Develop the model of PBMM using bending process, welding process, drilling process and cutting process.
4. Fabricate the model PBMM using welding skill and machining.

V. DIAGRAM

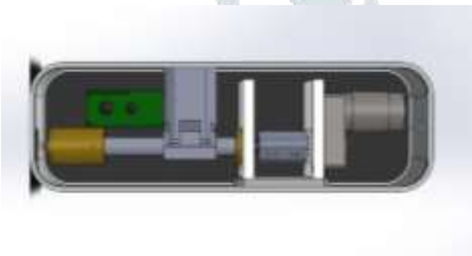

Fig. 5.1 Filament Extruder

Fig. 5.2 Front View

Fig. 5.3 Inclined View Back Side

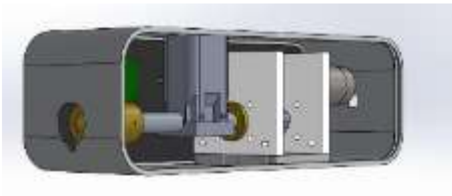

Fig. 1.4 Inclined View Front Side

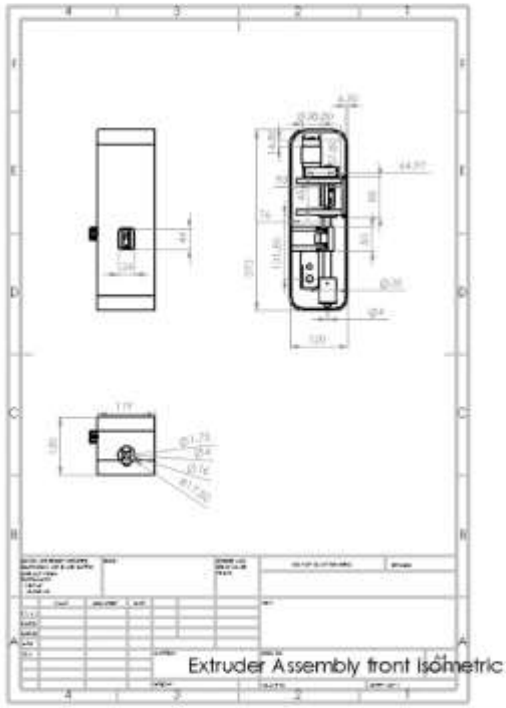

Fig: 5.5 Filament Extruder Dimensioning

VI. WORKING

The material enters through the feed throat (an opening near the rear of the barrel) and comes into contact with the screw. The rotating screw (normally turning at e.g. 120 rpm) forces the plastic beads forward into the heated barrel. The desired extrusion temperature is rarely equal to the set temperature of the barrel due to viscous heating and other effects. In most processes, a heating profile is set for the barrel in which three or more independent PID-controlled heater zones gradually increase the temperature of the barrel from the rear (where the plastic enters) to the front. This allows the plastic beads to melt gradually as they are pushed through the barrel and lowers the risk of overheating which may cause polymer degradation.

Extra heat is contributed by the intense pressure and friction taking place inside the barrel. In fact, if an extrusion line is running certain materials fast enough, the heaters can be shut off and the melt temperature maintained by pressure and friction alone inside the barrel. In most extruders, cooling fans are present to keep the temperature below a set value if too much heat is generated. If forced air cooling proves insufficient then cast-in cooling jackets are employed.

At the front of the barrel, the molten plastic leaves the screw and travels through a screen pack to remove any contaminants in the melt. The screens are reinforced by a breaker plate (a thick metal puck with many holes drilled through it) since the pressure at this point can exceed 5,000 psi (34 MPa). The screen pack/breaker plate assembly also serves to create back pressure in the barrel. Back pressure is required for uniform melting and proper mixing of the polymer, and how much pressure is generated can be "tweaked" by varying screen pack composition (the number of screens, their wire weave size, and other parameters). This breaker plate and screen pack combination also eliminates the "rotational memory" of the molten plastic and creates instead, "longitudinal memory".

After passing through the breaker plate molten plastic enters the die. The die is what gives the final product its profile and must be designed so that the molten plastic evenly flows from a cylindrical profile, to the product's profile shape. Uneven flow at this stage can produce a product with unwanted residual stresses at certain points in the profile which can cause warping upon cooling. A wide variety of shapes can be created, restricted to continuous profiles.

VII. CONCLUSION

The Filament Extruder is machine that use to reused waste material remains from the 3D printing process that grinding and then use as row material for the extruder process and try to reduce the waste by 3D printing.

REFERENCES

[1] 3dprintingfromscratch.com (2014-12-10). "3D Printer Filament Types Overview | 3D Printing from scratch". 3D Printing from scratch. Retrieved 2017-12-12.
[2] "What Material Should I Use For 3D Printing? | 3D Printing for Beginners". 3D Printing for Beginners. 2013-02-10. Retrieved 2017-04-20.
[3] "30 Types of 3D Printer Filament - Guide & Comparison Chart | All3DP". All3DP. 2017-01-03. Retrieved 2017-04-20
[4] "PP - Polypropylene - Technical Data Sheet" (PDF). Fiberlogy. Retrieved 2020-03-09.
[5] The book name "The Dynisco Extrusion Processor Handbook 2nd edition" Written by: John Goff and Tony Whelan Edited by: Don Delaney