

A Review on 3D Printing Technology

Shagufta Khan

Department of Electronics and Communication Engineering,
Galgotias University, Yamuna Expressway
Greater Noida, Uttar Pradesh
Email ID: shagufta.khan@Galgotiasuniversity.edu.in

ABSTRACT: 3D printing Technology is also known as rapid prototyping where a 3-dimensional structure is formed by laying the layers of material in succession. Here 3 phases such as designing, printing & finishing are included in this process. In the first step we build 3d modeling using any CAD software. Using this design, in 2nd step 3D printer create an object. And the finished object in third step is removed from the printer. This technology will save time & money. This saves on material wastage. It is very useful for giving the demo of any product in industry. By using this technology we are able to transform our thoughts into physical objects. It is very flexible technology, no person skilled to handle the printer. It is very useful to one and everyone who has an idea to create something unique. A 3D printer has the ability to create a model using many types of materials such as plastic, polymer, metal and composite materials. 3D printing is now being used in many professional career fields, especially those associated with engineering and biology.

KEYWORDS: CAD, Flexible, 3D, Rapid Prototype and Successive layer.

INTRODUCTION

3D Printing Technology[1] means the development of 3 dimensional physical object processes also known as additive production processes. Here 3D Printer creates an object in this technology by lying the material down on the printer platform until the desired object is formed. Use in this material or powder melted to create object. Printing is nothing more than the method of creating text or images. For 2D Printing[2], paper & ink may be used but in 3D, different materials are used to print an object. In industry this technology is mostly used to transform ideas into reality. This is now a day's leading technology that attracts the skilled students & industries. Use 3d printer we can build a whole model at once. If we use a different method then designing takes more time & expense, creates separate part and then connects all the parts by glue. The basic principle of this technology is material cartridge, versatility of production, and the clear conversion of code. The printer is a machine which is convert digital data or simply the design into physical object. This 3D design creates by using CAD software. It is used in various industries such as footwear, jewellery, dental, aerospace, automotive etc.

TYPES OF PRINTING

There are 3 Types of Printing Technology which are as Follows:

1. Selective laser sintering (SLS)
2. Fused deposition Moulding (FDM)
3. Stereo lithography (SLA)

1. Selective Laser Sintering:

This is an additive manufacturing method that uses high laser to fuse the material that will be used for making an item in printer. Content in this process is in powder form. Materials include plastic, metal, glass, ceramic etc. The sensitive laser[3] fuses the powder by scanning the surface of the powder bed for digital data. After all cross-section scanning is finished, the powder bed is lowered by one layer thickness and a new layer of powder is added to the top and procedure is repeated until the product is completed. Most of the system uses two types of powder-coated powder or powder mixture because the laser powder only melts the

outer surface of the particles in a single component, fusing the unmelted center of the solid state into each other. Figure 1 shows the selective laser sintering.

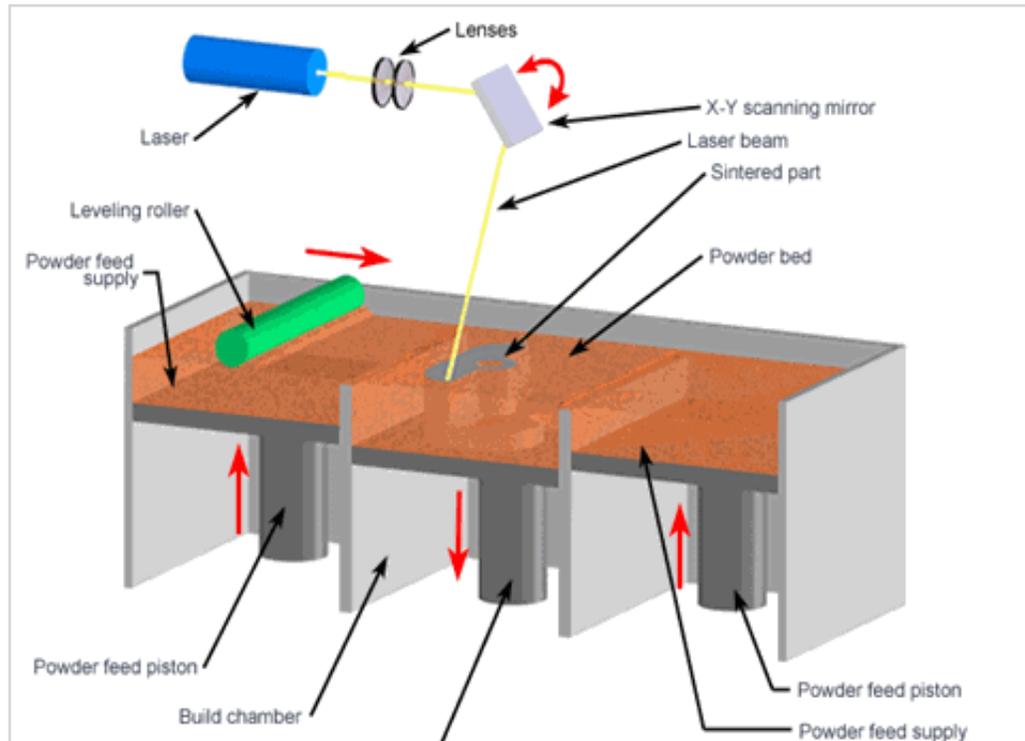


Fig.1: Selective Laser Sintering

2. Fused Deposition Moulding:

This is an additive manufacturing method used to mold prototype & device output. This operates on additive theory, whereby we can create an object by laying down the material layer by layer. Here they use plastic filaments or metal wire[4]. This filament is attached to the nozzle for extrusion. Nozzle is heated by using guided mechanism to melt the filament; it is pushed in both horizontal and vertical direction.

This mechanism is regulated via the CAM (Computer Added Manufacturing) reference. The extruder head is driven by stepper motor or servo motor. Once we submit the CAD design to the printer, the extrusion nozzle is heated to melt the plastic filament or metal wire, and it travels horizontally and vertically in order to form the layer of the item. The material hardens immediately following nozzle extrusion. Figure 2 shows the fused deposition modeling.

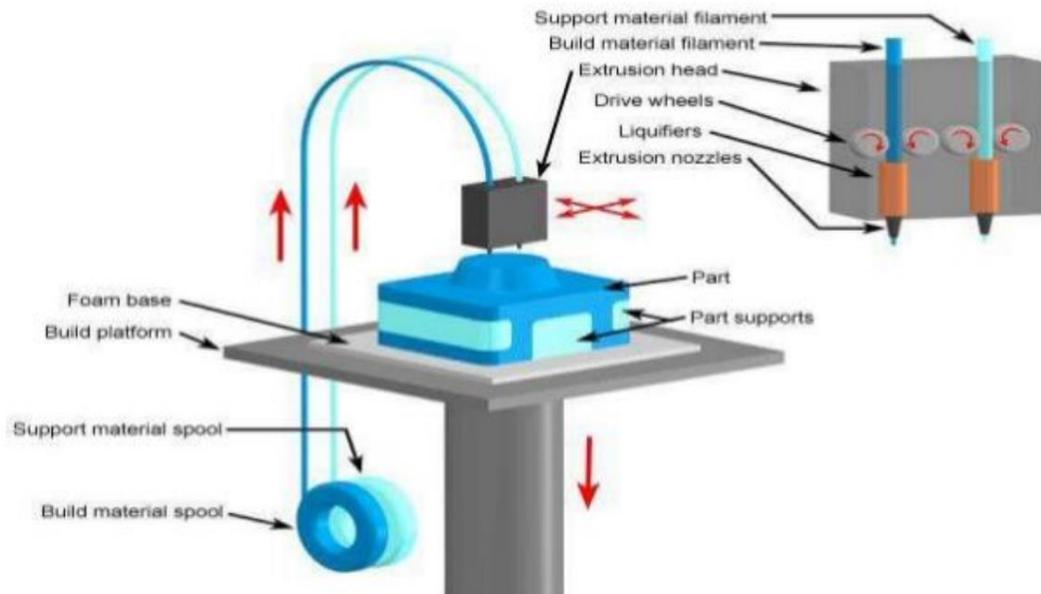


Fig. 2: Fused Deposition modeling

3. Stereolithography:

Liquid photopolymer and ultraviolet laser used in stereolithography[5] to create the object layer by layer. For each layer laser beam traces a cross-section of the part pattern on the surface of the liquid resins. Ultraviolet laser light penetration heats and solidifies the pattern traced on the resins, and attaches them to the bellowed layer. After that, the elevator frame of SLA moves down a distance equal to the thickness of one sheet, usually 0.05 mm to 0.15 mm, and the process is repeated until the object is finished. After the completion of this process object throws into the chemical bath in order to clean excess resins and subsequently cured in an ultraviolet oven.

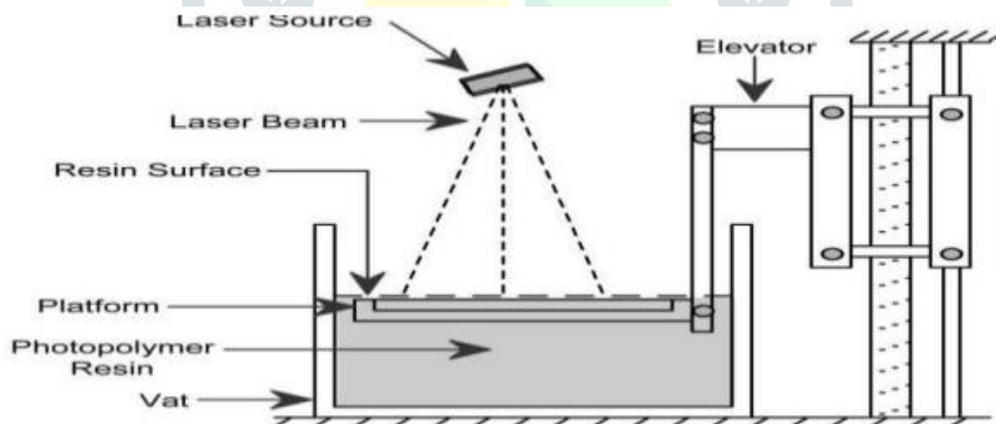


Fig. 3: Stereolithography

WORKING

3D printing is an Adaptive manufacturing process whereby laying down the material layer by layer object can be created. 3D printing is done in three steps which are follows:

1. CAD Design
2. Printing Process
3. Finishing

Step1: The design of the object is created using the computer in the first step. Special software form such as CAD[6] was required. Any person who knows about that program can design object. There are many types of software available which type of software is fine; it depends entirely on what you are designing to need. In this stage, the person who designs this software must be well known. After designing this file send to the printer.

Step2: Printer slices built into the 0.1 mm thick layer level. From that design, the printer is used to create the object. Print head moves over a powder bed where the cross-sectional sending of data from the computer is printed. Here the scanner scans the design and the laser beams fall onto the powdered bed surface after the first layer platform lowered by 0.1 mm has been completed and the another layer of powder is to be distributed over it and the process is repeated until the object is created.

Step3: Once the structure has been built extra powder removes from the platform by adding vacuum pressure and friction to the bottom of the build chamber. Removed powder is transported, filtered, and returned to the hopper for reuse through the device. First, you will open the system front and delete the object from the board.

ADVANTAGES

1. Less wastage of raw material.
2. Easy to use.
3. No skilled person required.
4. Cheaper process than any other process.
5. Reduce design complexity
6. Lighter, stronger and less assembly is required.

DISADVANTAGES

1. Cost of raw material is high.
2. 3d Printer is also expensive.
3. It takes more time to create a single object.

APPLICATIONS

A. NASA

As with our space programme, nothing exudes innovation and progress. NASA designed, printed and tested rocket engine injectors in July 2013 by exposing them to extreme pressures and temperatures exceeding 6,000 degrees Fahrenheit[7]. Indeed the 3-D printed pieces surpassed those made of traditional materials. A key advantage of 3-D printing is to eliminate the need for welded seams in an object and to identify and print traditional objects or design components that would normally require welded seams.

B. Biotechnology

There is infinite scope for creating new products and prototypes, it's just about developing new devices with different capabilities and working with different materials. The market is already shifting to smaller scales, with some research even on the nano-scale taking place. In 2012, an elderly Belgian woman received a 3-D printed jawbone, transplanted and tailored specifically to her facial structure[8]. This year, Princeton engineers were able to produce an ear print using a culture of animal cells and silver nanoparticles; the experimental version was able to capture audio beyond the human reach.

C. Cars

The automotive industry was one of the earliest adapters of 3-D printing to produce parts. However, we could soon start seeing whole cars printed. That is the business model for Urbee that is urban electric, a startup auto company that wants to make the greenest car on earth.

D. Defense

For M1 Abrams tanks and Bradley fighting vehicles using 3-D printing[9], a company called EOIR Technologies developed a way to mass-produce camera gun sights. That reduced the cost of manufacturing the gear by 60 percent, according to CSC. The Air Force is also in the early stages of pumping components of otherwise highly sensitive and costly devices, such as drones, to be used in training exercises.

E. Replication

A key idea in the growing field of 3-D printing[10] is the ability for printers to replicate themselves, or to create as many essential components as possible that are necessary to build a machine. Many consumer 3-D printers now come assembled with parts that were themselves printed in 3-D. As the technology advances and the industry develops, more and more essential machine components will be able to be printed. Soon we will find ourselves able to print all the components necessary to making things with complex structures, such as houses, cars, and more 3-D printers. This year, a functioning pistol was designed and printed, with the computer automated drawing schematics made readily available online.

CONCLUSION

Today's 3D printer can only make the remote battery cover, but in the future we can also make the entire TV remote for people in need of transplantation in the future. 3D printer will become popular on all places in becoming few years. There are countless advantages of 3D printing technology so it's more useful. Object size will increase in the future, prices will decrease, and the amount of materials will be used in the same printer. 3D printer will become more popular in future. 3D printing is the process of transforming 3D concept to reality using 3D printer. After the arrival of a few years, if they want to make some toy or anything, we can see 3d printer in every home then they will buy the 3d file instead of the product. One day printer will make human organs for people's needs. This technology is to be applied in industries these days. There are countless benefits of 3D printer, so it is the most preferred tool.

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