An overview of the many processes used in 3D printing and their aspects

[1]Santosh Kumar Tiwari, [2]Mrs.Smita Verma

[1]Bachelor of Pharmacy, [2]Associate professor
Nirmala devi Pharmacy College Nayansand, Jaunpur, Uttar Pradesh 222133.
Dr. A.P.J. Abdul Kalam Technical Univercit
Lucknow, Uttar Pradesh.

***Abstract*- Additive manufacturing, sometimes known as 3D printing, is a way to create 3D objects by using a computer controlled process that adds layers of material one at a time from 3D models or other electronic information sources. [1] Nayoga Municipal Industrial Research Institute's Hideo Kodama is usually seen as the one who made thing a computer . In 1984, Charle Hulls was a leader in creating the first 3D printer. He worked for his own company called 3D Systems Corp at that time. Charles also made a big invention known as stereolithography and an important format used today named STL in this field. He is also seen to have begun business rapid prototyping concurrently as his creation of 3D printing. At first, he used meltable materials that get hot with UV light to make things soft and hard. [2] In 1984, CharlesW. Hulls from 3D Systems Corp made the first 3D printer. Since then it's grown in usefulness and got cheaper so more people can use them.**

***Key Word:* 3d-Printing; Pdditive Manufacturing.**

These days, rapid prototyping is applied in many different domains of human endeavor: In different fields like science, engineering, medicine, the military, building and design of homes buildings. fashion teaching computer world and more. In 1990, the plastic shaping technology most often linked with "3D printing" was created by Stratasys. They made modeling of fused deposition (FDM). Since the beginning in the twenty-first century, there have been a big increasein the pricing and sales of 3D printers tag.

gradually decreased. Early in the decade of 2010 people started to talk about 3D printing and additive manufacturing as blanket terms for technologies used in making things. One of these words is used by regular people and news channels, while the other is mostly used by big companies that make these machines or set technical rules worldwide. These terms show that the technologies all have a common theme of stacking layers on top of each other in 3D during automatic control.
Other phrases used as synonyms for AM were desktop making, fast production and quick tooling. Also referred to as on-demand manufacturing. In 2010s, metal pieces for machines like big nuts and engine holder were grown (maybe before or instead of cutting) in factories. This was a change from always needing to cut them out of bars or flat sheets when they were made.

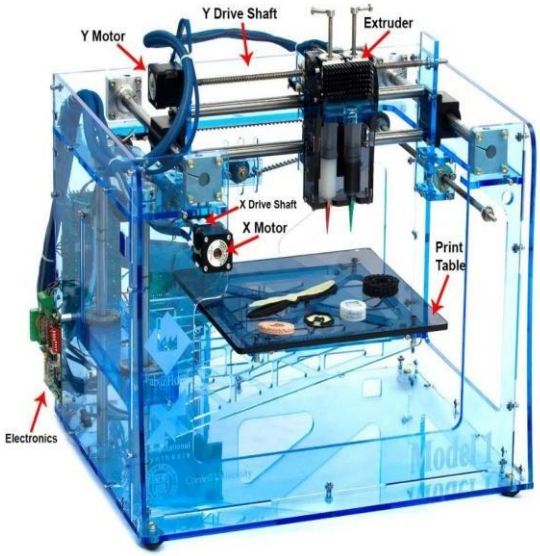

Fig.1.3D-printer

A. Modelling

You can make 3D printable models with the use of design software or by using a 3D scanner. Making models by hand for 3D computer pictures is like how people sculpt. Making 3D models is a way to study and gather info on the look and form of something. Usingfrom this data, a three-dimensional representation of the scanned item can be made. Making 3D printed models by hand or having them made automatically is very hard for normal people. That's why A few markets have expanded globally in recent years. Shapeways, Thing verse, My Mini Factory, and Threading are the ones that a lot of people find appealing.

B.Printing

Before making a using an It has to changed special software called . This changes the design into lots instructions for a printer. These instructions are stored in an STL file converted to a G-code file. There are some free cutting programs available, like Slic3r, KISSlicer and Cura. The 3D printer uses the G-code rules to place down layers of liquid, powder or flat material in order to make a model using different cross-sections. The final form of a model is created by connecting or merging these layers, which correspond to the fake cuts from the CAD model. This method's main advantage is its ability to create nearly any shape or form. Using traditional techniques, building a model can take many hours or even days. It is contingent upon the approach taken and the size or complexity of the model. This time is sometimes reduced to a few hours by additive systems; however, this depends greatly on the type of machine being used as well as the size and quantity of products being produced.

C.Finishing

Even makes a good picture, making something a little bigger and then using higher quality methods to take away parts can make it more exact. Just like Press release about the Accucraft iD-20 and associated devices. International Manufacturing Technology demonstrates a few 3D printing ways can use different materials while making parts.

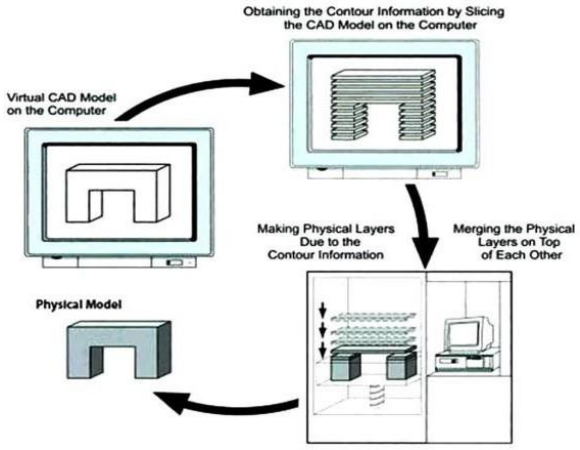

Fig.2.Printingprocedure

Since the late 1970s, many different types and ways for making things in 3D have been created. At first, the printers were big and costly for what they could make. There are many current additive manufacturing techniques. Some techniques to melt or soften materials to create layers. As an illustration, consider fused deposition modeling (FDM), selective laser melting (SLM), and selective laser sintering (SLS). Others employ distinct methods, such as laminated object manufacture (LOM) and stereolithography (SLA), to solidify liquids.

Selective Laser Sintering

In the 1980s, Dr. Carl Deckard and his advisor from the University of Texas developed selective laser sintering (SLS) with DARPA's help. They started a company called DTM to build these machines. In 2001, DTM's main competitor, 3D Systems bought DTM. The latest patent about The use of Deckard's laser sintering technique lasted from January 1997 to January 2014. With selective laser sintering, powder material (usually metal) is melted using a laser as the power source for 3D printing. It focuses on points in space based on a 3D image. This makes the material stick together, forming one solid shape.Similar idea, stuff is all melted rather than just joined. This lets for different things (crystal shape and small holes). SLS is a new tech mostly used for making things and low-volume production of parts. The jobs involved in making things are growing as the sale of 3D printing technology gets better.

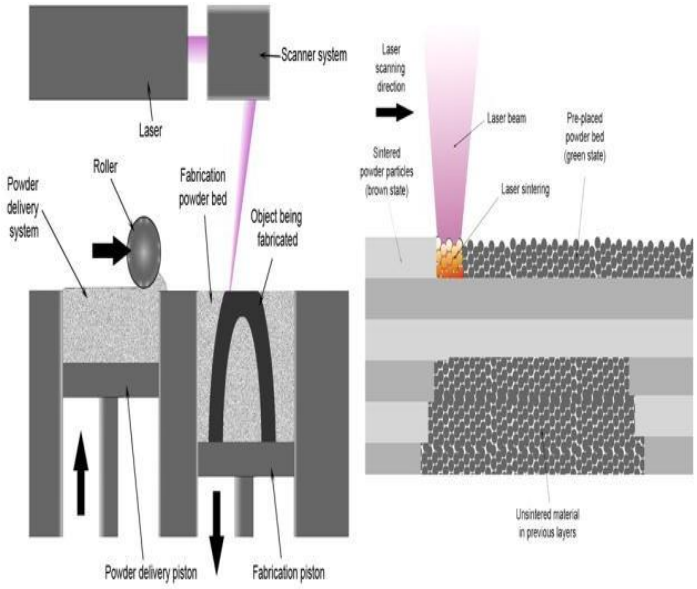

Fig.3.Selectivelasersintering

A. Fused Deposition Melting

In the late 1980s, S. Scott Crump invented a method called fused deposition modeling (FDM). Stratasys designed it in 1990. When the patent on this technology ended, a big group of people started working together for free. They made versions that could be bought using 3D printers like before. So, the cost of making things with FDM technology has gone down by two big numbers since it was first made. In this method, the model is made by pushing out little balls of material that get hard to create layers. A thermoplastic rope or cord is being unrolled into a circle to give material for A head for an extrusion nozzle. The material is heated to a certain temperature and its flow is turned on and off by the nozzle head. Stepper motors are typically utilized to move the extrusion head in the z-direction, up and down, and control how much it flows as needed. The top can move left and right, up and down. It's controlled by a computer program on a small controller in the machine.

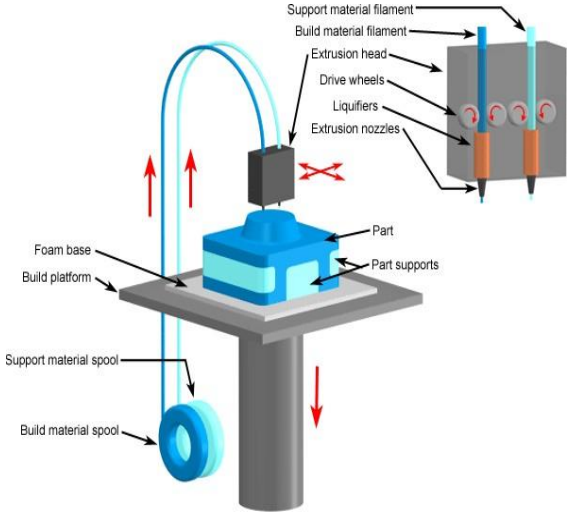

Fig.4.Fuseddepositionmodeling

B. Stereolithography

Stereolithography is an old and often-used way of 3D printing. 3D printing was made to let engineers make their own designs faster and more effectively. The tech first came up in 1970. A Japanese doctor named Dr. Hideo Kodama made a new way to do 3D printing using UV light and special plastic that can harden when exposed to light. This helped make today's stereolithography process more modern. In July 1984, before Chuck Hull applied for his own patent and Alain Le Mehaute registered a patent for the stereolithography method. The French inventor's idea for a patent was ignored by the big company in France and also by CILAS. They make lasers together. Le Mehaute thinks that giving up is a problem with new ideas in France. Stereolithography is a way of making 3-D models and prototypes. It uses light to connect chains of molecules together, forming polymers. These polymers then make up the body of a three-dimensional solid in layer by layer style.[1] People did research on this topic in the 1970s but Chuck Hull named it and got a patent for it in 1986. Then, he created 3D Systems Inc. to sell his patent in the market.

C. Laminated Object Manufacturing

It is a 3D-printing tech made by Helisys Inc. (now Cubic Technologies). In it, sheets of sticky paper or plastic are glued together one layer at a time and cut into the right shape using a special laser cutting tool. Things made using this method can also be changed by using machines after they are printed. The normal size for making layers in this task is based on what you're using. It usually ranges from one sheet to a number of sheets like in a copy machine.

Acrylonitrile Butadiene Styrene

One of the most used material since 3D printing started. This is long-lasting, a bit bendy and not heavy. It can be squeezed out easily which makes it great for 3D printing. It takes less strength to push out than when using PLA, another common 3D filament. This fact makes it easier to make small parts using extrusion. The problem with ABS is that it needs more heat. Its glass change temperature is around 105 degrees Celsius and a cool down to: For printing with ABS materials, 210-250 degrees celsius is typically used. Another problem with this material is strong smells during printing. This can be harmful to pets or people who have trouble breathing. So, 3D printers must be put in a spot with good air flow. A good tip is to not breathe in fumes when printing because it can be expensive if you use ABS materials. This is the cheapest type and why many people use it for this process.*PolyLacticAcid[PLA]*

The biodegradable substance which comes popular choice among fans of 3D printing. It's a type of thermoplastic decomposes naturally and is made of renewable resources. Products made of PLA are consequently more environmentally friendly than those made of other plastic materials. The human body and PLA are biocompatible. yet another fantastic quality. PLA has a tougher structure than ABS, and it melts at a temperature between 180 and 220°C, which is lower than ABS. Because PLA glass transitions between 60 and 65 °C, PLA and ABS can be ideal choices for any projects you are working on.

A. High Impact Polystyrene [HIPS]

High Impact Polystyrene (HIPS) filament is an additional example of a support 3D material. The food industry uses this material extensively for packaging. The white light bulb is natural and breaks down easily. It doesn't hurt people or animals when it touches them. It is also used to put CD discs in bags and create trays in the medical area. Using a warm bed during printing can help lessen problems with HIPS filaments sticking and curling. Material from HIPS that can be melted in a clear oil solution after being used as a support structure. during printing.

1. Time-to-Market: Rapid idea development is made possible by 3D printing. Printing conceived reduces the several months to a few days, which helps businesses stay one step ahead of each other.
2. Save Costs: Production runs and injection mold tool prototyping are costly endeavors. Compared to traditional machining, the 3D printing technology enables the fabrication of components at significantly lower .
3. Reduce Risk: The ability to confirm a design before spending a lot of money on aiswell the investment in . Compared to redesigning, 3D printing a test prototype is significantly less expensive.
4. Get the Feel: The way something feels in your hands is something that can never be captured in a photograph or virtual prototype on a computer screen. You have to really grasp, use, and test a thing to make sure its ergonomics and fit are perfect.
5. Customize It: In mass production, every component emerges from the mold or the assembly line in the same way. With 3D printing, a component may be personalized or customized to precisely suit one's demands. This enables the medical industry to provide custom fits and encourages individuals to develop their ideas in novel ways.
6. Are They Squared? No Issue: For many years, product design has been limited by the constraints of ordinary machining. Along with the advancements in AM, there are now countless possibilities. It is now feasible to create geometry that was previously impossible to produce, such as directional holes and unrealistic overhangs, and it is actually quite easy.
7. Fail Fast, Fail Cheap: Product developers can achieve relatively inexpensive breakthroughs early on with 3D printing, which can lead to more affordable dead ends and better products.

DISADVANTAGES

1. Intellectual property concerns: The simplicity with which 3D technology allows for the creation of replicas gives rise to concerns regarding intellectual property rights. The fact that designs are freely available online could alter if for-profit companies wish to profit from this new technology.
2. Size restrictions: At the moment, 3D printing technology is constrained by size restrictions. Even with 3D printers, it is still not possible to create really massive objects.
3. Raw material limitations: Currently, about 100 different raw materials can be used with 3D printers. Considering the vast array of raw materials utilized in conventional manufacturing, this is negligible. More investigation is needed to come up with ways to make 3D printed goods stronger and more resilient.
4. Cost of printers: A 3D printer is currently too expensive for the typical household to afford to acquire. Additionally, printing various kinds of objects requires the use of different 3D printers. Moreover, color printers are more expensive to buy than monochrome printers.
5. Fewer Manufacturing employment: The number of manufacturing employment will decline as a result of all new technologies. Due to their reliance on a high number of low-skill occupations, third world countries, particularly China, may see significant economic effects from this disadvantage.
6. Unrestricted manufacture of dangerous goods: Liberator, the first functioning 3D-printed pistol in history, demonstrated how simple it was to create one's own weaponry if one had access to a 3D printer and the design.

APPLICATIONS

1. The aerospace and aviation industries push the limits of geometric design complexity; as vehicles evolve and improve over time, parts must continue to increase in accuracy and efficiency even as vessel sizes decrease. Design optimization is therefore crucial to the industry's advancement. Because it might be difficult to optimize a design using conventional manufacturing methods, 3D printing has become popular among engineers.
2. Patterns for the metal casting of dental crowns are also made using these technologies. later on and to construct tools that are used to vacuum form plastic to create aligners for teeth, in order to enable the creation of new products for the medical and dental industries.
3. 3D printing has shown to be very upsetting for the jewelry business. A lot of people are interested and starting to use 3D printing because it might help this business grow better. From making traditional jewelry better by using 3D CAD and 3D printing, to having direct 3D printed production that gets rid of many old steps., there are new creative freedoms available
4. Creating precise demonstration models of an architect's design has long been a mainstay of 3D printing processes: architectural models. A somewhat quick, simple, and cost-effective way to create Architects utilize 3D printing to create detailed models directly from 3D CAD, BIM, or other digital data formats.
5. With advancements in resolution and flexible material properties, a particular sector known for its bold claims and innovative practices has emerged in 3D printing. Of course, fashion is on our minds.Shoes, headgear, caps, and purses are just a few of the items manufactured with 3D printing that have appeared on international catwalks.

CONCLUSION

The introduction section provides a brief overview of the history of 3D printing. The next section illustrates 3D printing, its methods, and the characteristics of the materials used in 3D printers. We have outlined the primary benefits and constraints of 3D printing technology in the third part. It is possible to draw the conclusion that the significance and social impact of 3-D printing technology are growing daily and have an impact on modern society, the economy, and human life.Technology like 3D printing has the power to transform society. Technological developments in The potential of 3D printing is drastically alter enhancemanner that items are produced globally. Using computer-aided design software, an object is scanned or created. It is then divided into thin layers that may be produced as a solid three-dimensional product by printing it out.. It is evident that nearly every area of Maslow's hierarchy of requirements can find use for 3D printing. Even though technology might not be able to fill a heart that is empty and unloved, it will offer businesses and quick simple manufacturing at—the restriction . Conversely, can make things happen quickly.

REFERENCES:

1. Dongkeon Lee, Takashi Miyoshi, Yasuhiro Takaya and Taeho Ha, “3DMicro fabricationof Photosensitive Resin Reinforced with CeramicNanoparticlesUsingLCD Microstreolithography”,Journal ofLaserMicro/NanoengineeringVol.1,No.2,2006.
2. Ruben Perez Mananes, Jose Rojo-Manaute, Pablo Gil, “3D Surgicalprinting and pre contoured plates for acetabular fractures”, Journal ofELSEVIER 2016.
3. AlexandruPirjan,Dana-

MihaelaPetrosanu,“TheImpactof3DPrintingTechnologyonthesocietyandeconomy”,JournalofInformationSystems andOperationsManagement,Volume7,Dec2013.

4. Gabriel Gaala, Melissa Mendesa, Tiago P. de Almeida, “Simplifiedfabrication ofintegrated microfluidic devices using fuseddepositionmodeling3Dprinting”ScienceDirect.
5. Pshtiwan Shakor, Jay Sanjayan, Ali Nazari, Shami Nejadi, “Modified3D printed powder to cement-based material and mechanical propertiesofcement scaffoldusedin3Dprinting”,ScienceDirect.
6. SiddharthBhandari, BRegina,“3D Printing andItsApplications”,International Journal of Computer Science and Information TechnologyResearch ISSN2348-120X.
7. Elizabeth Matias, Bharat Rao, “3d printing on its historical evolutionandtheimplicationsforbusiness”,2015ProceedingsofPICMET:Management oftheTechnologyAge.
8. Frank van der Klift, Yoichiro Koga, Akira Todoroki, “3D Printing ofContinuous Carbon Fibre Reinforced Thermo-Plastic (CFRTP) TensileTest Specimens”, Open Journal of Composite Materials, 2016, 6, 18-27.