

Recent Trend of 3d printing in Manufacturing Industries

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Abstract

3D Printing is a future of manufacturing industries. There are different types of manufacturing processes like casting, rolling, forming, molding, machining etc. In which material removal process from raw material and getting the required shape and size. This technology works on principle of material addition not removal. It is also known as additive manufacturing process (AM). This technology is mainly used for making prototypes of different complex parts. It is a type of quick manufacturing processes therefore production rate is fast in this technology

Many limitations in the kind of objects that can be digitised are still present. for example, optical technology may encounter many difficulties with shiny,

1. INTRODUCTION

This method is a type of Rapid manufacturing processes. 3D printing or preservative manufacturing is a process of making three dimensional solid objects from a digital file.

The creation of a 3D printed object is achieved using additive processes. In which an object is created. Each of these layers can be seen as a finely sliced parallel cross-sectional process an object is created by laying down successive layers of material until section of the eventual object.

A. How does 3D Printing Work?

A characteristic 3D printer is very much like an inkjet printer operated from a computer. It builds up a 3D model one film at a time, from the base upward, by frequently printing over the same area in a method known as fused depositional model (FDM). Working completely by design, the printer creates a model over a period of hours by turning a 3D CAD drawing into lots of two-dimensional, cross-sectional layer—successfully divide 2D prints that sit one on top of another, but without the paper in between. Instead of using ink, which would never build up to much volume, the printer deposit layer of molten plastic or fine particles and fuses them jointly (and to the existing structure) with adhesive or ultraviolet light.

B. 3D Scanners

A 3D scanner can be based on many different technologies, each with its own limitations, advantages and costs.

reflective or transparent objects. For example, industrial computed tomography scanning and structured-light 3D scanners can be used to construct digital 3D models, without destructive testing.

C. 3D Modeling Software

In 3D lighting tricks, 3D modeling is that the method of developing a mathematical illustration of Associate in Nursing surface of an object (either inanimate or living) in 3 dimensions via specialised software system. the merchandise is termed a 3D model. somebody UN agency works with 3D models could also be observed as a 3D creator. It are often displayed as a two-dimensional image through a method known as 3D rendering or employed in a technique of physical phenomena. The model may be physically created exploitation 3D printing devices. Models could also be created mechanically or manually. The manual modeling method of making ready geometric information for 3D lighting tricks is comparable to plastic arts like sculpting. 3D modeling software system could be a category of 3D lighting tricks software system accustomed manufacture 3D models. Individual programs of this category are known as modeling applications or modelers.

D. From 3D model to 3D Printer

You will must prepare a 3D model before it's able to be 3D printed. this is often what they call slicing. Slicing is dividing a 3D model into hundreds or thousands of horizontal layers and desires to be through with software. Sometimes a 3D model will be sliced from within a 3D modeling software application. it's also possible that you just are forced to use a specific slicing tool for a specific 3D printer. When the 3D model is sliced, you're able to feed it to your 3D printer. this may be done via USB, SD or WiFi. It really depends on what brand and kind 3D Printer you have got. When a file is uploaded in a very 3D printer, the item is prepared to be 3D printed layer by layer. The 3D printer reads every slice (2D image) and creates a 3 dimensional object.

II. MATERIAL USED FOR 3D PRINTING

A. FDM Thermoplastics

FDM Technology works with specialised 3D printers and production-grade thermoplastics to create robust, sturdy and dimensionally stable elements with the most effective accuracy and repeatability of any 3D printing technology. Stratasys founder Scott Crump fancied FDM Technology quite twenty years past, and Stratasys has continuing to steer the 3D printing revolution ever since.

Benefits of FDM:

- The technology is clean, simple-to-use and office-friendly
- Supported production-grade thermoplastics area unit automatically and environmentally stable
- Complex geometries and cavities that will preferably be problematic become sensible with FDM technology

B. Poly Jet Thermo polymers

PolyJet could be a powerful 3D printing technology that produces sleek, correct components, prototypes and tooling. With microscopic layer resolution and accuracy right down to zero.014 mm, it will manufacture skinny walls and sophisticated geometries victimization the widest vary of materials accessible with any technology.

Benefits of Polyjet:

- Create sleek, elaborated prototypes that convey final-product aesthetics.
- Produce correct molds, jigs, fixtures

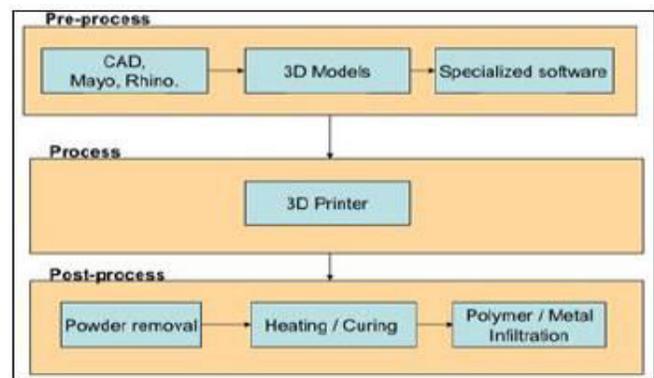
and alternative producing tools

PROCESSES AND TECHNOLOGY

Not all 3D printers use the identical technology. There are several ways to print and every one those available are additive, differing mainly within the way layers are built to form the ultimate object. Some methods use melting or softening material to provide the layers. Selective laser sintering (SLS) and fused deposition modeling (FDM) are the foremost common technologies using this fashion of 3D printing. Another method is once we discuss curing a photo-reactive resin with a UV laser or another similar power source one layer at a time. the foremost common technology using this method is named stereo lithography (SLA). To be more precise: since 2010, the American Society for Testing and Materials (ASTM) group “ASTM F42 – Additive Manufacturing”, developed a collection of standards that classify the Additive Manufacturing processes into 7 categories in line with Standard Terminology for Additive Manufacturing Technologies. These seven processes are:

- Vat Photo polymerization
- Material Jetting
- Binder Jetting
- Material Extrusion
- Powder Bed Fusion
- Sheet Lamination
- Directed Energy Deposition

A. Process



ig.1: Work Flow

A virtual design of the item is formed. CAD (Computer Aided Drafting) uses a 3D modeling program or 3D scanner for virtual design. The software slices the ultimate model into hundreds or thousands of horizontal layers. The printer creates the item layer by layer, leading to one three dimensional object.

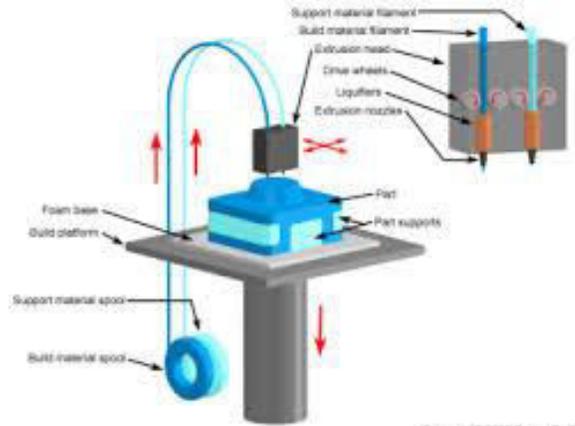
B. Material Extrusion Method

Material extrusion is an additive producing technique that uses a continuous filament of thermoplastic or stuff to construct 3D components. The filament is fed through an extruding nozzle, where it is heated so deposited onto the build platform layer by layer.

Material extrusion is currently the foremost well-liked additive producing method in terms of handiness for general client demand and quality. As per ISO/ASTM 52900-2015, it's one in every of the seven Additive producing processes. you'll be able to scan the opposite varieties here. Material extrusion technology was initially developed within the Nineteen Eighties by S. Scott Crump underneath the registered name of consolidated deposition modelling (FDM). The term consolidated deposition modelling (FDM) and its abbreviation FDM are proprietary by Stratasys. In 1991, at the National Congress, a corporation co-founded by Scott Crump.

Fused filament fabrication (FFF) is another kind that falls underneath this class developed by the members of the RepRap project that isn't restricted to use by others. you'll be able to scan all concerning RepRap in

here. this is often additionally noted as Plastic Jet Print-



ing

Fig.2: Process of 3D Printing

- Nozzle ejecting plastic
- Deposited material (modeling part)
- Controlled movable table

In above fig shows plastic injecting nozzle, this produces successive layers of plastic. For producing the task moving bed (saddle) is provided, which can move pro re nata. Here height of the task engineered by applying sequential layers, so at the time of manufacturing vertical movement of bed is not needed.

APPLICATIONS OF 3D PRINTING

AM technologies found applications beginning within the Nineteen Eighties in development, information image, speedy prototyping, and specialised producing. Their growth into production (job production, production, and distributed manufacturing) has been below development within the decades since. Industrial production roles within the metalwork industries achieved vital scale for the primary time within the early 2010s. Since the beginning of the twenty first century there has been an oversized growth within the sales of AM machines, and their worth has born well.[5] consistent with Wohlers Associates, a practice, the marketplace for 3D printers and services was value \$2.2 billion worldwide in a pair

of 2012, up twenty ninth from 2011. McKinsey predicts that additive producing may have Associate in Nursing economic impact of \$550 billion annually by 2025. There are several applications for AM technologies, together with design, construction (AEC), industrial style, automotive, part military, engineering, dental and medical industries, biotech (human tissue replacement), fashion, footwear, jewelry, eyewear, education, geographic info systems, food, and plenty of different fields.

A. Industrial 3D Printing

3D printing alias additive producing (AM) or direct digital producing (DDM) is really a game ever-changing technology that has the potential to revolutionize the producing of objects within the twenty first century. It conjointly marks the new age of mass personalization that guarantees to boost innovation, encourage higher use of resources and renovate the manner things square measure being made. The 3D printing trade is growing with leaps and bounds; it already reached two billion USD in 2012 and is anticipated to succeed in seven billion USD by 2025. Growth in varied industries in conjunction with the advancement within the technology has led to a rapid climb within the budding 3D printing trade. Automotive, medical and shopper merchandise square measure over needing to adopt this technology in their producing processes and conjointly to require the trade in a very whole new level. Initially 3D printing was developed for speedy prototyping of assorted objects. It allowed designer to style the merchandise terribly} very precise manner saving time and energy and conjointly the huge prices that square measure incurred whereas printing these proto-types. However, ever since the 3D printers started getting used in varied sectors, the evolution of the technology related to these printers has evolved in no time. creating them one in all the foremost desired technologies within the world. With the rise within the quality of this technology most of the industries have embraced this technology with open arms. This technology has flourished within the jewellery and alternative personalised fashion item, in dental laboratories to supply crowns, bridges and implants further as within the production of hearing aids

and prostheses providing patients an ideal work.

C. Bio-Printing

Bioprinting is associate additive producing method wherever biomaterials like cells and growth factors are combined to form tissue-like structures that imitate natural tissues. The technology uses a fabric called bioink to form these structures during a layer-by-layer manner. The technique is wide applicable to the fields of medication and engineering science. Recently, the technology has even created advancements within the production of gristle tissue to be used in reconstruction and regeneration.

In essence, bioprinting works during a similar thanks to standard 3D printing. A digital model becomes a physical 3D object layer-by-layer. during this instance, however, a living cell suspension is used rather than a thermoplastic or a organic compound.

D. Medical Industry

3D printing has several functions during a form of industries, however, within the medical field it's four main applications. Allie Nawrat pointed out however this technology can be accustomed replace human organ transplants, speed up surgical procedures, turn out cheaper versions of needed surgical tools, and improve the lives of these dependent on prosthetic limbs. Additive producing, otherwise called 3D printing, was 1st developed within the Eighties. It involves taking a digital model or blueprint of the topic that's then written in serial layers of AN applicable material to make a brand new version of the topic. The technique has been applied to (and utilized by) many various industries, together with medical technology. typically medical imaging techniques, like X-rays, computerized tomography (CT) scans, resonance imaging (MRI) scans and ultrasounds are accustomed turn out the initial digital model, that is later fed into the 3D printer. It has been forecast that 3D printing within the medical field are value \$3.5bn by 2025, compared to \$713.3m in 2016. The industry's compound annual rate of growth is meant to succeed in seventeen.7% between 2017 and

2025.

There are four core uses of 3D printing within the medical field that are related to recent innovations: making tissues and organoids, surgical tools, patient-specific surgical models and customized medicine.

Blessings of 3D Printing

- Faster Production.
- Easily Accessible.
- Better Quality.
- Tangible style and products Testing.
- Cost-effectiveness.
- Creative styles and Customization Freedom.
- Unlimited Shapes and pure mathematics.
- Can Implement different Raw Materials

Disadvantages of 3D Printing

- High Energy Consumption.
- 3D Printing Technology is dear.
- Limited Materials.
- 3D Printers are not that easy.
- Harmful Emissions.
- Too abundant Reliance on Plastic.
- 3D Printers are unit Slow.
- Production of Dangerous instrumentation.

CONCLUSION

3D printing is one in each of the fastest manufacturing ways on the market in engineering field. 3D printing is in the main used for paradigm making. thanks to 3D printing technology various sorts of jobs are usually manufactured in less time. but we are going to use entirely non-metals for 3D printing technology, therefore large size components cannot be manufactured by this technology

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