3D Printing Technology or Additive Manufacturing System

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Abstract:- Manufacturing system is a method of organizing product from the availability of raw material from start to the final output subtractive manufacturing is a type of production in which metal removal takes place by various methods like drilling, milling, cutting, etc. But in this era of 20th century we have in manufacturing system called additive manufacturing it is in its initial stage till end of 20th century and is known by prototype manufacturing which has now become 3D printing technology it is a rapid and reliable process.

The main difference in subtractive and additive manufacturing system is that in subtractive material removal takes place while in additive material addition takes place by layers to form the final product.

This additive manufacturing system or 3D printing technology will become the fastest and most accurate method of production till 21st century and will be used by almost all the manufacturing industries in the world.

As being a simple process i.e. just upload the 3D design of the model in the system and the 3D printing machine will make the 3D model of the product by applying number of layers of the required material till the final dimension of the product is achieved. Material used in formation of product may be plastics, metal but there are limitations not all metals can be used selective metals are used A brief information on this technology is being discussed in the paper.

Key words:-- Additive manufacturing, 3D Printing Technology, Product Formation by Layers.

I. INTRODUCTION

3D Printing technology is also known as Additive manufacturing it refers to the process used to synthesize a three dimensional object by means of forming layers of a material under the control of the computer they are formed by a digital model or 3D CAD model any type of shapes can be produced by this method. This technology is one of the most advanced technologies developed . Additive manufacturing is one of the most simplest way for creating a rapid prototype of the product desired. This technology is opposite to subtractive manufacturing were the product is formed by removal of material from the work piece. There are large number of different methods for additive manufacturing or for 3D printing like extrusion method which consist of fused deposition modeling (FDM) or fused filament fabrication (FFF) and Direct Ink Writing(DIW), Other method is Light Polymerization Method which consist of stereolithography (SLA) and Digital Light Processing (DLP), This two methods are widely used, and the most common is the extrusion method it is a simple and reliable process Drawbacks of the conventional methods are also recovered by additive manufacturing bringing revolution in the manufacturing industry. Further important points of additive manufacturing have being discussed in this paper

II. ADDITIVE MANUFACTURING

3D printing or Additive Manufacturing is defined as the process of creating a three dimensional object by forming layers of the material of the product by using digital file of a model like 3D CAD model. The process is very simple and reliable. Any product of simple as well as complicated shaped products can be created by additive manufacturing without increase in the costing hence it is also a cost effective process of manufacturing. There are way number of advantages of additive manufacturing as well as some limitations. The market of this 3D printing technology is increasing day by day as this technology is helping many industries for overcoming their difficulties occurred by conventional manufacturing. Hence it is the topic coming into the views of the industrialist which is gaining popularity day by day making a step towards future technology in the industries.

III. DRAWBACKS OF CONVENTIONAL MANUFACTURING

1. Prototype making in Conventional Manufacturing:- takes a lot of time, money, effort which is spent on tooling the production line and setting up of assembly process, more effort will be needed if the prototype needs to be reworked

2. Production of Waste:- Conventional manufacturing means subtractive manufacturing that is production of the product by removing the undesired material from workpiece to achieve the final design of the product which means there is a lot of production of waste material which is being removed from product which is one of the major drawback though the waste is recycled it adds extra time, money, labor to the manufacturing .

3. Cost Structure:- Cost Structure of the product depends mostly upon the design of the product to be produced when there is a increase in the complication in the design of the product the costing of the product also increases for manufacturing it.

4. Bottom Line of factory:- The bottom line of the factory is improved by mitigating risk and increasing predictability that is the factory have to predict the amount of volume or material needed also the time due to this fixed or accurate dates cannot be given to the customer

IV. ADVANTAGES OF ADDITIVE MANUFACTURING OVER CONVENTIONAL MANUFACTURING

Some of the major drawbacks discussed in the previous point about the drawbacks of conventional manufacturing same drawbacks is taken into consideration while comparing it with the advantages of additive manufacturing

1. Easy production of Prototype:- This is one of the most important advantage of additive manufacturing over conventional manufacturing while producing a prototype there is no need of special tooling to make a part nor any type of assembly line this saves time, money and labor

2. Waste prevention Environment friendly:- Being a additive type of manufacturing Hence while production of a product only the material to be consumed is being extruded by the extruder of 3D printer hence almost no waste is created in this process and this helps saving the extra cost of recycling and time and also maintains the eco-friendly environment.

3. Stable cost structure:- In this process the cost structure remains stable for any type of design although it may be complicated which means the cost of product will not vary due its design structure where as in conventional it goes high with increase in complications in design

4. Improvements in the bottom line of the factory:- In this type there is no need of taking a lot of risk or predicting as while 3D printing a product the 3D printers can read the 3D CAD files to know how much time will be taken and how much material is needed before its even on the machine. This improves plan capabilities and give accurate dates to the customers and schedule factory capacity by forecasting future needs without any interruption

V. WORKING PRINCIPLE OF ADDITIVE MANUFACTURING

Additive Manufacturing Technology is A type of advanced technology which on the principle of fabricating models by Fusing, Sintering and polymerization of materials in a predetermined layers with no need of tools.

VI. TYPES OF ADDITIVE MANUFACTURING PROCESSES

TYPE	TECHNOLOGIES	MATERIALS USED
Extrusion	Fused Deposition Modeling (FDM) Or Fused Filament Fabrication (FFF)	Thermoplastics, eutectic metals, edible materials, Rubbers, Modeling clay, , Metal clay
	Direct Ink Writing (DIW)	Ceramic materials, Metal alloy, cermets, metal matrix composite
Light polymerize	Stereolithography (SLA)	Photopolymer
	Digital light processing (DLP)	Photopolymer
Powder Bed	Powder bed and inkjet head 3D printing (3DP)	any metal alloy, powdered polymers,
	Electron-beam melting (EBM)	any metal alloy including Titanium alloys
	Selective laser melting (SLM)	Titanium alloys, Cobalt Chrome alloys, Stainless Steel
	Selective heat sintering (SHS)	Thermoplastic powder
	Selective laser sintering (SLS)	metal powders, ceramic powders
	Direct metal laser sintering (DMLS)	Almost any metal alloy
Laminated	Laminated object manufacturing (LOM)	Paper, metal foil, plastic film

Wire	Electron beam freeform fabrication(EBF^3)	Almost any metal alloy

VII. GENERAL ADDITIVE MANUFACTURING PROCESS

Step 1:- 3D CAD DESIGN

This is the most basic step of additive manufacturing in which the external geometry of the part to be manufactured is created in a type of software model by using professional software's like CAD modeling software for creating a 3D structure of the part

Step 2:- CONVERT DESIGN TO STL FILE

This a type of file which is accepted by all additive manufacturing machine. The CAD software's can give their output in STL type of file. This file helps to describe external closed surfaces of the 3D CAD model and also helps in formation of base calculation for the layers

Step 3:-MANIPULATION AND TRANSFER OF STL FILE TO AM MACHINE

The STL file which contains the part details should be transferred to the AM machine where first there is a general manipulation of the STL file related to size, position and orientation of building it

Step 4:-SETUP OF THE MACHINE

The setup of the additive manufacturing machine should be done properly according to the build process. Such setup would be related with the energy source, the thickness of the layer to be build, timing and material

Step 5:- BUILDING OF PART

This is the step where the actual printing of 3D model of the part starts. There is no need of supervision as it is a automated process. Places to monitored are some errors like lack of material, disturbances in power supply, software problem

Step 6:- REMOVAL OF PART

After the machine finishes with the building of the part it must be removed carefully with the interaction of machine as they have safety interlocks

Step 7:- POST-PROCESSING OF THE PART

After the removal of the part from the machine it should be cleaned carefully as the part may not be strong enough at this stage for rough cleaning if the part consist of the supports it should also be removed this requires time and carefulness

Step 8:- READY FOR USE

Now the manufactured part is ready for the use. But still may require some treatment like priming and painting for a perfect surface finish or the produced part needs to be assembled with other components to form the final model or product

VIII. AREAS OF APPLICATION

There are large number of applications in this field but some of the areas which are important are:-

1. Aerospace Industry :-

Aerospace industries is a area where high level of material is needed for manufacturing parts by using additive manufacturing it has become easy to manufacture some parts like fuel system , turbine blades, guide ways etc.

2. Mechanical Field :-

In mechanical fields it can be used for building of customized parts for a particular vehicle according to the need of customizer

3. Medical Field:-

In medical this technology can be a boon for many patients who are in the need of prosthetics as the prosthetics available in market have high cost depending on their quality by additive manufacturing it becomes simple for creation of a prosthetic according to the size and comfort zone of the patient

4. Industrial:-

In industrial field this technology can be used for various parts which are heavy and bulky it can be for heat exchangers , cooling channels for increasing cooling action

IX. LIMITATIONS OF ADDITIVE MANUFACTURING

1. Production Of Dangerous Item:-

This technology can be used by terrorist for printing guns by additive manufacturing it will become easy to produce any type of gun according to the ideas

2. Limitation Of Size :-

There is limitation of the size of manufacturing the products due to limited size of printers. Very large objects are still not possible to build on 3D printers

3.   *Limited Raw Material:-*

Still all the raw materials used in conventional machining are not possible to be used in additive manufacturing process

4.   *High Cost Of Printers:-*

It is not possible to buy a 3D printer for household purposes as the cost of 3D printers is to high and different printers are there for different types of job and the cost of 3D color printer is also very high

X.   FUTURE SCOPE

Future scope for this technology is bright as this manufacturing coming into image this is just the beginning for such manufacturing process there will be more improvement in this technology for increasing quality of product and overcoming the drawbacks of additive manufacturing process and consequently the cost of the printers will also decrease once they come in mass production this technology will the way of manufacturing of products in 21st century but some of the processes cannot be replaced with conventional manufacturing

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