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Additive Layer Manufacturing: Advantages and Scope over Conventional Methods

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ABSTRACT

Additive layer manufacturing is referred to as rapid manufacturing or 3D printing. Three dimensional parts are manufactured into 2D form up to 0.05mm. ALM widely used in various field like mechanical, electronic, electrical, aerospace, defense, biomedical and design engineering. The fundamental approach of ALM is to minimize the pressure to develop new and high quality components rapidly and economically. The other main function of ALM is to ensure quick response manufacturing and rapid deployment of components into production. ALM do not require special tool for the manufacturing of complex shaped parts. CALM will promote and develop this exciting and versatile different method of manufacturing components and parts across various sectors, using its unique set of facilities and knowledge experts. This paper describes research into the concept for a Design for ALM technology plate form. Until these objectives are meet, the applicability of ALM has advanced over the past decade into many various areas of manufacturing and has enable exploration of novel process and development of hybrid process. The research community of today has the opportunity to shape the future direction to utilize the full potential of ALM.

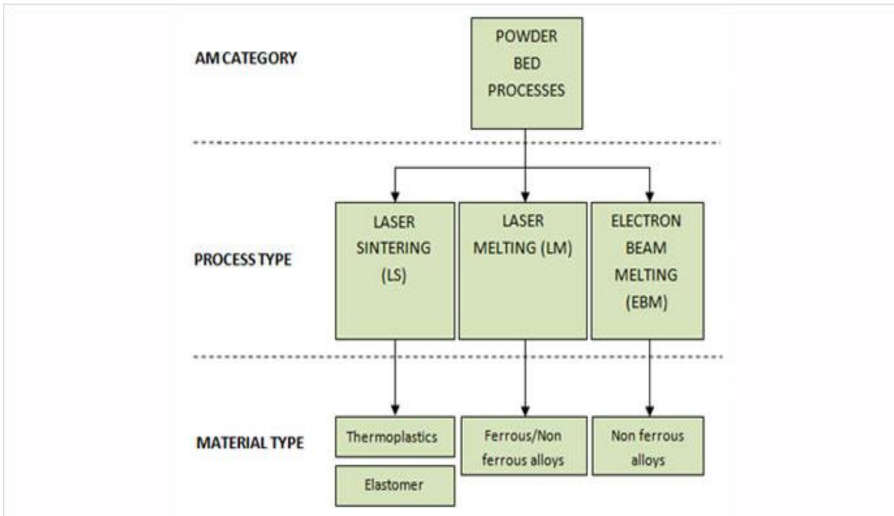
KEY WORDS

Additive manufacture, Rapid prototyping, Selective laser melting, Layer manufacturing materials used.

INTRODUCTION

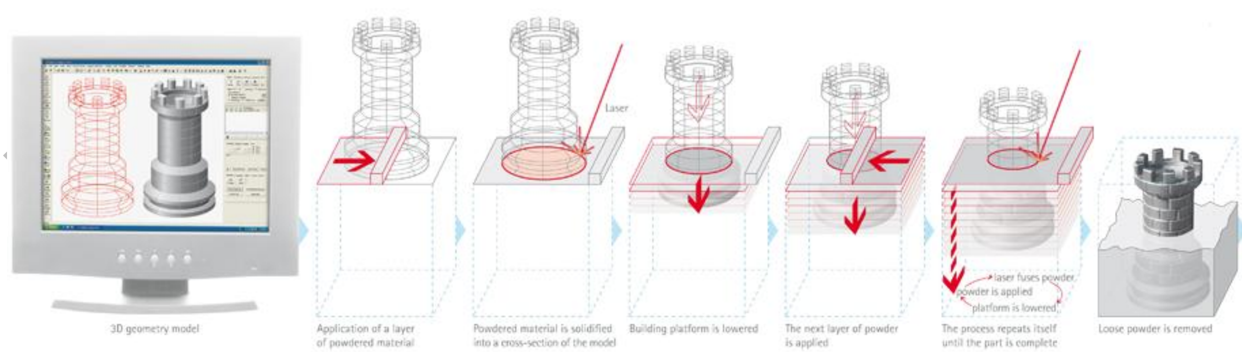
Additive Layer Manufacturing (ALM) refers to create three dimensional object layer-by-layer, with help of CAD drawing. The components are fabricated by ALM without any mould support, hence this technique is also known as Rapid Prototyping or 3D Printing. The latter is more accurate in that it describe a production technology which is clearly differentiate from conventional methods of material cutting. The productivity is very high as compare to other conventional methods like grinding, casting etc. ALM can be used as an alternative of casting to reduce the production lead time and production cost.ALM technology is used specially in conjunction with Rapid Prototype. Additive Manufacturing is widly used in series production to avoid the production lead time. Highly complicated structure can be fabricated by ALM with high degree of design freedom. A wide range of different materials, plastics and composite materials can be used for the fabrication of complex shape structure.

The term Additive Manufacturing includes a wide range of technologies, like laser sintering, FDM, FDM, sterolitho graphy and many others.



The process starts by applying a thin layer of the powder materials to building platform. The highly coherent laser beam melts the powder at exactly the coordinate points defined by the computer aided design data. After that another layer is of powder is applied in same manner. Laser beam again melt the powder layer and fixed its position with coordinates. Depending upon the properties of materials, parts can be fabricated by using sterolithography, laser sintering or 3D printing.

General functional principle of laser-sintering



The laser beam melts the powder material by scanning the layer created by the CAD drawing on the surface of a powder bed. After a layer is testing, the powder is poured again for the next step. This process is repeated until the final component is completed. The remaining powered material can be used for next fabrication.

ADDITIVE LAYER MANUFACTURING TECHNIQUES

A wide range of additive manufacturing process is available now. The main difference in each technique is defined on the basis of layer deposited to fabricate parts and in materials used.

Additive Manufacturing Technique		
Techniques	**Material Used**	**Applications**
Fused deposition modeling (FDM)	Thermoplastics, Polyphenylsulfone, Polycarbonate and Ultem	Prototyping scaffold for medical tissue
Selective laser sintering (SLS)	Ceramics, Metal alloy, titanium alloy	Aerospace, automotive, industrial designs
Stereo lithography (SLA)	RTV Silicon, Stainless steel and Aluminium	Product development, mass and job production

MATERIALS USED IN ALM

Wide range of materials used in different technique of additive manufacturing technology. These materials are used for fabrication depending upon the physical, chemical and mechanical properties of materials. There are surprisingly few limitations placed on the kinds of materials used to print 3D objects. As additive manufacturing develops into a widespread practice it's important to focus on the potential of the ingredients used. Here's a rundown of the popular and the strange. Following are materials used in ALM for the 2D structure components:

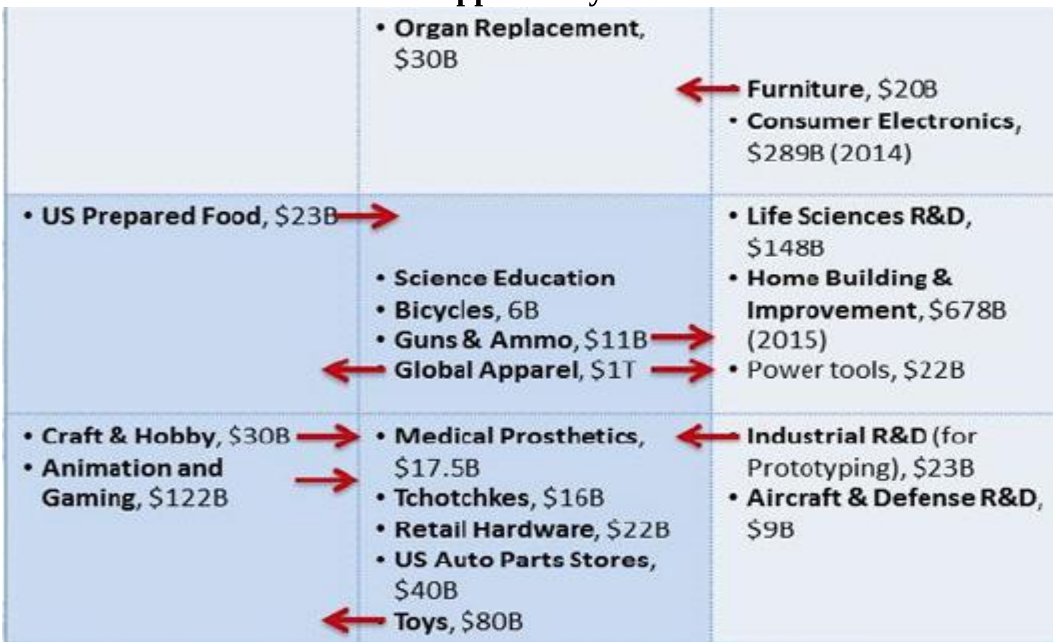
1. Nylon-11
2. Nylon -12
3. Polymers
4. Steel
5. Titanium
6. Gold
7. Silver
8. Steel
9. Bio ink
10. Bone material
11. Object digital materials
12. Full color sand stone

SCOPE OF ALM

Additive layer manufacturing played a significant role in the fabrication of 2D object into 3D by using computer aided design data.

1. Aerospace
2. Automotive
3. Commercial
4. Consumer
5. Industrial
6. Dental Coping
7. Surgical Tools

Global Opportunity for ALM



CONCLUSION

Additive Layer Manufacturing receives the data from computer Aided Design that later converted into STL format. In this paper, ALM defines the advantages of its fabrication methods over various conventional methods. Different types of materials and scope of additive manufacturing also clarify the economic advantages. This is the early version of ALM for manufacture rapid prototype. Additive manufacturing are classified into three categories.ALM is applicable in aerospace and automotive industry due to the fabrication of lighter weight parts. It is possible to construct a model before the surgery of bone. However, there is still a lot of work and research to be accomplished before additive manufacturing processes become the standard in the manufacturing industry because not every commonly used manufacturing material can be handled.

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