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ADDITIVE MANUFACTURING

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ABSTRACT

Additive manufacturing commonly known as 3 D printing,is a process that builds physical objects directly from digital CAD models by depositing materials layer by layer.Unlike conventional manufacturing,where material is removed from a solid block,additive manufacturing builds the object only where material is needed. Additive Manufacturing allows for highly complex geometries that are impossible or too expensive to produce using conventional methods.Because material is added only where needed,it results in significantly less waste.

KEYWORD: Additive, 3D printing, Autodesk Fusion,Polymerisation etc.

INDRODUCTION: Additive Manufacturing or Additive Layer Manufacturing is the industrial production name for 3D printing, a computer controlled process that creates three dimentional objects by depositing materials usually in layer. Using computer aided design or 3 D object scanners,additive manufacturing allows for the creation of objects with precise geometric shapes. There are built layer by layer as with a 3D printing process which is in contrast to traditional manufacturing that often require surplus material.

There are two types of manufacturing- (1) ADDITIVE MANUFACTURING
(2) SUBTRACTIVE MANUFACTURING

(1) ADDITIVE MANUFACTURING- Adds material layer by layer, utilizing only what is needed for the structure.

(2) SUBTRACTIVE MANUFACTURING- Starts with a large, solid block of material and removes or cuts away pieces until the final product is achieved.

ADDITIVE MANUFACTURING PROCESS There are some types of additive manufacturing process which is given below-

(1) **BINDER JETTING-** This technique uses a 3D printing style head moving on X,Y,Z axes to deposit alternating layers of powered material and a liquid binder as an adhesive.

(2) **DIRECTED ENERGY DEPOSITION**- Direct energy deposition additive manufacturing can be used with a wide variety of materials including ceramics,metals and polymers.A laser,electric arc or an arm moves horizontallymelting wire,filament feedstock or powder to build up material as a bed moves vertically.

(3) **MATERIAL EXTRUSION-** This common additive manucacturing process uses spooled polymers which are either extruded or drawn through a heated nozzle which is mounted on a movable arm.Thia builds melted material layer by layer as the nozzle moves horizontally and the bed moves vertically.The layers adhere through temperature control or chemical bonding agents.

(4) **POWDER BED FUSION-** Powder bed fusion comprises a variety of additive manufacturing techniques including direct metal laser melting,direct metal laser sintering,electron beam melting,selective laser sintering and selective heat sintering.

(5) **SHEET LAMINATION-** Sheet lamination can be split into two technologies, Lamainated object manufacturing(LOM) and Ultrasonic additive mnanufacturing(UAM).Laminated object manufacturing is suited to creating items with visual appeal and uses ultrasonic welding to join thin metal sheets,a low energy,low temperature process. UAM can be used with various metals such as aluminium,stainless steel and titanium.

(6) **VAT POLYMERISATION-** This process uses a vat of liquid resin photopolymer to create an object layer by layer.Mirrors are used to direct ultraviolet light which cures the successive layers of resin through plotopolymerisation.

(7) **WIRE ARC ADDITIVE MANUFACTURING-** Wire arc additive manufacturing uses arc welding power sources and manipulators to build 3D shapes through arc deposition.This method of additive manufacture is usually performed using robotic welding equipment.

Additive manufacturing is the process of building three dimensional objects from digital 3D models by layering material with a 3D printer.

There are variety of Material Used for additive manufacturing,these include biochemicals,ceramic,metals and thermoplastics.

BIOCHEMICALS- Biochemicals used in additive manufacturing include silicon,calcium phosphate and zinc . These materials are generally used for healthcare applications.

CERAMIC – A range of ceramics are used in additive manufacturing,including alumina,tricalcium phosphate and zirconia as well as powered glass which can be baked together with adhesive to create new types of glass product.

METALS- A wide variety of metals and metal alloys are used for additive manufacturing,including gold and silver,stainless steels and titanium amongst others.These can be made to create a variety of different metal parts,ranging from jewellery to aerospace components.

THERMOPLASTICS- Thermoplastic polymers are the most commonly used of Additive Manufacturing materials and include a variety of types with theior own advantages and applications.These include acrylonitrile butadiene styrene(ABS),polylactic acid(PLA) and polycarbonate(PC).

Additive Manufacturing software is categorized by its specific role in the production pipeline.CAD/Design tools(Autodesk Fusion) for 3 D modeling,slicers(Ultimate Cura) for build preparation,simulation software(Ansys Additive) for structural validation,and workflow management systems(Materialise Magics) for scaling industrial production.

USES OF ADDITIVE MANUFACTURING-

(1) **MEDICAL AND HEALTHCARE-** Additive Manufacturing use point of care 3D printing to quickly produce anatomical models or replacement parts for equipment.

(2) AEROSPACE AND DEFENSE- Used to manufacture complex,lightweight engine components and heat exchangers that are otherwise impossible to create using traditional methods.This process helps reduce aircraft weight and improve fuel efficiency.

(3) AUTOMOTIVE- Employed to print complex gearbox,suspension,and engine parts using high performance materials.

(4) PRODUCT DESIGN AND RAPID PROTOTYPING- Allows engineering and design teams to turn digital files into physical objects in hours.

(5) SUPPLY CHAIN AND DIGITAL INVENTORY- Allows companies to store 3D design files instead of warehousing physical spare parts,enabling on demand,localized manufacturing to avoid shipping delays.

CONCLUSION

Additive manufacturing has fundamentally transformed the production landscape by shifting from traditional sustractive methods to efficient,layer by layer construction.It enables unmatched geometric freedom,part consolidation and decentralized, on demand supply chains.By adding material only where it is needed,manufacturers can significantly reduce material waste and energy consumption.

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