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Additive manufacturing concepts for automotives parts and its extensions – Review

Sivasankaran.P

Associate Professor, Department Of Mechanical Engineering,ManakulaVinayagarInstiute Of Technology,Pondicherry–605107,INDIA.

Abstract:

Modern technologies in general have had a significant impact on the universe in our quickly expanding globe. Toproducediverseautomobilesubassembliesutilizing3Dprintingtechnologies,additivemanufacturingistherecommende dtechnology.Themanufacturingpartsforautomobilesareproducedusing3Dprinting,anenvironmentally friendly method of layer-by-layer material deposition. The goal of this paper is to use a surveyapproach to gather information about additive manufacturing for automotive parts from a variety of well regardedindexed journals. Additionally, a brief explanation of the various techniques for carrying out 3D printing proceduresforvehicle parts Likewise examiningtherelativemerits ofseveraltechniques interms ofprice, accuracy,andsurface quality. Choosingthe bestinexpensiveapproachbasedonprice and otherfactors

Keywords:3DPrinting,AdditiveManufacturing,Cost,Accuracy,Automotiveparts,optimalmethod

1. Introduction

Three-dimensional (3D) printing, often known as additive manufacturing (AM), is a manufacturing technologythat allows the manufacture of objects by layering prints that are guided by digital 3D models. Additivemanufacturing helps to produce complex contour shaped parts very easily using scanned laser tomography ascompared to conventional method of manufacturing.Consequently, additive manufacturing (AM) is a resourcethat gives designers the ability to produce complex or custom models in a single step without the limitations oftraditional manufacturing, such as high material waste, the difficulty of manufacturing complex shapes, and therequirementforspecializedtooling.UsingAM(AdditiveManufacturing)partcountcanbereducedbyminimizing theassembly costsandtime.

Polymers, ceramics, and metals are just a few of the materials that AM (Additive Manufacturing) technologymay work with. Researchers and companies are becoming more interested in metallic materials among thesematerials. In addition to the aforementioned advantages, metal additive manufacturing (MAM) may also havesome environmental advantages, such as reduced waste, improved quality, lower pollutant emissions, and theability to produce parts as needed. Rapid prototyping, invented in the 1980s for making models and prototypeparts, was the first method of layer-by-layer construction of a three-dimensional object using computer-aideddesign (CAD). This technology was developed to aid in the implementation of engineers' visions. One of theearliest methods of additive manufacturing (AM) is rapid prototyping. It enables the production of printed partsin addition to models. Time and cost savings, more human engagement, a shorter product development cycle,andtheabilitytogeneratenearlyanyshape—evenonesthatwouldbechallengingtomachine—arejustafewof thesignificantadvancementsthis techniquebrought toproduct creation.

1.1. ClassificationofAdditivemanufacturing

In thissection varioustypesofadditivemanufacturing techniquesarelistedbelowasshown infig1.

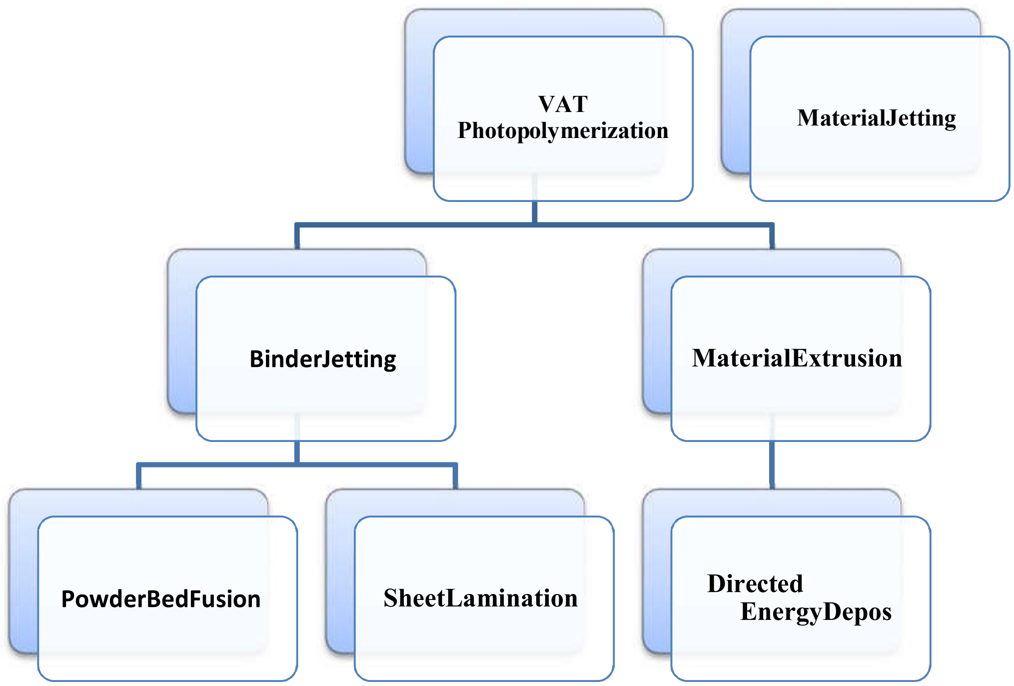

Fig. 1. Classification of Additive Manufacturing Methods1.VATPhotopolymerization:

VAT Stereo lithography is another name for photo polymerization. The name VAT photo polymerizationreferstoamethodofadditivemanufacturingthatusesavatofliquidphotopolymerresin.Vatpolymerizationcanquicklyproducestructureswhileofferingahighlevelofaccuracyandabeautifulfinish, eventhoughresincanbefairlyexpensive.

Despite its advantages, vat polymerization manufacturers are only allowed to use photo-resin ingredientsand must carry out a significant amount of post-processing. Before they can be used, the printed objectsmustbe taken outofthe resinandthoroughly cleaned.

2. **MaterialJetting:**

Material jetting builds objects by layering materials, much as binder jetting. Material jetting, on the otherhand, melts wax-like materials and accurately deposits droplets onto the build platform, as opposed tobuilding adhesive overa bed ofpowder. The item assumes shapeas thelayers are added.Due toits lowcostandexceptionalaccuracywithhigh-qualitysurfacefinishes,materialjettingiswidelyusedbymanufacturers.Unfortunately,theonlymaterialsthatmay beusedformaterialjettingarewax-likepolymers, which can be delicate. Additionally, since each droplet is built separately, items take longer toconstruct.

3. BinderJetting:

One of the most popular forms of additive manufacturing is called binder jetting, often known as materialjetting or inkjet powder printing. The only difference between this technique and your standard officeprinter is that it prints three-dimensional objects. Binder jetting shoots glue into a powdered material ratherthan ink onto a sheet. With each pass, the print head moves both vertically and horizontally, adding a freshlayerofconstructionmaterial.

Due to its low entrance barrier and the low cost of its constituent parts, binder jetting is one of the mostaffordableadditivemanufacturingtechnologies. Additionally,it can produce objects infull colourandmore quickly thanmostotheradditive manufacturingtechniques.

4. MaterialExtrusion:

Extrusion of material functions similarly to a hot glue gun. A coil of material feeds into the printer. Thesubstance is heated and melted at the nozzle's tip. The liquid substance is then applied to the constructionplatform in layers, where it can cool and solidify to form the object.Material extrusion has limits, whilebeing the most affordable additive manufacturing technique. You can only use plastic polymers since theheatingcomponentslackthestrengthtomelthigh-densitymaterialslikemetal,whichmakesthemunsuitableforseveral applicationslike tooling andfixturing.

5. Powderbedfusion:

The process of powder bed fusion, also known as electron beam melting (EBM), begins with a sizable bedof materialthat hasbeenpowdered,usuallycomposedofsand, metal,plastic, orceramicpowders.

A laser or electron beam is utilized to selectively fuse the powder together. The working area is moveddownward after a layer of material has fused, and a new layer is then added on top using the sameprocedure. PBF produces items with a high degree of complexity, which makes them more durable thanthose made by some other methods of additive manufacturing. It is challenging to keep the workplace tidybecause a bed of powder is needed. If you need to use powdered materials, this method is not the greatestchoiceforsmallareas.

6. SheetLamination:

A form of additive manufacturing called sheet lamination, also known as ultrasonic additive manufacturing(UAM) or laminated object manufacture (LOM), involves stacking thin sheets of material and joining themviaultrasonicwelding,bonding,orbrazing.Theitem assumesshape asthelayersare added.

7. DirectEnergyDeposition:

To produce three-dimensional objects, directed energy deposition (DED) applies welding techniques. Alaser or electron beam or other concentrated energy source melts the substance, which is commonly metalwire or powder. Following a precise pour onto the construction platform, the liquid substance instantlysolidifiesto form alayer.Uptillthe print job is complete, thisprocessis repeated.

1.2. MaterialsusedinAdditiveManufacturing:

Currently,the primary typesofmaterials utilizedin3Dprintingare:

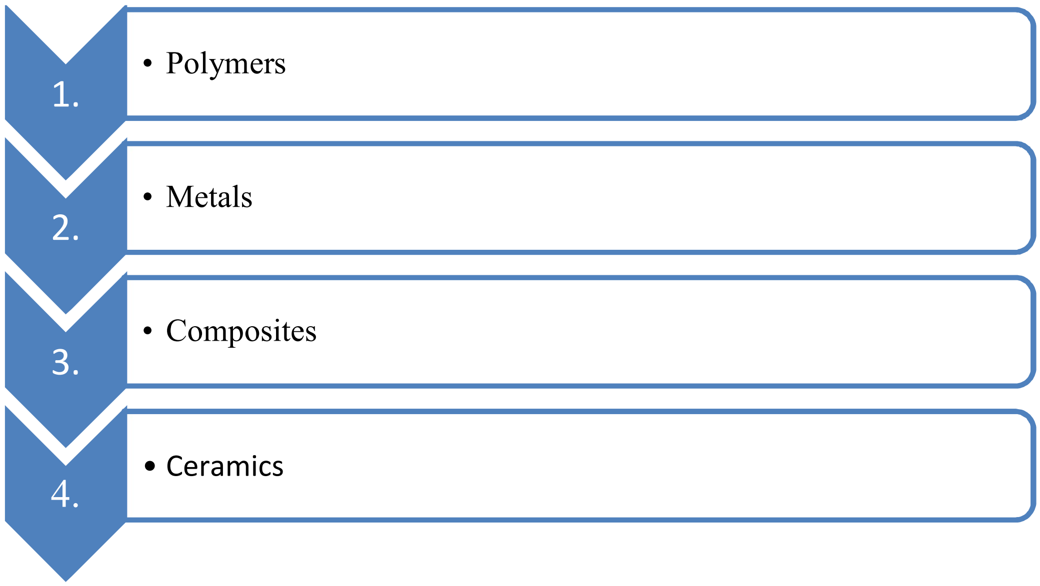

Fig.2.ListofMaterialsusedinAdditiveManufacturing

i. **Polymers:** Stereo lithography, the first 3D printing technology, uses a vat polymerizationtechniquetocureresinandcreatepolymerpieces.Eventoday,polymersareacommon typeof material for 3D printing, but they have advanced much from the early, brittle materials.Thermoplastics like PLA and ABS are among the materials used in filament-driven systemsthe most frequently, although high-performance materials like PEEK and PEKK are alsogainingpopularityinthissector.Inpowderbedfusionmethods,nylonsandTPUhavebecome popular.Thermoset materials have traditionally been used in vat polymerization, butthey are now also starting to be made accessible for extrusion and selective laser sintering.Typically, polymer materials come in the form of solid filament, pellets, liquid resin, orpowders.

ii. **Metals:**Aluminum, titanium,stainless steel, Inconel, andcobalt chrome are some ofthemost often 3D printed metals. Blue-light laser technology has made it possible to 3D printcopper, a material that has previously been challenging to do so. Other techniques, like asbinder jetting, may be more effective for printing reflective metals like copper. An alloy thatworks for one type of metal 3D printing might not work for others. Metals for 3D printing areoften offered as wire or powder, although they can also be combined with other substances. Inmore recent "bound metal deposition" (BMD) techniques, "green" parts are constructed usingfilament or rods made of metal powder embedded in polymer, which are subsequently fired inan oven to take on their final dimensions and acquire metal characteristics, much like in metalinjectionmolding(MIM).Forprocedureslikethis,metalpowdercanalsobegivenintheform ofa paste orsuspendedinresin.

iii. **Composites:** A growing trend in 3D printing is composites, which blend many types ofmaterials.Thecompositemaybeproducedthrough3Dprinting,ortheprocessmaystartwith a material that already contains an additive. From short-run injection moulds to compositelayup tools to finished products, polymers reinforced with chopped carbon and glass fibres areemployed in a variety of applications, providing a cost-effective alternative to more expensivemetals. Some 3D printers allow you to lay continuous fiber reinforcement either concurrentlyor intermittently with the 3D printed form, while others use sheets of reinforcement materialfused with polymer layers. Insome situations, polymer composites like this one can beproducedrobustenoughtoreplacemetalwhilefrequentlyreducingweightsignificantly.Another class of materials finding new applications through 3D printing is metal matrixcomposites(MMCs),which combineametalalloy withanother material,such ceramic.

iv. **Ceramics:**Ceramics havealowabsorptionandarechallengingforlaser-basedprintingmethods. However, extrusion, material jetting, and photo polymerization-based methods havebeen created. Similar to the above-discussed procedure for bonded metal deposition, the 3Dprinting step frequently uses a ceramic slurry or material mixture to create a green object thatcan later be sintered.

2. LiteratureReview:

In this section literature review is focused on metal additive manufacturing in automotive and aerospaceapplicationsas describedbelow:

ShahirMohd Yusuf et al [2019] Metal additive manufacturing (AM) has developed from its origins in theresearch stage to the creation of a broad range of useful commercial applications. Particularly at this time,metal additive manufacturing (AM) is widely used in the aerospace sector to construct and maintain avariety of parts for both civilian and armed forces aircraft as well as for spacecraft. First, the sorts of AMtechnologies that are frequently employed to create metallic parts are described. The evolution of metaladditive manufacturing in the aerospace sector from prototypes to the production of propulsion systems andstructural components is then discussed. The development of metal additive manufacturing (AM) withintheaerospace sector frommerelyprototypingtotheproductionofpropulsionsystems andstructuralcomponentsisalsoaddressed.Additionally,existingunresolvedproblemsthathindermetaladditive manufacturingfrombeingproducedinlargequantitiesintheaerospacesectorareexplored.Theseproblems include the creation of standards and qualifications, sustainability, and supply chain development.**Ana Vafadar et al [2021]**Additive Manufacturing (AM), commonly known as 3D printing, has recentlybecome more prevalent in a number of industrial fields as a result of the benefits it offers in terms ofincreased functionality, productivity, and competitiveness. Although the spectrum of applications for metaladditive manufacturing (AM) technologies has expanded recently and these technologies have practicallylimitless potential, industries have had difficulty adopting them and adjusting to a volatile market. Despitethe substantial research that has been done on the properties of metal AM materials, a thorough grasp of theprocedures,difficulties,requirements,and considerationsrelated to thesetechnologiesisstillnecessary.

As a result, the objective of this study is to give a thorough analysis of the most popular metal additivemanufacturing(AM)technologies,alookatmetalAMadvancements,andanexaminationofindustrial uses for the various AM technologies across several industry sectors. This study also identifies currentconstraints and issues, such as production volume, standards compliance, post-processing, product quality,maintenance,andmaterialvariety,whichprohibitindustriesfromfullyutilizingmetaladditivemanufacturing prospects. In order to help enterprises choose an appropriate AM technology for theirapplication, this article offers a survey as the standard for future industrial applications and research anddevelopmentprojects.

Markus Johannes Kratzer et al [2021] Due to its flexibility in design, functional integration, andquicker product development cycles, additive manufacturing (AM) is gaining importance across a range ofindustries. Components made with additive manufacturing may need additional processing procedures likeheating and surface treatment before they can be used in a variety of applications. Both for the execution ofthe printing process and for the succeeding steps, there are a sizable number of alternative processesaccessible. As a result, the design of the complete production process chain has a wide range of potentialcombinations. Decision support methods and systems have previously been established in research to makechoosing a procedure in the area of AM easier. However, they do not take into account the full processchain, which includes post-processing. In order to maximize output in terms of economic criteria and fullyutilize the technical capabilities of AM components, a wider perspective is required. In most instances,consideration is not given to the particulars of the automobile industry in terms of selection criteria or anunderlying databaseofmaterials andprocedures.

MostafaYakout et al [2018] A layer-based manufacturing technique called additive manufacturing isused to create parts directly from 3D models. Key technologies for metal additive manufacturing arereviewed in this paper. It focuses on how crucial process variables affect the microstructure and mechanicalcharacteristics of the finished product. Aerospace alloys including titanium (TiAl6V4 [UNS R56400]),aluminum (AlSi10Mg [UNS A03600]), iron- and nickel-based alloys (stainless steel 316L [UNS S31603],inconel 718 [UNS N07718], and invar 36 FeNi36 [UNS K93600]) are among the materials that are takeninto consideration.

Vladimir C.M. Sobota et al [2020]This article discusses the key considerations in choosing additivemanufacturing (AM) technology as a means of producing metal parts. AM builds items by layering onmaterial based on 3D models. Currently, there is a lot of interest in AM since it is believed that AM willincrease the competitiveness of Western manufacturing firms. To determine the variables influencing thechoice of AM technology, a literature review is done. Based on relative factor weights, these criteria areranked in order of importance using expert interviews and the best-worst technique. A comprehensivepicture of AM technology selection is provided by categorizing and further mapping elements relating totechnology,demand, environment, andsupply. Market demandwas deemedto be the most importantfactor, despitethefactthat it isnowabsent.

Validity restrictions are brought on by the make-up and size of the expert panel as well as how some of theelements were framed in relation to prior research. To separate the selection criteria for various AMimplementation projects,additional researchis encouraged.

Matteo Strano et al [2021] Rapid tool manufacture for plastic molding, sheet metal forming, and blankinghas always been a crucial and significant objective for applied research, and many different productiontechniques havebeen suggestedthroughoutthe years. Extrusion-basedadditivemanufacturing(EAM),such as fused filament fabrication (FFF) or comparable technologies, has not been frequently regardedamong these techniques and needs to be further investigated. EAM is typically viewed as a low-cost, low-quality, low-performance class of additive manufacturing (AM) that is best suited for creating purelycosmeticprototypesratherthanpracticalparts.

Maximilian Kunovjanek et al [2022]The use of additive manufacturing (AM) is still not widespread inmost supply chains. However, a number of industries, from consumer goods to aerospace, are looking intoits potential to support the digital value chain. In light of these advancements, the research community hasoffered numerous arguments in favour of the use of AM in supply chains. By methodically assessingpertinent literature according to industry sector, purpose, and supply chain area using the SCOR frameworkto provide quick access to crucial material, this article contributes to the scientific conversation. The reviewcovers 1004 articles, 141 of which were given a full-text analysis and coding for each argument. Resultsshowed the most common AM trends for supply chains, as well as perceived advantages and difficulties,and potentialapplications.

DimitriosChantzis et al [2020]A major component of an automotive OEM's business strategy issustainability. Particularly in the realm of vehicles, attention has intensified, and big manufacturers havealready made large investments. However, lightweight design as well as alternative propulsion technologiesis also necessary in order to properly address the sustainability dilemma in the car sector. For internalcombustionandelectrifiedvehicles,respectively,therelationshipbetweenvehicleweightandfuelconsumption and range makes weight reduction a top priority. The development of improved steel andaluminum-forming methods over the past few decades has led to a significant decrease in the weight ofvehicle components. One of the oldest methods for producing modern steel and aluminum alloys is hotstamping. The method offers parts with high strength and little spring back, low forming loads, and goodformability. Advanced tooling designs are necessary due to the high temperatures of the formed materialsacross several cycles and the extensive cooling needed to guarantee desired component characteristics.Tools are typically made using casting and machining, however due to the design flexibility it provides,additive manufacturing has recently attracted a lot of attention. The state-of-the-art hot-forming toolingdesigns are thoroughly reviewed in this study, along with the future direction of additive manufactured(AM) tools.

Neng Li et al[2021]Metal matrixcomposites (MMCs)laser additive manufacturing research hasadvanced significantly. On five different types of MMCs, recent efforts and developments in additivemanufacturing are presented and reviewed. The design of the material, the pairing of reinforcement andmetalmatrix,thesynthesisprincipleappliedduringthemanufacturingprocess,andtheresultingmicrostructures and characteristics are the key points of emphasis. Then, a future development trend ispredicted,including:Astrengtheningphaseformationmechanismandreinforcementprinciple;amaterial and process design that actively achieves expected performance; a novel structure based on the uniquecharacteristics of laser AM MMCs; and simulation, monitoring, and optimization of the laser AM MMCsmanufacturingprocess.

Alessandro Busachi et al [2017]Given its capacity to delocalize manufacturing close to the point of use,"Additive Manufacturing" (AM) is a promising technology that will significantly benefit providers ofDefense Support Services. Due to its potential for disruption, interest in the technology is growing. AMencompasses a broad range of strategies that can turn a 3D file into a physical object by depositing materialin successive layers. AM is still being developed and is regarded as a young technology. Due to thisimmaturity, there is a large degree of uncertainty surrounding important indicators like time and cost. Thesemetrics serve as important selection criteria for assessing additive manufacturing (AM) and contrasting itwith traditional manufacturing. Due to this immaturity, there is a large degree of uncertainty surroundingimportant indicators like time and cost. These metrics serve as important selection criteria for assessingadditivemanufacturing(AM)andcontrastingitwithtraditionalmanufacturing.Thisreviewpaperinvesti gatesthestateoftheartinAMandattemptstoinformthereaderaboutthevariousAMmethodologies with a close attention to those technologies that are most relevant to the defense supportservices industry. The study is organized as follows: first, the various AM technologies are given, alongwiththeireconomicimplications;second,costmodelingmethodologiesareexamined;andthird,adiscussion is held.

Roberto Citarella et al [2021]With the introduction of additive manufacturing (AM) techniques used inthe fabrication of structural components, structural design methodologies and optimization techniques thattake into consideration the unique properties of the fabrication process are now necessary. While AMtechniques provide for unheard-of geometrical design freedom and can significantly reduce componentweight (e.g., through reduced part count), they also have an impact on fatigue and fracture strength due toresidual stresses and micro structural characteristics. This is brought on by flaws, distortions, anisotropy,and stressconcentrationeffects,the impactsofwhich stillneedtoberesearched.

Kaufui V. Wong et al [2012] Stereo lithography (STL) files, which are used in additive manufacturingmethods, are created by translating computer-aided design (CAD) files into stereo lithography (STL) files.Inthisprocedure,theCAD-createddrawingisapproximatedbytrianglesanddividedintosectionscontainingthedetailsofeachlayerthatwillbep rinted.Thepertinentadditivemanufacturingtechniquesand their uses are discussed. They are used by the aerospace industry because it is possible to producelighter structurestosaveweight.

DevarajanBalaji et al [2022]Metal additive manufacturing (MAM) does not need any introduction to beusedinavarietyofengineeringandtechnologyfields.Theapplicationofadditivemanufacturing,specificallyfora erospacecomponents,iscoveredindetailinthisarticle.Withthe helpofa patentlandscape analysis, the opening section of this article introduces the most cutting-edge MAM technologiesnowavailable.Inthisarticle,theaerospacemanufacturingcyclehasbeenexaminedbeginningwiththe design phase and continuing with the selection of the process parameters. Understanding the manufacturingcycle is the first step in any manufacturing process. The decision of assessment parameters, whereby thesurface texture analysis of components manufactured using additive manufacturing is covered, is the instantresultofprinting.

Mario Enrique Hernandez Korner et al [2020]Over the past 30 years, the research trend in additivemanufacturing(AM)hasdevelopedfrompatents,designadvancements,layer-by-layermaterials,totechnologies. But there are some obstacles in the way of this evolution, including the adoption of additivemanufacturing(AM)inproduction;thelatter'sproductivityrestrictions,andthesustainabilityoftheeconomy and society. To fully utilize the capabilities of AM, these obstacles must be removed. This study'sgoal is to conduct a comprehensive assessment of the bibliometric data on these hurdles in two study areas:businessmodelinnovationand sustainabilityinadditive manufacturingfromanIndustry4.0 perspective.

Reviewsummary:

Based on the above review information it was observed that metal additive manufacturing (MAM) conceptsis focused in the literature survey. Key important study is done on the following areas like automotives andaerospace.

3. CurrentstatusofadditivemanufacturinginAutomotiveIndustry–Overview:

Additive Manufacturing (AM) has Been Heavily Used within the Automotive Sector to Overcome theCapital Versus Scope Trade-Off and Improve Performance. Additive Manufacturing (AM) has been Usedfor a Long Time by High-Volume Automotive Oems and Suppliers to Improve Overall ManufacturingCapabilitiesandCutCosts.AMcancreateprototypeswithoutdevelopingtools,shorteningdesignprocesses and cutting costs. Today, AM is used by both OEMs and suppliers to improve current processes:to support decision-making during the product design phase, to establish quality during the preproductionphase,tocreatecustomizedtools,andto shortentheoveralltime tomarket.

Accelerating the product design stage of new product development: Before choosing the final design,organizations go through multiple iterations in the product design stage. The ability to inexpensivelygenerate several variations of a product is one of additive manufacturing's biggest benefits. This allowsvehiclemanufacturerstousephysicalmodelstoimprove theirproductideas.

For instance, a well-known tyre manufacturingfirm uses AM to quickly produce prototypes throughout thedesignphase,andaftertestingthefeelandtouchofseveraloptions,selectsthebestdesign.Interestingly,the prototypes help the business by offering brand distinctiveness in addition to tailoring choices based onOEM needs: When sharing new goods with their OEM clients, the corporation has an advantage over rivalswho mightonlyhave access to design specificationsandblueprints.

Rapidprototypingimprovesquality: Automakerscantestforqualityaheadofactualproductionschedules by employing AM to manufacture prototypes long before the final production. Due to AM'sdesign versatility, businesses may create and test a wide range of prototypes. For instance, GM's design,engineering,andmanufacturingfunctionalareasuseselectivelasersintering(SLS)andstereolithography

(SLA) extensively in preproduction and design processes, and its rapid prototyping department creates testmodelswithmore than20,000components.

Custom tool fabrication is important to automakers because it helps the assembly line produce reliable,high-quality products. AM enables the creation of specialized tools to increase factory floor productivity.For making the hand tools required in testing and assembly, BMW, for instance, used AM in directproduction.

Lowering the cost of tooling in product design:Prior to production runs, some automobile componentsreceivetoolingandinvestment castings.

4. **FuturedirectionsforAM(AdditiveManufacturing)infosteringperformanceandexpansion:**

Future automotive business models are likely to involve OEMs closely collaborating with a smaller, moretightlyknit supplier baseandsupportingquickerrefresh ratesfor vehicleswithcutting-edgefeatures.OEMs can implement this strategy by strengthening their relationships with so-called "tier 0.5" suppliersand continue to streamline their supplier base. Currently, it takes years for a car to reach the market frombasic design to final manufacture. With AM, manufacturers can lengthen the growth and maturity phaseswhiledramatically cuttingtheproductlife cycle'sdevelopmentphase.

loweringproductionandassemblycoststhroughpartsimplificationDesignrestrictionsimposedbyconventional manufacturing methods might multiply the number of parts needed to make a component. Thelength and complexity of the assembling process both grow as the number of parts does. Complex designsthateliminate theneed formanyparts canbe producedbyAM.

5. **WhereisAM(AdditiveManufacturing) goingnowandinthefuture?**

Dashboardsandcoolingventsinsomevehiclesarecurrentlyproducedutilizingadditivemanufacturing.Itislikelythatmoreproductscouldbeproducedusingadditivemanufacturing(AM)thankstorecentadvancementsinprocessandmaterialstechnologyandawideruseofthe technology.

Figure 3displays a non-exhaustive list of the items that are currently made using additive manufacturing(AM) andthosethat maybemanufacturedin thefuture.

ManufacturingProcesses(Applications:Investmentcasting,specializedtooling,andprototyping)

ExhaustEmissions(Applications:Emissions)

Fig.3.IllustrativeexampleofAdditiveManufacturinginAutomotives

When the number of part production increases additive manufacturing is the only tool to simply the makethe part using various additive manufacturing techniques.Additive manufacturing simplifies the partproduction methodby reducingthe manufacturingpartcostbysimplifying thedesign.

6. **DrivingfactorsandobstaclestoAdditiveManufacturingadoptionintheautomotivesector:**

Future AM (Additive Manufacturing) applications in the automobile sector's success will mainly dependon how AM (Additive Manufacturing) technology develops over the next few years. Four barriers and twodrivers that we have identified could potentially influence the adoption of AM (Additive Manufacturing) inthe future.

Driver1:MoreAM-compatiblematerials

Agreaternumberofqualitiescanbeincludedintofinishedproductsbecausetothewidevarietyofmaterials available. Due to the restrictions on the materials that may be employed, AM applications havetraditionally beenconstrained.

Contrary to conventional manufacturing, which today employs a wide range of materials including metals,alloys, and composites, additive manufacturing (AM) has not been around long enough to experience thesameadvancements.

Driver2:Higher-qualityAMproducedgoodsandlesspost-processing

The majority of AM systems can generate parts with some variability from time to time from thermal stressor voids. Lower repeatability is the outcome, which presents a problem for high-volume businesses like theautomobilesectorwhere qualityanddependability arecrucial.

7. **Conclusion**

Inthisarticletheextensiveliteratureisfocusedonadditivemanufacturingconceptsinautomotiveapplications.Additive Manufacturing plays a vital role in prototype development, simulation and testing.AMconceptshelpstoreducethecomplexityinmanufacturingpartsusing3DPrintingapproachascomparedtoconventionalmanufacturingmethods. Inthisworkmetaladditivemanufacturingis considered using suitable methods like laser sintered fused deposition method.Hence in this work attempthas been made to conduct survey on additive manufacturing applications in automotive areas using metaladditivemanufacturing technology.

Thefuturedirectionofadditivemanufacturinginautomotiveindustryisalsoillustratedinsection4,5and6respectively.

As a whole any part manufactured by additive manufacturing reduces the cycle time of part developmentand improves the accuracy.

Future extensions: The future extension of additive manufacturing is continued to focus on biomechanicsfield ofareaas extendedsurvey.

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