



**HAL**  
open science

## Industrial Preeminence of 3D Printing Process in the Expanse of Additive Manufacturing Process

Mr. Paramesh H N, Mr. Prashanth M, Mr. Likhith J Basapur, Mr. Yogesh G  
R, Mr. Udaykumar S

► **To cite this version:**

Mr. Paramesh H N, Mr. Prashanth M, Mr. Likhith J Basapur, Mr. Yogesh G R, Mr. Udaykumar S. Industrial Preeminence of 3D Printing Process in the Expanse of Additive Manufacturing Process. Journal of Scholastic Engineering Science and Management, 2023, 2 (2), pp.8-15. hal-03989747

**HAL Id: hal-03989747**

**<https://hal.science/hal-03989747v1>**

Submitted on 15 Feb 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives 4.0  
International License



# *“Industrial Preeminence of 3D Printing Process in the Expanse of Additive Manufacturing Process”*

<sup>1</sup>Mr.Paramesh H N, <sup>2</sup>Prashanth M, <sup>3</sup>Likhith J Basapur, <sup>4</sup>Yogesh G R, <sup>5</sup>UdayKumar S

<sup>1</sup> Selection Grade Lecturer, <sup>2,3,4,5</sup> Student (Diploma V<sup>th</sup> Semester)



<sup>1,2,3,4,5</sup> Department of Technical Education, Bengaluru, Karnataka, India



Email: [reach2paramesha@gmail.com](mailto:reach2paramesha@gmail.com)

## **ABSTRACT**

Digital fabrication technology, additionally referred to as 3D printing or additive manufacturing, creates bodily objects from a geometrical illustration with the aid of successive addition of materials. 3D printing technological know-how is a fast-emerging technology. Nowadays, 3D Printing is broadly used in the world. 3D printing science is increasingly more used for the mass customization, manufacturing of any types of open supply designs in the area of agriculture, in healthcare, car industry, locomotive enterprise and aviation industries. 3D printing science can print an object layer by means of layer deposition of cloth at once from a laptop aided graph (CAD) model. This paper gives the overview of the sorts of 3D printing technologies, the utility of 3D printing technological know-how and lastly, technology can print an object layer by using layer deposition of fabric directly.

**Keywords:** Additive manufacturing, 3D Printing, manufacturing industry

## **1. INTRODUCTION**

3D printing can create bodily objects from a geometrical illustration by means of successive addition of material. This 3D method has experienced an exceptional enlargement in recent years. First commercialised 3D printing methods in 1980 via Charles Hull. Currently, 3D printing is specially used for producing synthetic coronary heart pumps, jewellery collections, 3D printed cornea, PGA rocket engine, metal bridge in Amsterdam and different merchandise associated with the aviation enterprise as nicely as the meals industry. 3D printing science has originated from the layer by means of layer fabrication technological know-how of third-dimensional (3D) buildings immediately from computer-aided graph (CAD) drawing. 3D printing technological know-how is surely revolutionary and has emerged as a versatile technological know-how stage. It opens new possibilities and offers hope to many probabilities for agencies searching to enhance



manufacturing efficiency. Conventional thermoplastics, ceramics, graphene-based materials, and metallic are the substances that can be printed now by way of the usage of 3D printing technology. 3D printing technological know-how has the attainable to revolutionise industries and trade the manufacturing line. The adoption of 3D printing technological know-how will expand the manufacturing velocity whilst decreasing costs. At the same time, the demand of the client will have an extra effect on over production. Consumers have increased entry in the closing product and can request to have it produced to suit their specifications. At the same time, the amenities of 3D printing technological know-how will be positioned nearer to the consumer, permitting for an extra bendy and responsive manufacturing process, as well as increased first-rate control. Furthermore, when the use of 3D printing technology, the want for world transportation is appreciably decreased. This is because, when manufacturing websites are placed nearer to the stop destination, all distribution ought to be accomplished with fleet monitoring technological know-how that saves power and time. Lastly, the adoption of 3D printing science can trade the logistics of the company. The logistics of the groups can manipulate the whole process, provide extra complete and start-to-finish services.

## **2. MATERIALS USED FOR 3D PRINTING TECHNOLOGY IN MANUFACTURING INDUSTRY**

Like any manufacturing process, 3D printing needs high quality materials that meet consistent specifications to build consistent high-quality devices. To ensure this, procedures, requirements, and agreements of material controls are established between the suppliers, purchasers, and end-users of the material. 3D printing technology is capable to produce fully functional parts in a wide range of materials including ceramic, metallic, polymers and their combinations in form of hybrid, composites or functionally graded materials (FGMs)

### ❖ **Metals**

Metal 3D printing technological know-how acquired many attention in aerospace, automobile, clinical software and manufacturing enterprises due to the fact of the blessings current by using this process. The substances of metallic have fantastic bodily homes and this cloth can be used to complicated manufacture from printing human organs to aerospace parts. The examples of these substances are aluminium alloys, cobalt-based alloys, nickel-based alloys, stainless steels, and titanium alloys. Cobalt-based alloy is appropriate to use in the 3D printed dental application. This is due to the fact it has excessive particular stiffness, resilience, high healing capacity, elongation and heat-treated conditions. Furthermore, 3D printing technological know-how has functionality to produce aerospace



components with the aid of the use of nickel base alloys. 3D-printed objects produced using nickel base alloys can be used in hazardous environments. This is due to the fact it has excessive corrosion resistance and the warmth temperature can withstand up to 1200°C . Lastly, 3D printing technological know-how additionally can print out the object by means of the use of titanium alloys. Titanium alloy has very distinctive properties, such as ductility, precise corrosion, oxidation resistance and low density. It is used in excessive stresses and excessive running temperatures and excessive stresses, for instance in aerospace aspects and biomedical industry.

❖ **Polymers**

3D printing applied sciences are broadly used for the manufacturing of polymer aspects from prototypes to useful buildings with hard geometries. By the use of fused deposition modelling (FDM), it can structure a 3D printed via the deposition of successive layers of extruded thermoplastic filament, such as polylactic acid (PLA), acrylonitrile butadiene styrene (ABS), polypropylene (PP) or polyethylene (PE). Lately, thermoplastics filaments with greater melting temperatures such as PEEK and PMMA can already be used as substances for 3D printing technology. 3D printing polymer substances in liquid nation or with low melting factor are broadly used in the 3D printing enterprise due to their low cost, low weight and processing flexibility. Mostly, the substances of polymers played an essential position in biomaterials and clinical system products, regularly as inert materials, with the aid of contributing to the environment-friendly functioning of the gadgets as properly as offering mechanical guidance in many orthopaedic implants.

❖ **Composites**

Composite substances with the super versatility, low weight, and tailorable homes have been revolutionising high-performance industries. The examples of composite substances are carbon fibres strengthened polymer composites and glass fibres strengthened polymer composite. Carbon fibre strengthened polymers composite buildings are broadly used in the aerospace enterprise due to the fact of their excessive precise stiffness, strength, proper corrosion resistance and top fatigue performance. At the identical time, glass fibres strengthened polymer composites are broadly used for a variety of functions in 3D printing and have notable doable purposes due to the price effectiveness and high-performance. Fibreglass have an excessive thermal conductivity and distinctly low coefficient of thermal expansion. Furthermore, fibreglass can't burn, and it is now not affected through curing



temperatures used in manufacturing processes, therefore, it is very appropriate for use in the 3D printing application.

❖ **Smart materials**

Smart substances are described as this cloth has the ability to alter the geometry and form of an object, influenced by using exterior stipulations such as warmth and water. The instance of 3D printed objects produced with the aid of the use of Smart substances are self-evolving buildings and tender robotics systems. Smart substances additionally can be labelled as 4D printing materials. The examples of crew clever substances are structure reminiscence alloys and structure reminiscence polymers. Some shape-memory alloys like nickel-titanium can be used in biomedical implants to microelectromechanical gadgets application. In the manufacturing of 3D printed merchandise by the use of nickel-titanium, transformation temperatures, reproducibility of microstructure and density is the essential issue. Meanwhile, Shape reminiscence polymer (SMP) is a sort of purposeful fabric that responds to a stimulus like light, electrical energy heat, some kinds of chemical and so on. By the usage of 3D printing technology, the elaborate form of form reminiscence polymer should be without problems and readily produced. The great comparison of this fabric is carried out based totally on the dimensional accuracy, floor roughness and section density.

### **3. IMPORTANCE OF 3D PRINTING IN MANUFACTURING TECHNOLOGY**

❖ **Aerospace industry**

3D printing technological know-how offers unparalleled freedom in plan in factors and production. In the aerospace industry, 3D printing science is workable to make light-weight parts, multiplied and complicated geometries, which can minimise power necessities and resources. At the same time, by means of the use of 3D printing technology, it can lead to gasoline financial savings due to the fact it can decrease the fabric used to produce aerospace's parts. Furthermore, 3D printing science has been broadly utilised to produce the spare components of some aerospace factors such as engines. The engine's phase is without problems damaged, which requires everyday replacement. Therefore, 3D printing science is a proper solution to the procurement of such spare parts. In the aerospace industry, nickel-based alloys are extra favoured due to the tensile properties, oxidation/corrosion resistance and harm tolerance.



---

❖ **Automotive industry**

Nowadays, 3D printing science has hastily modified our enterprise to design, enhance and manufacture new things. In the automobile industry, 3D Printing strategies have made phenomena to convey new shines, permitting for lighter and extra complicated constructions in the quick time. For instance, Local Motor had printed the first 3D-printed electric powered vehicle in 2014. Not solely cars, Local Motors additionally prolonged the huge variety of software of 3D printing technological know-how through manufacturing a 3D-printed bus referred to as OLLI. OLLI is a driverless, electric, recyclable and extraordinarily clever 3D printed bus Furthermore, Ford is the chief in the use of 3D printing science and additionally utilised 3D printing technological know-how to produce prototype and engine parts. In addition, BMW makes use of 3D printing science to produce hand-tools for automobile testing and assembly. Meanwhile, in 2017, AUDI collaborated with SLM Solution Group AG to produce spare components and prototypes. Consequently, via the use of 3D printing technological know-how in the car enterprise permits businesses to attempt quite a number options and emphasise proper in the enhancement stages, prompting best and positive automobile design. At the same time, 3D printing technological know-how can limit the wastage and consumption of the materials. Moreover, 3D printing technological know-how can decrease prices and time, therefore, it approves us to check new designs in a very quick time.

❖ **Food industry**

3D printing science opens the doorways no longer solely for the aerospace industry, however additionally for the meals industry. At present, there is a developing demand for the improvement of customised food for specialised dietary needs, such as athletes, children, pregnant women, sufferers and so on which requires a one-of-a-kind quantity of vitamins by way of lowering the quantity of pointless components and improving the presence of healthful ingredients. However, the improvement of customised ingredients ought to be performed in a very targeted and creative way, which is the place the adoption of 3D-food printing appears. Food layer manufacture, additionally recognized as 3D-food printing, is fabricated via the deposition of successive layers by means of layer derived immediately from computer-aided layout data. By the usage of 3D printing technology, particular substances can be blended and processed into a range of complex constructions and shapes. Sugar, chocolate, pureed meals and flat food such as pasta, pizza and crackers can be used to





create new meals objects with complicated and interesting designs and shapes. 3D printing science is a high-energy effectivity technological know-how for manufacturing meals with environmentally friendly, desirable, nice manipulation and low cost. 3D-food printing can be healthful and provide advantage to human beings due to the fact it creates new tactics for meals customization and can modify with character preferences and needs. By permitting meals practise and elements to be routinely adjusted to the consumer's information, it would be viable to have diets which put in force themselves barring the want to exercise.

❖ **Fabric and Fashion Industry**

When 3D printing technological know-how enters the retail industry, 3D printed shoes, jewellery, client items and apparel are rising into the market. The aggregate of trend and 3D printing may additionally no longer appear like the most herbal fit, however it is beginning to emerge as an daily reality all over the world. For instance, massive corporations like Nike, New Balance and Adidas are striving to improve the mass manufacturing of 3D printed shoes. Nowadays, 3D printed footwear are produced for athlete's shoes, personalised footwear and sneakers. Besides, 3D printing technological know-how can unfold innovative probabilities for trend design. Indeed, it makes it viable to make shapes besides moulds. In the trend industry, through the usage of 3D printing technology, it can plan and produce clothes by using the usage of a mesh device and additionally can print adorns for regular textiles. Moreover, the utility of 3D printing technological know-how is no longer constrained to the trend industry, however additionally can print leather-based items and accessories. For instance, jewellery, watchmaking, add-ons and so on. The outlets and designers trust the reason for developing trend merchandise through the use of 3D printing science is no longer to reproduce cutting-edge products, but to enhance product diagrams by way of imparting personalised and special merchandise to clients . The blessings of the product improvement through the usage of 3D printing technological know-how are that the product is on demand for customised health and styling. At the same time, with the aid of the use of 3D printing technology, it can minimise the grant chain cost. Lastly, 3D printing science can create and supply merchandise in small portions in a quick time.



## CONCLUSION

In this review, there is a wealthy panorama of 3D printing in the manufacturing industry. At present, 3D printing technological know-how is established in the manufacturing industries, it affords many advantages to the people, organisation and government. Therefore, extra data is wanted to grow on approaches to beautify the adoption of 3D printing technology. The extra statistics about 3D printing technological know-how will assist the enterprise and authorities to improve and enhance the infrastructure of 3D printing technology. Thus, this paper is to overview the sorts of 3D printing technologies, substances used for 3D printing technological know-how in manufacturing enterprise and lastly, the functions of 3D printing technology. In the future, researchers can do some research on the kind of 3D printing machines and the appropriate substances to be used by means of each kind of machine.

## REFERENCES:

1. Chike, O.G., Ahmad, N.B. and Al-Naib, U.M.B., 2021. Additive Manufacturing: A Layered Taxonomy and Classification for Material Engineering Process. In Materials Science Forum (Vol. 1045, pp. 157-178). Trans Tech Publications Ltd.
2. Joshi, P.C., Dehoff, R.R., Duty, C.E., Peter, W.H., Ott, R.D., Love, L.J. and Blue, C.A., 2012, October. Direct digital additive manufacturing technologies: Path towards hybrid integration. In 2012 Future of Instrumentation International Workshop (FIIW) Proceedings (pp. 1-4). IEEE.
3. Lele, A. and Lele, A., 2019. Additive manufacturing (AM). Disruptive Technologies for the Militaries and Security, pp.101-109.
4. Liravi, F. and Vlasea, M., 2018. Powder bed binder jetting additive manufacturing of silicone structures. Additive Manufacturing, 21, pp.112-124.
5. Magaya, T.A., 2017. Additive manufacturing (3 D printing): challenges and opportunities for large scale adoption (Doctoral dissertation, Massachusetts Institute of Technology).
6. Jaiswal, P. and Rai, R., 2019. A geometric reasoning approach for additive manufacturing print quality assessment and automated model correction. Computer-Aided Design, 109, pp.1-11.
7. Paquet, E., Metillon, M., Subrin, K., Furet, B. and Caro, S., 2022, July. Path Generation for Foam Additive Manufacturing of Large Parts with a Cable-Driven Parallel Robot. In 39th International Symposium on Automation and Robotics in Construction (ISARC 2022).
8. Chaturvedi, I., Jandyal, A., Wazir, I., Raina, A. and Haq, M.I.U., 2022. Biomimetics and 3D printing-Opportunities for design applications. Sensors International, 3, p.100191.





9. Thompson, M.J., 2016. Additive Manufacturing (3D Printing) Aircraft Parts and Tooling at the Maintenance Group Level. AIR FORCE INSTITUTE OF TECHNOLOGY WRIGHT-PATTERSON AFB OH WRIGHT-PATTERSON AFB United States.
10. Vallinayagam, S., Rajendran, K., Ramya, A.K., Remya, R.R. and Balan, L., 2021. Enhancing the Fracture Toughness of Biomimetic Composite Through 3D Printing. In High-Performance Composite Structures: Additive Manufacturing and Processing (pp. 215-244). Singapore: Springer Singapore.
11. Banerjee, K., Debroy, M., Balla, V.K. and Bodhak, S., 2021. Recent progress in 3D-printed polyaryletherketone (PAEK)-based high-performance polymeric implants for musculoskeletal reconstructions. *Journal of Materials Research*, 36, pp.3877-3893.
12. Guo, S., Agarwal, M., Cooper, C., Tian, Q., Gao, R.X., Grace, W.G. and Guo, Y.B., 2022. Machine learning for metal additive manufacturing: Towards a physics-informed data-driven paradigm. *Journal of Manufacturing Systems*, 62, pp.145-163.
13. Salarian, M. and Toyserkani, E., 2018. The use of nano-computed tomography (nano-CT) in non-destructive testing of metallic parts made by laser powder-bed fusion additive manufacturing. *International Journal of Advanced Manufacturing Technology*, 98.
14. Dehouck, A., 2015. The wear and lifetime of hybrid moulds produced by additive manufacturing and the reproducibility of the injected parts.
15. Siu, T.L., Rogers, J.M., Lin, K., Thompson, R. and Owbridge, M., 2018. Custom-made titanium 3-dimensional printed interbody cages for treatment of osteoporotic fracture-related spinal deformity. *World neurosurgery*, 111, pp.1-5.



Mr.Paramesh H N, Mr.Prashanth M, Likhith J Basapur, Yogesh G R, UdayKumar S is licensed under CC BY-NC-ND 4.0

