

3D Printing: Innovation and Promising!

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ARTICLE INFO

Article history:

Received 04 June 2024

Accepted 20 June 2024

Available online 22 July 2024

Keywords:

3D printing,
3D printer,
additive manufacturing
technology,
innovation,
sustainability.

ABSTRACT

3D printing is an emerging technology that finds applications across various fields due to its versatility and adaptability. It facilitates the development of innovative research methods and techniques for exploring natural phenomena and assessing the properties of different materials involved in the process. As a core aspect of additive manufacturing, 3D printing focuses on creating objects of various shapes and sizes using suitable materials, notably polymeric filaments commonly used in daily applications. The use of 3D printers streamlines the production of parts and objects, serving a multitude of purposes efficiently. 3D printing is significant in the sustainable development because of its eco-friendly features. No time waste, no natural resources waste and cost efficiency make this activity too familiar for people in general.

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Introduction

3D printing is a widely utilized method in manufacturing technology, instrumental in producing various objects and components for numerous research purposes. Primarily employing polymers as key materials, 3D printers can create parts that either retain the properties of the original material or exhibit different characteristics, influenced by the printing parameters and environmental conditions. Given its relatively recent emergence in sustainable development, 3D printing holds significant potential for revolutionary innovations, making it a compelling area of exploration and advancement.

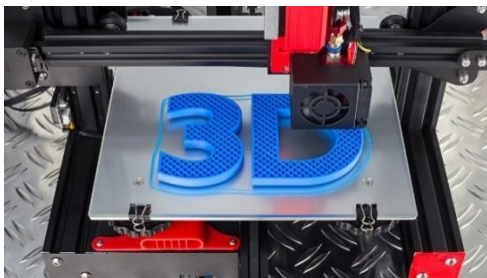


Fig.1. 3D printing

The primary objective of 3D printing is to improve societal well-being by substituting harmful items, which can often be carcinogenic, with practical and safe alternatives made from biomaterials or natural-based polymers. [1]

According to sustainable development, 3D printing is very promising because it's characterized with too little waste of useful natural resources as well as electricity and time. This makes the process very easy-going, practical, and approachable even for DIY activities.

3D belongs to additive manufacturing and is a process linked directly to CAD (computer-aided design system) because one must create objects digitally, at first and afterwards print them with 3D printer. It is crucial to inspect the process in order to avoid defects and irregularities that may happen during 3D printing. Generally, 3D printing is an easy-flowing activity and therefore one propagates quick towards great results for a short interval of time.



Fig.2. Additive manufacturing and 3D printing

Research methods

3D objects and parts get 3D printed using polymeric filaments especially PLA (polylactic acid). PLA is the most famous polymer used in 3D printing. It is

synthesized from natural sources (cornstarch) and its biocompatibility and bioavailability make it a very promising material for getting recyclable products (3D printed parts) and thus avoiding damages to environment. [2]

3D printed parts and their filaments can be examined in various ways based on their intended applications, using both qualitative and quantitative analyses. In the field of electronics, these parts are subjected to impedance analysis with the help of an impedance analyzer. This qualitative method provides detailed insights into their electrical properties, allowing for the determination of whether these components function as conductors, insulators, dielectrics, or other classifications.

Scanning Electron Microscopy (SEM) is a widely recognized qualitative technique used to examine the microstructure of filaments and to observe any changes that occur during compression tests. SEM analysis gives information about grains containing the material, defects and their types and other physical characteristics of the surface of the material. [3]

Thermogravimetric Analysis (TGA) serves as both a quantitative and qualitative method. It is employed to observe how a material, such as polylactic acid (PLA), undergoes phase changes when subjected to high temperatures until it melts. Following this, the cooling process is analyzed to understand how the material returns to its original state.

This technique is also useful for determining the quality of an unknown material when its components are not clearly identifiable. Quantitatively, it helps to understand the percentage of elements and substances present in. [4]

Conclusions and outcomes

Engaging in 3D printing yields valuable findings and outcomes that contribute to advancing sustainable development within society. Having expertise in 3D printing allows for the creation of precise parts and objects that seamlessly integrate into modern and innovative advancements. These intriguing items find applications in medicine, aerospace, automotive industries, decoration, electronics, and more. 3D printing and sustainability go along with each other because of some reasons. [5] 3D printing has reduced waste, because the process gives results that don't need enormous correction and reshaping. During the process there is reduced water and energy usage. It could be a localized production, which avoids the transportation of products from one side of the world to another with huge ships, and therefore reducing the amount of CO₂ released because of shipping. 3D prints can be reproduced and reused for several time and repurposed afterwards for many applications. This reduces the waste of raw, initial polymer. Choosing the right material also contributes to less waste because one does not waste other materials by testing if they are

compatible with the process or not.

Summary and Recommendations

3D printing is a contemporary process that is straightforward, user-friendly, and easy to maintain. It is cost-effective due to the use of affordable materials and is portable, allowing operation anywhere with access to electricity. The 3D printing process is rapid, eliminating extended waiting times, and it poses no risks to public health as it does not emit harmful substances. People find 3D printing enjoyable, contributing positively to society's mental well-being due to its ease and enjoyable aspects. It holds great promise for sustainable development not only for the reasons mentioned but also because it involves the use of biocompatible and biodegradable materials that enhance overall societal health.

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