Mini Review
Volume 12:05, 2022

Journal of Bio ceramics Development and Applications

ISSN: 2090-5025

Open Access

Ceramic Additive Manufacturing Using Thermoplastic Feedstocks

Martins Randers*

Department of Silicate Materials, Riga Technical University, Riga, Latvia

Abstract

Ceramics are widely used in various industries, from aerospace to medical devices, due to their unique properties such as high strength, hardness, and chemical resistance. Traditionally, ceramics have been manufactured from powders through a process called sintering, which involves heating the material to a high temperature to densify it. However, advancements in material science and engineering have led to the development of new methods for producing ceramics, including the use of thermoplastic feedstocks. Thermoplastics are a class of materials that soften and become moldable when heated and harden upon cooling. They are widely used in various applications, including packaging, automotive, and electronics. The use of thermoplastic feedstocks for manufacturing ceramics has several advantages over traditional powder processing methods, including lower processing temperatures, faster processing times, and greater control over the final shape and size of the ceramic product. The process of manufacturing ceramics from thermoplastic feedstocks involves several steps, including the preparation of the feedstock, the shaping of the material, and the sintering of the ceramic material.

Keywords: Thermoplastics • Traditional powder • Ceramic material

Introduction

The first step in the manufacturing process is the preparation of the thermoplastic feedstock. This involves mixing a ceramic powder with a thermoplastic binder, such as polyethylene or polyvinyl alcohol, to create a homogeneous mixture. The mixture is then extruded into a continuous filament using a single-screw or twin-screw extruder. The next step in the process is the shaping of the material into the desired shape and size. This can be achieved through a variety of methods, including injection molding, 3D printing, or tape casting. Injection molding involves injecting the molten feedstock into a mold cavity under high pressure. The mold is then cooled and the part is ejected from the mold.

Literature Review

This method is suitable for producing complex shapes with high dimensional accuracy and repeatability. 3D printing, also known as additive manufacturing, involves using a computer-aided design (CAD) model to create a three-dimensional object layer by layer. This method is suitable for producing parts with complex geometries and internal structures. The final step in the process is the sintering of the ceramic material. This involves heating the material to a high temperature, typically between 1000 and 1500°C, to densify the ceramic and remove the thermoplastic binder. The sintering process can take several hours to several days, depending on the size and shape of the ceramic part [1,2].

***Address for Correspondence:** Martins Randers, Department of Silicate Materials, Riga Technical University, Riga, Latvia, E-mail: martins3.randers@rtu.lv*

***Copyright:** © 2022 Randers M. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.*

Received: 01 September 2022, Manuscript No. bda-23-93983; **Editor assigned:** 03 September 2022, PreQC No. P-93983; **Reviewed:** 15 September 2022, QC No. Q-93983; **Revised:** 20 September 2022, Manuscript No. R-93983; **Published:** 27 September 2022, DOI: 10.37421/2090-5025.2022.12.224

Discussion

There are two primary AM processes for material extrusion: FFF and Direct Ink Composing (DIW) likewise alluded to as Robocasting which is an AM strategy created for handling pottery. During DIW, fibers of concentrated colloidal suspensions or glues are utilized as feedstock and handled at room temperature . The high solid loading and viscoelastic rheological properties are to blame for the shape retention. A thermoplastic filament is made in FFF by loading ceramic particles with a lot of solids. A heated nozzle is used to extrude the melted filament. When the temperature is decreased, the extruded material solidifies and maintains the desired shape because the feedstock is thermoplastic. On the other hand, a crush feedstock can be straightforwardly expelled to shape a 3D item, by changing the taking care of and expulsion instrument. The compounded and granulated feedstock of ceramic powder and thermoplastic binder are required for the process, which is also referred to as direct extrusion FFF, screw extrusion, or micro extrusion. However, unlike conventional FFF, this method does not require the formation of a continuous, flexible filament. A screw-based extrusion system uses a nozzle to extrude granulate feedstock. This method has advantages like eliminating filament-related issues like buckling, brittleness, and nozzle clogging, but it also has disadvantages like limited resolution and surface quality [3-5].

Conclusion

During the sintering process, the thermoplastic binder decomposes and evaporates, leaving behind a network of interconnected ceramic particles. The ceramic particles bond together through a process called necking, which involves the formation of small, localized bonds between adjacent particles. As the temperature increases, the necks grow and merge, resulting in a denser, more compact ceramic material. The use of thermoplastic feedstocks for manufacturing ceramics has several advantages over traditional powder processing methods. One of the main advantages is lower processing temperatures, which can reduce energy consumption and production costs. In addition, the use of thermoplastic feedstocks allows for greater control over the final shape and size of the ceramic product, as well as the ability to produce complex geometries and internal. However, there are also some limitations to the use of thermoplastic feedstocks. One limitation is the limited range of ceramic materials that can be used with.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Paramita, Roy Chakrabortty Rabin and Subodh Chandra Pal. "Groundwater vulnerability assessment using random forest approach in a water-stressed paddy cultivated region of West Bengal, India." *Groundwater Geochemistry: Pollution and Remediation Methods* (2021): 392-410.
2. Jay, Krishana and Suyash Kumar Singh. "Delineating groundwater potential zones in a hard-rock terrain using geospatial tool." *Hydrol Sci J* 58 (2013): 213-223.
3. Fashae, Olutoyin A., Moshood N. Tijani, Abel O. Talabi and Oluwatola I Adedeji. "Delineation of groundwater potential zones in the crystalline basement terrain of SW-Nigeria: An integrated GIS and remote sensing approach." *Appl Water Sci* 4 (2014): 19-38.
4. Gogu, Radu Constantin, Vincent Hallet and Alain Dassargues. "Comparison of aquifer vulnerability assessment techniques. Application to the Néblon river basin (Belgium)." *Environ Earth Sci* 44 (2003): 881-892.
5. Jaiswal, Mukherjee, J. Krishnamurthy and R. Saxena. "Role of remote sensing and GIS techniques for generation of groundwater prospect zones towards rural development an approach." *Int J Remote Sens* 24 (2003): 993-1008.

How to cite this article: Randers, Martins. "Ceramic Additive Manufacturing Using Thermoplastic Feedstocks." Bioceram Dev Appl 12 (2022): 224.