Enhancing the Strength and Durability of PLA 3d Printed Component joints through Adhesive Bonding

Dr.S.Suresh[2], Mohamed Faizal J.A[1], Mohanraj S[3], Sanjay B[1], Rajkumar R[1], Dhayanithi G[3], Dr.M.Pandian[4]

[1]*UG Student, Department of Mechanical Engineering, Erode Sengunthar Engineering College, Perundurai -638 057*

[2]*Associate Professor, Department of Mechanical Engineering, Erode Sengunthar Engineering College, Perundurai -638 057*

[3]*Assistant Professor, Department of Mechanical Engineering, Erode Sengunthar Engineering College, Perundurai -638 057*

[4]*Professor, Department of Mechanical Engineering, Erode Sengunthar Engineering College, Perundurai.*

***Abstract*—These instructions give you guidelines for preparing papers for the International Journal of Innovative Research in Technology (IJIRT). Use this document as a template if you are using Microsoft Word 6.0 or later. Otherwise, use this document as an instruction set. The electronic file of your paper will be formatted further at International Journal of Innovative Research in Technology. Define all symbols used in the abstract. Do not cite references in the abstract. Do not delete the blank line immediately above the abstract.**

***Index Terms*—About four(minimum) key words or phrases in alphabetical order, separated by commas.**

I. INTRODUCTION

In recent years, researchers and developers have demonstrated an increasingly widespread interest in additive manufacturing (AM) technologies aimed at the fabrication of composite structures. The combination of advantages inherent in AM – first and foremost, greater freedom in the design and customization of the components than with subtractive methodologies – with the wide range of reinforcement and polymer materials process able today is indeed driving industry to a growing confidence with this process in several fields (including aerospace, automotive, and robotics).

Indeed, 3D printing of composites is now recognized as the turning point for AM, from a prototyping technology to a fabrication process for real-world applications of increased complexity. Different 3D-printing processes dedicated to composites available today. Some of them are well-established, such as Fused Filament Fabrication (FFF), Selective Laser Sintering (SLS), Inkjet 3D Printing (3DP) or Stereolithography (SLA), while others are still in development or rarely used (Polyjet, Digital Light Processing, Liquid D Fabrication - CFF) is the most widely diffused today This fact is due to specific advantages, such as process flexibility (in this study exploited to produce tailored mixed-fiber composites), robustness and reliability, low material wastage, and relatively low cost of printers and consumables. Similarly to the more conventional FFF using pure polymers, this extrusion-based technology provides for the layered creation of components by depositing reinforced-polymer filaments, starting from digital 3D models.

II. AIM

The aim of enhancing the strength and durability of 3D printing of lap joints is to improve the mechanical performance of the joints and ensure that they can withstand the intended loads and stresses. Here are some methods that researchers have explored to enhance the strength and durability of 3D printed lap joints. To increase the shear strength of the joint: Cyanoacrylate adhesive is commonly used for bonding PLA 3D printed parts since it has higher shear strength than epoxy. To glue together separate 3D printed parts: 3D printing separate parts and gluing them together is a great way to create models that exceed the size of the 3D printer's build envelope or to combine 3D printed parts with other components. To bond FDM parts: Epoxy and cyanoacrylate adhesives are commonly used to bond FDM parts. They are easy to use and offer good mechanical strength. To create a quick and easy repair: Cyanoacrylate adhesive is a fast-curing adhesive that can be used for quick, easy repairs and light-duty bonding applications

III. SCOPE OF THE PROJECT

Adhesive lap joints are used in additive manufacturing to join two or more 3D printed parts together. The scope of work for adhesive lap joints in 3D printing includes designing and optimizing the joint for maximum strength and durability. Researchers have explored various methods to improve the mechanical performance of adhesively bonded joints, such as using different types of fiber reinforcements to the 3d printed. Other studies have investigated the use of polymer additive manufacturing technology to impart texture to bond regions in adhesively bonded joints. Additionally, joint-design strategies for additive manufacturing have been developed, such as the Add Joining process, which involves 3D printing the substrates and the joint simultaneously, using the structure as the build plate. Finite elements modelling and design of experiments have also been used to optimize interlocking micro-structured adhesive joints. Overall, the scope of work for adhesive lap joints in 3D printing involves developing and testing various joint designs and optimizing them for the maximum strength and durability.

IV. EXPERIMENTS OF LAP JOINTS

Epoxy Adhesive Lap Joint Procedure: Prepare the surfaces to be bonded by degreasing, abrasion, physical methods, or chemical treatments. Apply the epoxy adhesive to one of the surfaces to be bonded. Place the two surfaces together and clamp them in place. Allow the adhesive to cure according to the manufacturer's instructions.

Cyanoacrylate Adhesive Lap Joint Procedure: Prepare the surfaces to be bonded by ensuring they are clean and dry Apply the cyanoacrylate adhesive to one of the surfaces to be bonded. Place the two surfaces together and hold them in place for several seconds. Allow the adhesive to cure according to the manufacturer's instructions. It is important to note that the strength of the joint can be affected by factors. Such as the type of plastic substrate used, the surface preparation method, and the thickness of the adhesive layer. Therefore, it is recommended to test the lap joint strength using lap shear testing.

V. EXPERIMENTAL TESTS

Standard tensile tests are also performed on 3D-printed adhesively bonded joints a hydraulic tensile test machine equipped with a 15 kN load cell. The machine has cross-head speed range of 0.01 mm/s to 30 mm/s. In order to avoid the likely effect of the displacement rate, a series of the tests was performed under displacement control condition with a constant rate of 1 mm/min for all single-lap joint specimens. All the tests were performed under room conditions with temperature and relative humidity of 23 ± 3 C and $50 \pm 5\%$, respectively.

VI. PUBLICATION PRINCIPLES

The contents of the journal are peer-reviewed and archival. International Journal of Innovative Research in Technology publishes scholarly articles of archival value as well as tutorial expositions and critical reviews of classical subjects and topics of current interest.

Authors should consider the following points:

1) Technical papers submitted for publication must advance the state of knowledge and must cite relevant prior work.
2) The length of a submitted paper should be commensurate with the importance, or appropriate to the complexity, of the work. For example, an obvious extension of previously published work might not be appropriate for publication or might be adequately treated in just a few pages.
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purpose of a paper is to introduce a new measurement technique. Authors should expect to be challenged by reviewers if the results are not supported by adequate data and critical details.

VII. CONCLUSION

According to the search results, both epoxy and cyanoacrylate adhesives are used for bonding materials, including 3D printed plastic materials. Epoxy adhesives are known for their strength, elasticity, and shear strength, making them suitable for metal-to-metal bonding applications that are relatively static.On the other hand, cyanoacrylate adhesives are known for their ability to bond quickly and their gap-filling qualities. However, they are brittle and weak under shear force.Ethyl cyanoacrylate forms stronger and more durable joints to rubber and other flexible substrates, while methyl cyanoacrylate adhesives produce slightly weaker joints. In terms of testing the strength and durability of these adhesives, one study compared the performance of structural epoxy and cyanoacrylate adhesives on jointed 3D printed polymeric materials.

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