



# Dynamic mechanical analysis performance of pure 3D printed polylactic acid (PLA) and acrylonitrile butadiene styrene (ABS)

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## ABSTRACT

Dynamic mechanical analysis (DMA) is a technique that is used to study the viscoelastic behaviour of polymeric materials. 3D printing is one of the well-known applications of additive manufacturing techniques which has wide areas of application. In that, Fusion Deposition modelling (FDM) has very fine outcomes with better printing qualities to execute good products. In this research work, the 3D printed samples of pure ABS and PLA were examined under dynamic mechanical analysis to study the various temperature heat, absorbing, storing, and dissipating behaviour of these samples. The results show, both ABS and PLA performed well under the heat flow categories. While comparing to conventional manufacturing technologies, these 3D printed DMA results are showing some excellent results. These polymeric samples may prepare as composites and used for various applications, for better outcomes and capabilities. Storage modulus, while taking the temperature values of ABS to 90 °C maximum and for PLA about 48 °C. This will happen, but this pure form of materials printed through FDM also has such a very good energy storing capacity. Considering the loss modulus energy dissipation in the form of heat started from 110 °C, this is one of the good signs on the fabricated technique and build quality of ABS. The continues decrease in the degree of crystallinity of the PLA and ABS increases the meshing strength noted in the damping factor.

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## 1. Introduction

Additive manufacturing (AM) is one of the finest innovations for all sets of engineering applications. In this principle, 3D printing is one of the most successful areas where we can make wonders. This 3D printing technology (3DPT) is mostly utilized for mechanical analysis to study the performance of the material in different mechanical loading conditions. The selection of materials and the right technology play a key role in the desired applications [1,2]. In that case, Polylactic acid (PLA) and Acrylonitrile Butadiene Styrene (ABS) are having some unique performance in mechanical and thermal studies. PLA is one of the bioplastic materials which

supports a higher degree of consumption towards economic volume from renewable energy resources. It also has a very wide of applications with very good mechanical, physical, and chemical properties [3-5]. ABS is one form of thermoplastic and amorphous polymer which poses very good heat responding properties. This material is used to prepared many plastics which are utilized for heat processing applications. Both the materials (ABS and PLA) are very good in the 3D printing technology for manufacturing many products with different forms of application has been seen in various fields. Fusion Deposition Modeling (FDM) is one of the 3D printing manufacturing methods which has more advantages to produce very low-cost in-situ components. This technology is

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