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EXPERIMENTAL INVESTIGATION ON THE EFFECT OF INFILL DENSITY ON MECHANICAL PROPERTIES OF 3D PRINTED FUNCTIONALLY GRADED POLYMERIC COMPONENTS

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Abstract. Functionally Graded Materials (FGM), unlike the conventional homogeneous materials, are a class of materials characterized by spatial variation in composition and orientation across the volume, contributing significantly to changes in material properties in line with functional requirements. The present work focuses on variations in FG polymeric components with the main intention of obtaining better mechanical properties of prepared polymers. The polymer used in the fabrication is Acrylonitrile Butadiene Styrene (ABS) in two standard grades: i) Acrylonitrile-30%, Butadiene- 20%, Styrene- 50% and ii) Acrylonitrile-20%, Butadiene- 30%, Styrene- 50%. CATIA V5R20 software was used for design of components while Fused Deposition Modeling (FDM) machine was used for preparing the FGMs. Three different infill densities (20%, 50%, 80%) were employed in the study. Experiments were carried out to systematically investigate the influence of process parameters such as butadiene content and infill percentage on the quality of parts prepared in terms of mechanical properties including tensile and hardness of the components. Tensile properties like Ultimate tensile strength, yield strength, breaking strength and Hardness and were determined using necessary instrumentation and standard procedure of conduction on the prepared components. From the experimental results it has been observed that variation in Butadiene content and Infill densities have shown significant effect on the above mentioned properties of the prepared components.

Keywords. Functionally graded material, Fused deposition modeling, Tensile properties, Butadiene, Infill densities, Hardness.

1 Introduction

In recent years utilization of polymeric components materials increased due to their good mechanical properties and easy manufacturing, starting from automotive industry up to food industry. Polymeric materials are used for obtaining components by moulding or by machining. Taking into account the wide range of applications, it is important to know the mechanical behavior of the polymeric materials in different loading conditions. Functionally