Influence of bond interface over the lap-shear performance of 3D printed multi-material samples

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Abstract. Multi-material 3D printing offers new possibilities regarding product development, allowing design freedom and multiple materials choices in terms of colour and polymer type. Material extrusion technologies are among the most popular options for multi-material printing due to their low equipment cost and various thermoplastic materials. However, polymers' compatibility and bond interface must be considered for multi-material components. Material Extrusion creates the parts layer by layer, and each layer is characterised by multiple lines of extruded thermoplastic at a defined width. Therefore, regardless of the 3D model's surfaces, they are composed of numerous lines of material and voids. Depending on the 3D Printing process setup, the bonding mechanism between materials can be influenced due to the different characteristics of horizontal and vertical contact interfaces. For this reason, this paper aims to study the influence of process parameters over horizontal interface through lap-shear tests for multi-materials samples made of acrylonitrile butadiene styrene (ABS), acrylonitrile styrene acrylate (ASA), and polycarbonate (PC). The results show that bond in-terface strength can be improved by creating ways for the mechanical interlock of the materials.

Keywords: fused filament fabrication, multi-material, bond interface, pro-cess parameters, lap shear

The full paper is published in MATEC Web of Conferences, Volume 368 (2022):

DOI: https://doi.org/10.1051/matecconf/202236801005