STRUCTURE AND MECHANICAL BEHAVIOR OF ADDITIVE MANUFACTURED FUSED DEPOSITION MODELING ABS

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ABSTRACT

One of the most important Additive Manufacturing (AM) technologies is the Fused Deposition Modeling (FDM) technology, suitable for various engineering applications which is currently used with many types of thermoplastic materials including ABS. AM-FDM printed ABS possesses an inherent capacity for property modifications as a function of printing parameters. The main goals of this study were to characterize experimentally the mechanical and structural properties of printed ABS specimens; as well as to reach an expression that will allow us to estimate the strength of the AM-FDM printed ABS for different printing parameters, prior to the printing process. In this experimental study, the mechanical and structural characterization of AM-FDM ABS material was performed by visual non-destructive testing inspection, mechanical testing, and light microscopy (LM) investigation. The three-point bend flexural test results revealed the mechanical properties as well as the fracture surface, according to build-on (coupon) specimens' dimensions and build-strategies. The results of this study provide preliminary quantitative estimates for the mechanical significant properties, as a function of some AM-FDM process variables for the ABS material. Parameter coefficients were defined to calculate the estimated strength of the printed ABS. They are chosen according to the desired printing parameters, and then multiplied by the highest average strength achieved for the X or Z direction bending tests specimens to achieve the estimated strength. The parameter coefficients were used to estimate the flexural strength of AM-FDM ABS specimens pertaining to a different R&D project; a decent agreement between the experimental data and the calculated results was obtained.

KEYWORDS: ABS, additive manufacturing, flexural strength expression, FDM, fracture surface, mechanical properties, three-point bend flexural test.

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