Book of Abstracts

mesic

Manufacturing Engineering Society
International Conference

10th edition

28 · 30 June 2023

Escuela Técnica Superior de
INGENIERÍA DE SEVILLA

Edited by: C. Vallellano, G. Centeno D. Morales-Palma, A.J. Martínez Donaire,
M. Borrego, F.J. Doblas, A. Estévez, J.A. Fernández-López

PARAMETRIC STUDY OF FUNCTIONAL COMPONENTS OBTAINED BY FUSED FILAMENT FABRICATION

DANIEL JESUS, CARLOS RELVAS, ANTÓNIO RAMOS

TEMA, Department of mechanical engineering, University of Aveiro, Aveiro, Portugal

Fused Filament Fabrication (FFF) is a growing additive manufacturing technology for various applications in the engineering field. The mechanical properties of 3D printed materials in FFF technology depends on various parameters. Literature suggests that infill pattern and infill density are parameters that affect the mechanical properties of 3D printed materials and have direct influence on the 3D printing time and amount of 3D printed material. In this work the influence of various printing parameters on the bending properties, 3D printing time and amount of 3D printed material will be investigated and presented. For this purpose, the Taguchi method was used and then the statistical method of ANOVA to calculate the influence of each parameter. Test specimens were printed according to ASTM Standard D790, in Polyethylene terephthalate glycol (PETG), with the same color and without any influence of external parameters to the study. The specimens were printed in the same position on the printing bed to reduce as much as possible the influence of external factors on the material properties. A visual and dimensional inspection of the specimens was carried out for further analysis and a prior study of the bridging phenomenon and the maximum acceptable distance that the printer can print was also carried out. In this study, the best combination between material and stiffness, with 350 Mpa/g, was obtained with 15% infill density, concentric pattern, 45º orientation, with 4 perimeters, layer thickness of 0.1 mm and speed of 45 mm/s. The results obtained would give us a broader picture of how to save as much as possible the 3D printing time and the amount of material consumed in the specimen's production and maintain the required stiffness properties.

Keywords: Additive Manufacturing, FFF/FDM, PETG, ASTM Standard D790

ANALYSIS OF PRINTING PARAMETERS FOR SHEET METAL BENDING WITH FDM PRINTED TOOLS

PABLO RODRÍGUEZ GONZÁLEZ[1], PABLO ZAPICO GARCÍA[2], LUCÍA LLAMAS FERNÁNDEZ[1], SOFÍA PELÁEZ PELÁEZ[1], ANA ISABEL FERNÁNDEZ ABIA[1]

[1] Department of Mechanical, Informatics and Aerospace Engineering, University of León, León, Spain

[2] Department of Construction and Manufacturing Engineering, University of Oviedo, Campus of Gijón, Gijón, Spain

The objective of this work is to use PLA plastic matrices printed using the FDM additive manufacturing technique as an alternative to conventional sheet metal bending. In this way, the demand of the industry to obtain highly customised short series bent parts at a reduced price is covered. To demonstrate this hypothesis, first, the maximum compressive strength of FDM printed specimens with different manufacturing parameters was characterised by performing a parametric analysis using a factorial design of experiments (DoE) model and based on the ISO 604 standard. Once the results were analysed, an articulated bending tool was designed and printed with the best configuration previously obtained. Then, 50 S280GD galvanised steel sheets of 1 mm thickness were bent. Finally, the bending angles of the sheets were examined, checking that the bending was performed correctly, obtaining the desired shape in the sheet. As for the analysis of the economic impact, reduction of a 97.75% was obtained in the manufacturing price of the tooling with respect to conventional tooling was observed, demonstrating the viability of these dies in an industrial environment.

Keywords: FDM, Bending Tools, DoE, Customisation

DESIGN AND FABRICATION OF A NEW FILAMENT, PLA WITH PTFE AS FILLERS, FOR WATER REPELLENT SURFACES

ESTHER MOLERO, BELÉN TORRES, OSCAR RODRÍGUEZ-ALABANDA, GUILLERMO GUERRERO-VACAS

Mechanical Engineering, University of Cordoba, Cordoba, Spain

The use of additive manufacturing by fused deposition is a versatile, cost-effective and simple prototyping and manufacturing technique that is generating an accelerating revolution in equipment and filaments. However, materials are limited to a small number of polymers. It is a scientific challenge to bring new characteristics and properties to the parts obtained. In this work, a new filament is designed with the combination of PLA (poly lactic acid) as matrix and PTFE (polytetrafluoroethylene) as filler. This filament will improve the water repellency of the parts obtained. Cleaning, demoulding, anti-adherence, anti-frost, anti-humidity and anti-bacterial applications can be deployed with this new filament. Extruded filaments have been obtained with PLA beads and PTFE micropowder. Flat test tubes have been produced with this filament. The experiments included PTFE fillers (1% to 40% by weight). The surfaces were characterised by sliding angle (SA) and static contact angle (CA) tests, surface roughness (Sa and Sz), flatness error and % water adsorption. The results indicate, as expected, that the higher the fluoropolymer content, the higher the hydrophobicity, reaching values of 125° for CA and 9° for SA, and the % adsorption decreases. In terms of roughness, the surfaces are less rough when the PTFE load increases. On the other hand, the flatness is a property strongly affected by the % PTFE load and at values higher than 15% it produces intense warping and deformation of the specimens. Finally, the PTFE loading thresholds in the PLA matrix under which the wettability and dimensional reproduction properties are balanced and optimal have been obtained.

Keywords: Additive Manufacturing, Repellent Surfaces, Hydrophobicity

RAPID TOOLING TECHNIQUES APPLIED TO INJECTION MOLDING OF POLYMERS

FRANCISCA GUERRERO-VILLAR, RUBÉN DORADO-VICENTE, GUSTAVO MEDINA-SÁNCHEZ, ALBERTO GARCÍA-COLLADO

Department of Mechanical and Mining Engineering, Universidad de Jaén, Jaén, Spain

Mold manufacturing is the major contributor to the total injection molding cost. This work explores several rapid tooling strategies to develop molds based on Additive Manufacturing (AM) that has the potential to reduce this cost. Among the techniques studied are; Room-Temperature vulcanizing (RTV) on an AM model, Acetal Clear. Epoxy Solid (ACES) injection molding through stereolithography, sprayed-metal tooling on an AM model, and Keltool process using Fused Deposition Modeling (FDM). It is explained how to use these approaches to produce a functional mold for a thermoforming educational center. Development time, cost, and dimensions are compared.

Keywords: Keltool Process, RTV Mold, ACES Mold, Sprayed Metal Tooling