IWAM INTERNATIONAL WORKSHOP ADITIVE MANUFACTURING

1ST INTERNATIONAL CONGRESS ON ADDITIVE MANUFACTURING

BOOK OF ABSTRACTS

IWAM 22

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BOOK OF ABSTRACTS

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João Rocha, Instituto Politécnico de Bragança, Portugal
João Eduardo Ribeiro, Instituto Politécnico de Bragança, Portugal
Jorge Santos, Instituto Politécnico de Bragança, Portugal
Rui A. Lima, Universidade do Minho, Portugal

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WELCOME

Additive manufacturing technologies are playing a decisive role in the laboratory environment, making a significant difference in STEAM education. Students use additive manufacturing to create physical models, topographic maps, biology artifacts, artwork, all types of engineering prototypes and solving mathematics challenges. By bringing additive manufacturing capabilities to the classroom, educators can raise interest in STEAM, introduce new concepts and capabilities, and help set the future for more skilled STEAM professionals.

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Mechanical characterization of specimens manufactured in 3D printing

R. Ariati[1], C. Rocha[1], João Rocha[1], J.E. Ribeiro[1*]
[1]Instituto Politécnico de Bragança, 5300-253, Bragança, Portugal
(*)***Email:*** jribeiro@ipb.pt

ABSTRACT

The use of additive manufacturing (3D printers) in the direct fabrication of commercial items is widespread, owing to the advancements and popularization of computer design programs (CAD) and 3D printers, particularly in the previous 10 years. Shimadzu Autograph AGS - X series universal testing machine was used for both tests. PLA+ can withstand larger stresses than ABS, with 44.2% and 25.73% higher tensile and yield strains, respectively. The modulus of elasticity of PLA+ is shown to be 61.99% greater than that of ABS. The goal of this study is to describe the most often used materials and procedures in 3D printing, as well as to characterize ABS and PLA polymers through tensile testing.

INTRODUCTION

The history of surgery was marked by several events that allowed us to evolve into the complex practices we know today. The need to inspect the body cavity to obtain more accurate diagnoses motivated the development of equipment that made it possible to perform these procedures without causing much harm to the patient. Initially used as a technique to obtain a diagnosis, laparoscopy has evolved into a minimally invasive surgical technique. This technique facilitated the patient's recovery, as it did not require the abdominal cavity to be fully opened to perform a particular surgical procedure.

The objective of this project is to perform mechanical characterization in 3D printing using FDM technology, in addition to ABS and PLA polymers. To compare experimental data with values from the literature for the mechanical characteristics of traction specimens made in FDM printers using PLA and ABS polymers.

RESULTS

Figure 1 depicts the tensile test specimens printed in PLA+ and ABS. Figure 2 shows that the findings for ABS and PLA+ were somewhat higher than the averages observed in the literature[1]–[4], owing to various unanalyzed characteristics that differed from one another. You start with the polymer (ABS or PLA+), which implies that each thread of material has distinct mechanical characteristics. A previously mentioned factor that, along with others, determines the tensile strength of PLA+ is its color, therefore the selected color (black) owing to the chemical makeup, typically mineral, ends up diminishing or increasing the object's resistance.

Figure 3 shows that the values obtained are quite close to the results obtained in the literature [1]–[4][5]–[7], demonstrating a similar behavior despite environmental changes and other characteristics. In the case of PLA+, the color of the filament influences the modulus of elasticity values, resulting in an increase in stiffness.

Figure 4 depicts a comparison of the two materials' average tensile and yielding stresses. PLA+ resists greater stresses, which are 44.2% and 25.73% higher than the tensile and yielding strains sustained by ABS, respectively.
Figure 5 demonstrates that the modulus of elasticity of PLA+ is 61.99% more than that of ABS, indicating that PLA+ is a more stiff polymer than ABS and, as a result, more brittle.

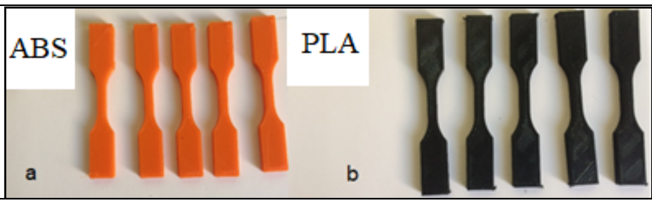

Figure 1 – PLA+ and ABS specimens to the stress test.

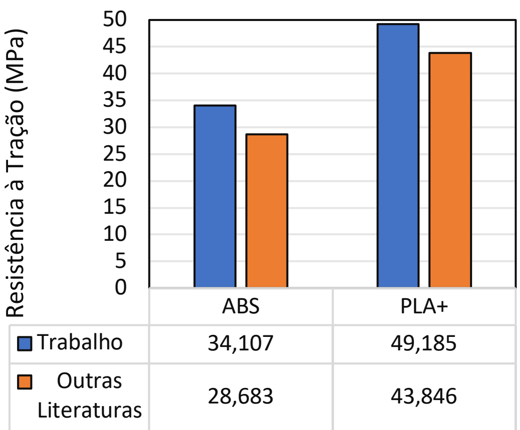

Figure 2 - Tensile strength values of Samples in ABS and PLA.

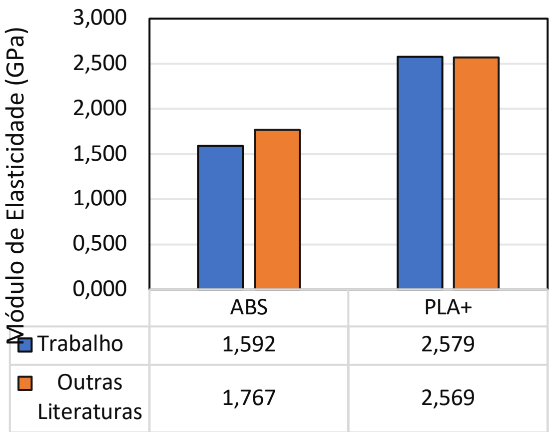

Figure 3 - Values of the elastic modulus of the samples in ABS and PLA.

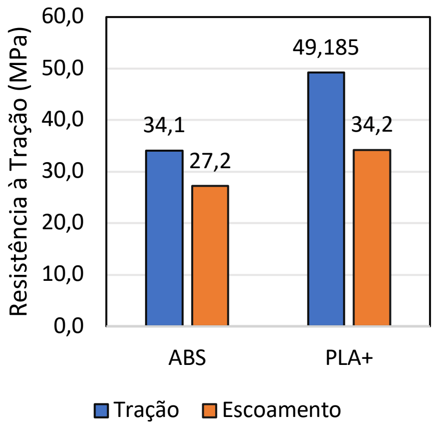

Figure 4 - Average tensile stresses

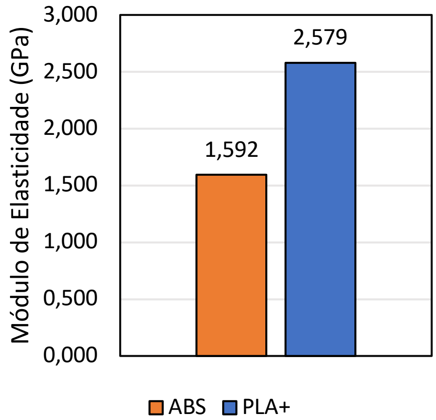

Figure 5 – Average elastic modulus

CONCLUSIONS

As a result, the specimens were successfully manufactured utilizing the Robox Dual 3D printer. The specimens were made following ASTM standards and tested using a Shimadzu Universal Tensile Machine Autograph AGS - X series. The tensile strength and modulus of elasticity of the specimens can be evaluated and analyzed based on the tensile test results. In general, the average values reached are a little higher than those found in the literature; this can be attributed to the color, filament origin, and 3D printer type. As a result, PLA+ has a higher tensile strength than ABS, equaling 44% and yielding 25%. In the comparison of the modulus of elasticity, PLA+ again stands out, reaching an increase of 62% about the value of ABS.

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