MECHANICAL PROPERTIES OF CERAMIC BODIES FORMED WITH 3D TECHNOLOGY

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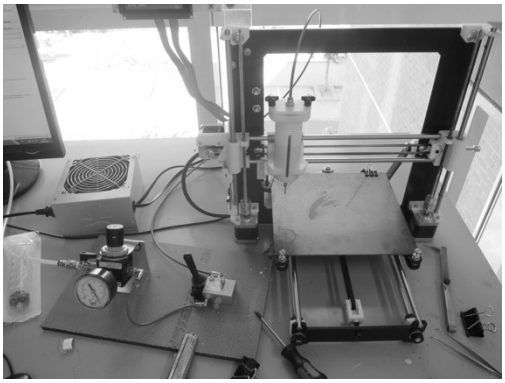
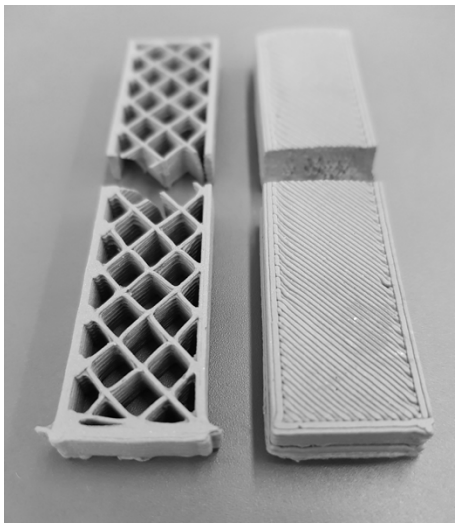
1. ABSTRACT

In recent times, a trend of significant economic importance has emerged in the traditional ceramic industry, which is the production of large-size pieces [1]. However, handling and transportation of large-size pieces are serious limitations for this type of high-end product. Pieces are produced by pressing and/or traditional extrusion that results in pieces that are thick and heavy, and thus prove difficult to handle [2,3].



3D printing is an emerging and rapidly expanding field that is increasingly being integrated into workflows and production processes in the industrial sector, covering a multitude of different fields such as the ceramic industry [4-6]. 3D technology, due to its operating principle, means great versatility in product forming, which makes it possible to obtain lightened part formats, thanks to its ability to modify their internal structure [7-8]. However, given the characteristics and applications of the ceramic industry, it is necessary to carry out an exhaustive study for each of the traditional ceramic materials and determine the mechanical properties and behaviours of the ceramic forming process to determine its possible applicability.



The main objective of this research focuses on the study and comparison of the mechanical properties of lightweight pieces, shaped by 3D technology, compared to pieces obtained by forming by pressing in traditional ceramics. The study has been carried out originally forming ceramic bodies of small size (3x10cm) either by 3D printing or by pressing under standard conditions. The design of the samples was modified, subjecting them to different types of finishing and internal filling to evaluate the different degrees of lightening achieved. The samples obtained by both methods were characterised mechanically, determining the properties such as bulk density and mechanical resistance to bending.

The obtained results showed good aptitudes on the part of the 3D technology for obtaining lightened ceramic bodies in a first phase at the laboratory level, opening a field of study for its implementation in the ceramic industry. The lightened parts showed lower flexural strengths than traditional pieces, but their characteristics allow us to continue with this line of study and obtain new products that satisfy the basic needs of the sector.

In conclusion, 3D printing by additive extrusion is being revealed as an emerging technology that can be implemented within the ceramic industry since it facilitates the obtention of more versatile and lighter formats of special pieces, provided the mechanical properties are optimised to adapt to market requirements.

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